

## The negative effects of wooden furniture industries in Egypt and ways to avoid them

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### Abstract:

Wood furniture manufacturing facilities deal with many things that can affect the environment. Materials such as paints, wood treatments, stains, varnishes, polishes, and adhesives can harm the environment and people if they are not properly managed. Wood working operations reduce waste wood and sawdust.

The research explain The results of hazard which happening in Wood Furniture industries in Egypt due to using these materials, The research follows The inductive, descriptive & analysis methodology to describe What Can Be Done At Wood Furniture Manufacturing Facilities according to the international and federal environmental regulations. And analyze the ways to prevent pollution at it. The research has specific suggestions on ways to prevent pollution.

The research describes proper disposal and how pollution (waste) should be controlled, stored and treated.

### Keywords:

*Sawmills*

*Wooden furniture industries*

*Pollution Prevention*

*Environment protection*

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### introduction

The industrial, scientific and social rapid development and use of non-rational natural resources led to heightened risks in the world. Scientists, decision-makers and experts of strategic planning had falter for treatment, the environment and sustainable development had become the subject of their care. So summits and international conferences were held and numerous recommendations, which aim to protect the environment under industrial progress which left a negative impact on human life.

The evidence of significant progress in the wood products industry in Egypt: (Roushdy, Mohamed-2003)

- The use of a small-sized equipment and low-impact practices in logging operations.
- The use of wood-saving manufacturing equipment (thin blades) and technologies of (laser guidance), full use of raw materials of wood, including through the use of waste to generate heat and power.
- The development of products that use low-quality shrubs, while wood products equipped with the improved performance of (engineered) such as wooden beams ((laminated beams) and floors .
- The use of paper, paperboard and wood recovered and recycled.
- Production of chopped wood shingles (chip Board) of timber Alcazurina, can also covered with natural or industrial veneer and melamine.
- Wood plastic production (industrial wood) which is similar to the wood in shape. but it is

made of plastic or recycled plastic and wood powder.

- compressed wood MDF production of sorghum residue.
- compressed wood MDF production from rice straw
- Manufacture of Chipboard Panels from Indigenous Date Palm Bioma( Hamed El-Mously -2011)
- wood particleboard manufacturing and MDF compact cortex of the stems of bananas, innovation Egyptian expert (Ramy Azar), and studies have confirmed that this type of wood has the ability to fire-resistant, water-resistant, resistant to grease, as well as functional efficiency, and appearance unconventional.

It can be concluded that all previous kinds of fibers for particleboards manufacturing are good solution to face the raw materials shortage in wood based panels industry. The mechanical evaluations of panels that adjusted to 12 mm of the thickness and glued with Urea formaldehyde resin indicate that these particleboards are complied with the requirements of European Standard type P4 (EN 312-2010) [20]; where the results of previous studies indicated that all the manufactured panels have good physical & mechanical profiles. Finley using these renewable lingo-cellulosic raw materials for particleboards manufacturing not only it contributes to reduce the shortage of raw materials but also it solves the environmental problems which are resulted from burning these residues.( Salem E. Zayed-2015). But in the other side may harm the environment inside the factories perimeter by using the deferent

treatments & industrial operations .

Makers of wood products are facing many challenges, including changes in consumer preferences, global demographics, competition for resources, competing materials and changes in forests owners that provide raw materials.

wood products benefit from the growing interest in the fulfillment of high standards of environmental performance, and new products based on timber, such as bio-energy and bio-chemicals and materials vital form basis for a comprehensive industrial growth. (FAO, 2014), and composite or "processed" wood products are changed quickly. Of the processed wood products that are alternatives to hardwoods, for example: Wooden conjoined packages, (glulam beams), wood products multi-layered (laminated veneer lumber), and beam for vertical and horizontal (I-beams),, and wood panels parallel (parallel strand lumber) with overlapping shapes (oriented strand board webs), such as flooring " parquet ", solid wood panels with adjacent Parties. (edge-glued) The wood panels interlocking (cross-laminated) are among the latest innovations, which are of outstanding durability and ability to remain steadfast and wooden products, allowing their use in high-rise buildings techniques. (Roushdy, Mohamed-2003)

Improvements include increased strength and density, improve the packing and diversity of the product through the different treatments of surfaces. Among the most important technological developments in the expansion of industry products of wood fibers mixed with other materials including linen, cotton, straw, paper and plastic for the production of wood composite panels. And it began to combine wood products and polymers penetrate the market because of their ease of use and durability. The researches in this area focus on the use of wood resources more efficiently, and to maximize the use of physical characteristics of raw materials, so gaining product specific properties such as fire or fungi resistance, and reduce manufacturing costs, and waste recovery when the products become invalid.

Technology and basic products of wood publication does not change at the same speed that the composite products change. The most important shift in that more of the timber comes from planted forests, and the high percentage of wooden blocks have small sizes with traditional standards. There have been improvements in the sort of wooden blocks, the output of the publishing process, the processing speed, the speed and quality of drying, surface treatment, and conservation non-toxic. And it can remove a lot of

the natural defects of sawn timber by visual inspection devices and cutting and automatic connectivity. The modern publishing technology suitable for rapid processing of small wooden blocks and turn them into types of panels, and transform publishing output at the same time to the appropriate chips for the manufacture of paper pulp. (FAO – 2014)

And it produces from all these processes many of materials and residues which harm the environment and workers in this field, which requires the study of ways to reach the optimal solutions for the prevention and treatment resulting from these various industries impacts to protect the environment and community.

#### Problem:

1. How can Wood furniture manufacturing affect the environment?
2. What are The results of hazard which happening in Wood Furniture industries in Egypt?
3. How pollution (waste) should be controlled, stored and treated?

#### Objectives:

The research describes proper disposal and how pollution (waste) should be controlled, stored and treated. A better solution is to prevent the waste or pollution.

#### Significance:

1. Studying the effect of Wood furniture manufacturing in the environment.
2. Analyzing the results of hazard which happening in Wood Furniture industries in Egypt.
3. Ways to prevent pollution at wood furniture manufacturing facilities in Egypt according to The **Environmental, Health, and Safety Guidelines** ( EHS Guidelines) for Sawmilling and Manufactured Wood Products.

#### Assumptions:

Following the international and federal environmental regulations & The Environmental, Health, and Safety Guidelines EHS for Sawmilling and Manufactured Wood Products help wood factories owners to avoid hazards which happening in Wood Furniture industries in Egypt.

#### Methodology:

The research follows The inductive, descriptive & analysis methodology to describe and analyze What Can Be Done At Wood Furniture Manufacturing Facilities, and the ways to prevent

pollution at it from books and other resources. The research has specific suggestions on ways to prevent pollution.

## 1-General Description of Industry Activities in Egypt:

The sawmilling and wood products manufacturing sector can be divided into two subsectors consisting of the basic sawmilling that produces inputs into the manufacturing processes and the final products manufacture and assembly. In some plants the entire process is integrated with inputs of round wood at one end leading to finished assembled products at the other. More often sawmills produce sawn timber for input to other plants or for sale directly into the market. Manufacturing plants purchase sawn timber and board products to build final products such as furniture.

### 1-1-Sawmills:

Sawmills typically take in round wood and produce sawn and dried dimensioned lumber as outputs. Input logs are commonly stored in a log yard where they may be irrigated, or, more rarely, they are stored in log ponds. From the log yard they are sorted by size and other criteria before transport into the mill on conveyor systems. Logs are often debarked as they enter the mill and are then wet sawn into a variety of lumber sizes.

Timber shaping and cutting activities in mills are typically complex with multiple passes through the mill before a piece is ready for the next process stage. Sawn dimensioned lumber is then ried either naturally or in drying kilns, prior to being exported directly to market or resawn and finished in a dry mill to provide a smooth input for another process.

The sawing process produces large amounts of waste in the form of chips, sawdust, slabs and flawed lumber. These wastes may be processed for input into board or paper mills or they may be burnt on site as waste disposal, or to generate heat for kilns or electricity for the facility. Minimization and disposal of solid waste is the major environmental challenge for this industry.

Lumber intended for outdoor use is commonly treated with a chemical preservative, typically applied in a pressurized vessel that ensures the penetration of the chemicals into the timber. The chemical solution is recycled for further use and is pumped into a storage tank whenever the pressure vessel is emptied. A wide variety of chemicals have been used in the past for wood preservation, some of which are now restricted in developed countries. Three main types of preservatives are used: water based (for example, sodium phenylphenoxide, benzalconium chloride,

guazatin, and copper chrome arsenate); organic solvent based (for example, pentachlorophenol and such substitutes as propiconazol, tebuconazol, lindane, permethrin, triazoles, tributyltin compounds, and copper and zinc naphthenates); borates; and tar oils (such as creosote). (Goda, Doaa- 2006)

Some of the preservatives mentioned here (for example, lindane, tributyltin, and pentachlorophenol) are banned in some countries. Chromated Copper Arsenate (CCA), the most common preservative chemical used in the United States, has been withdrawn from use in domestic human contact situations pending a complete risk assessment. A variety of alternatives are available on the market including ACQ (containing copper oxide and quaternary ammonium), Copper Azole and Borates for use in dry situations, in addition to alternative building materials. (WORLD BANK GROUP – 2007) In facilities where wood preservation has been carried out, surplus chemicals may need to be removed and contaminated sites rehabilitated, glue used in manufacturing of compressed wood panels (*urea resins-formaldehyde*)

### 1-2-Compressed Wood panels MDF:

Among the most important technological developments in Egypt in the field of timber industry expansion in the manufacture of products of wood fibers mixed with other materials such as linen, cotton, straw, paper, palm fronds, banana stalks and plastic for the production of improved wood panels. Improvements include increased strength and density, improve the packing and diversity of the product through the different treatments of surfaces, and to maximize the use of physical characteristics of raw materials, so gaining product specific properties such as fire or fungi resistance, and reduce manufacturing costs, and waste recovery when products become is unusable. The technical stages to produce compressed wood panels can be divided into the following points: assembly of raw materials from sources and storage, milling stage: where raw materials are chopped to the degree of grinding required as increasing final product quality by increasing milling degree outfitted to mix with the thermal glue material used, then the process of pressing which is the basic process for the production of compressed wood panels, followed by drying and cutting panels, and prepared for storage. (Roushdy, Mohamed-2003)

### 1-3-Manufactured Wood-based Products:

The wood manufacturing sector utilizes a mixture of boards and lumber products to produce final

products either in assembled form or in knock down form as flat packs for assembly elsewhere. The processes typically involve a mixture of sawing, planing, and routing, and use of adhesives, pins, and screws to produce and assemble the necessary components. The assembled or dimensioned products are commonly treated with a finish of lacquer or paint. The finishing processes of sanding and treating may be repeated so that wood is treated chemically and then sanded before receiving further coats of variety of chemicals. These chemicals include solvents for removing resin from the timber, water for raising the grain, stains, dyes, lacquers and varnishes for coloring and protecting the timber, and paints for providing an opaque covering. The chemicals are commonly dissolved in solvents which have both quick drying and slow drying

components.

Chemicals are applied using rollers or by spraying to account for both flat and non flat components. In some cases coating is carried out prior to the final machining and assembly. Solvents commonly used in these processes include Toluene, Methanol, Xylene, Methyl Ethyl Ketone, Acetone and N-Butyl Alcohol. In some sawmills and manufacturing plants, small waste timber is recovered and reprocessed in finger jointing plants to make longer boards which may then also be glued edge to edge to provide wide 'glulam' products. These reconstituted boards may be used to create large scale wooden engineering beams, by gluing together thousands of pieces and often by bending them in presses and moulds. (Zhiyong Cai-2010)

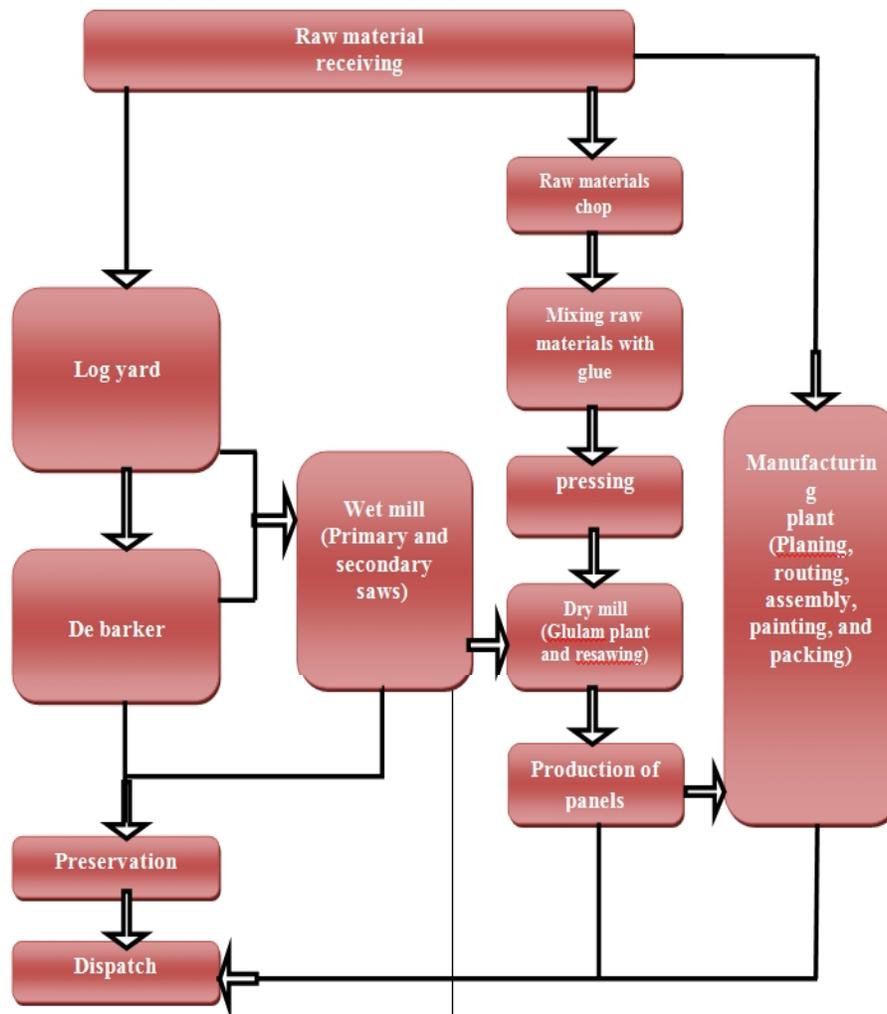


Figure1: Typical Sawmill, compressed wood panels and Wood Products Manufacturing Processes

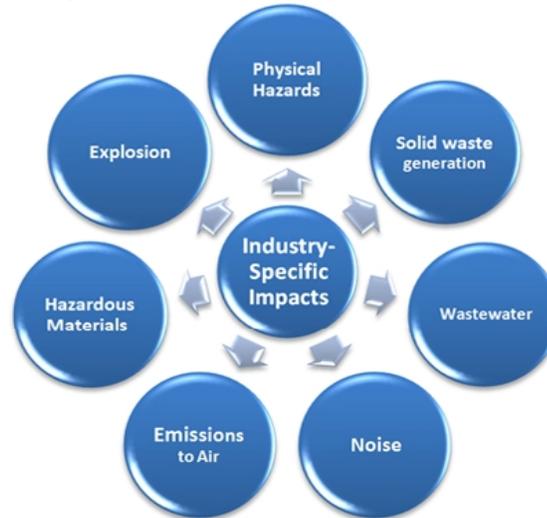
## 2- Industry-Specific Impacts and Management

The following section provides a summary of The **Environmental, Health, and Safety Guidelines** EHS issues associated with sawmilling and

manufactured wood products, include information relevant to projects and facilities such as plants manufacturing, glue laminated boards and beams ,preservative treatment of timber and timber

products, Plywood or other wood-derived board, and furniture manufacturing. It includes recommendations for their management and

decommissioning phases are provided in the General EHS Guidelines. (World Bank Group – 2007)



**Figure2: Wood Industry-Specific Impacts and Management**

### **2-1- Physical Hazards**

The most severe injuries in this sector are usually attributable to the failure of Lockout -Tagout systems. Robust Lockout – Tagout procedures as described in the General EHS Guidelines should be devised and practiced regularly.

#### **2-1-1-Machine Safety**

Wood processing plants employ various kinds of cutting equipment, for example saws, routers, chippers, planers, sanders, slicers, peelers, etc. De barkers may also expose workers to injury. Cutting and debarking equipment is often in rapid motion. Accidents often happen when machines are inadvertently switched on during maintenance and cleaning.

#### **2-1-2-Conveyor Systems**

Sawmills typically transport wood using electric, movable, multiroute conveyor systems. Conveyors under high tension may break, resulting in injury. Clothing or limbs can also become entangled in conveyors.

**Protection methods:** (HSE), UK. 2004

The following measures are recommended to prevent, minimize, and control injury from conveyor systems include:

- Plant design should emphasize simple conveyor routes that are clearly demarcated, with use of skirt boards to prevent access as necessary.
- Moving gears, chains, and rollers should be fully enclosed.
- Hard hats should be worn in areas where elevated conveyors are in use.
- Conveyor belt arrestors should be installed to stop the conveyor in the event of a belt failure.
- Belts should be inspected on a daily basis by

trained personnel to ensure that they are in good working order.

Lockout - Tagout systems for maintenance activities are addressed in the General EHS Guidelines.

#### **2-1-3-Lifting, Repetitive Work, and Work Posture**

Sawmill and wood manufacturing activities may involve movement of heavy pieces of equipment or timber, resulting in injuries to the back if lifting is not done correctly. In addition, many of the process tasks are repetitive and can lead to strains / injuries to hands and arms. Recommended management approaches to reduce these types of injuries are discussed in the General EHS Guidelines.

### **2-2-Solid waste generation**

#### **2-2-1-Conversion Efficiency**

Solid waste generation is directly related to the conversion efficiency of roundwood to sawn lumber or other final products. Conversion efficiencies from roundwood to sawn lumber are often below 40 percent. The use of modern equipment and trained staff may increase efficiencies to 70 percent.

- **Treatment & control methods:** (ILO). 2015) (Suttie E. 2004)

Technical and operational measures to increase wood conversion efficiency and minimize wood waste include:

- Optimizing primary log breakdown technology and techniques, e.g. consideration of bandsaw or framesaw use and use of cross cut before rip cut to increase usable wood volume.
- Use of log scanning equipment to establish the optimum cutting pattern, based on the raw log

dimensions and the product mix required for the log. Computerized real time sawing algorithms are available for this purpose.

- Use of scanning technology to maximize utilization of sawn boards and cutting according to predetermined algorithms.
- Use of finger-jointing in downstream operations to combine scrap or low value wood into products. Use of large dimension waste products in glued laminated boards (glulam).
- Operator training and monitoring to ensure awareness and implementation of measures to improve conversion, such as:
  - Log measurement and categorization by diameter, with framesaws blades spaced to appropriately maximize conversion efficiency
  - Logs fed perpendicularly into framesaw blades
  - Minimization of the use of hooks for movement of logs or boards, to avoid damage to the product.

#### **2-2-2-Recycling and Disposal**

Opportunities for recycling of wood waste may exist through use of waste as inputs for secondary products in other industries or as a source of fuel for heat and power generation. The optimal recycling options depend upon local market conditions and the size (e.g. sawmill chips or sanding dust) and dryness of the material, however the larger-dimensioned wastes are usually more profitably utilized as fiber by-products than fuels. The value and disposal options for sawmill waste are usually enhanced if the waste is bark-free, which necessitates debarking logs before primary breakdown.

Wood waste containing preservative chemicals should be treated as hazardous waste and disposed of in a landfill facility capable of handling wastes that may have chemical leaching properties or by high temperature incineration in an incinerator with effective air pollution control devices. Use of wood waste as an input for secondary products should consider potential contamination caused by residues of preservative chemicals. (HSE), UK. 2004)

**Treatment & control methods:** (Carnegie Mellon University-2006)

Wood waste utilization and disposal options include:

- Use of bark-free wood chips and other wood waste as a raw material input for the pulp and paper or board-making industries. Particleboard manufacturers may also accept sawdust and chips with bark.
- Use of wood and bark chips as mulch for

gardens, highway verges, and agriculture. Use of sawdust and wood shavings for animal bedding.

- Use of wood waste as fuel to generate heat / power for the facility's space heating and process needs, and / or for export.
- Production of fuel briquettes.
- Manufacture of charcoal.

If all other feasible, beneficial uses have been considered, wood waste should be disposed of through controlled incineration, as described below. Accumulation of waste in a dump or landfill at the sawmill is not acceptable as these options present a serious fire hazard, which once started can be very difficult to control, in addition to potential for ground water contamination.

#### **2-3-Wastewater**

**2-3-1- Industrial Process Wastewater:** (ILO. 2015)

Wastewater effluent from sawmills is generated from runoff from irrigated storage areas known as log yards and log ponds. Wastewater is also generated from chemical coating of wood. Toxic wood preservation chemicals may include polynuclear aromatic hydrocarbons, pentachlorophenol, other pesticides, and compounds of chrome, copper and arsenic. Process wastewater containing chemical preservatives should be contained as part of a closed loop application system.

The runoff from log yards and log ponds may contain toxic chemicals (such as tannins, phenols, resins, and fatty acids) leached from the timber, and soil and other materials washed out of the bark. The leachate typically has a high BOD (150 - 5000 mg/l) and COD (750 - 7500 mg/l).

#### **Treatment & control methods:**

Recommendations to prevent, minimize, and control effluents from stored timber include:

- Containment of runoff from log yards through use of impervious surfaces, sealed joints, and spill containment curbs to prevent leaching of contaminated waters into the soil and groundwater.
- Lining of log ponds to prevent contaminants leaching into the soil and groundwater.
- Recycling of irrigation water to limit effluent releases to ground and surface waters.
- Stormwater from process areas should be segregated from storm-water in non-process areas and managed as described in the General EHS Guidelines.
- separation of floatable solids such as wood fines using Dissolved Air Floatation (DAF).
- filtration for separation of filterable solids; flow and load equalization.

- sedimentation for suspended solids reduction using clarifiers.
- biological treatment, typically aerobic treatment, for reduction of soluble organic matter (BOD); dewatering and disposal of residuals in designated waste landfills, recognizing that some residuals may be hazardous.
- Additional engineering controls may be required for
- arsenic removal using ion exchange or membrane processes such as reverse osmosis,
- advanced metals removal using ion exchange or membrane filtration or other physical/chemical treatment technologies,
- removal of recalcitrant organics, pesticides, wood preservatives, and non biodegradable COD using activated carbon or advanced chemical oxidation,
- reduction in effluent toxicity using appropriate technology (such as reverse osmosis, ion exchange, activated carbon, etc.)

Management of industrial wastewater and examples of treatment approaches are discussed in the General EHS Guidelines. Through use of these technologies and good practice techniques for wastewater management, facilities should meet the Guideline Values for wastewater discharge as indicated in the relevant table of Section 2 of this industry sector document.

### **Other Wastewater Streams & Water**

#### **Consumption**

Guidance on the management of non-contaminated wastewater from utility operations, non-contaminated stormwater, and sanitary sewage is provided in the General EHS Guidelines. Contaminated streams should be routed to the treatment system for industrial process wastewater. Recommendations to reduce water consumption, especially where it may be a limited natural resource, are provided in the General EHS Guidelines.

#### **2-4- Noise**

Sawmill and wood manufacturing operations may result in elevated noise levels. In addition to occupational noise management recommendations in the General EHS Guidelines,

#### **Treatment & control methods:**

industry specific measures to prevent, minimize, and control injury due to noise include:

- Enclose machines and equipment with elevated noise emissions (e.g. in excess of 85dB(A)) in noise reduction housings;
- Conduct regular maintenance, including water lubrication of machines and cutting blades, and resin build-up removal.

- Adjust circular saw parameters (e.g. bite depth, blade angle, blade speed) in relation to the timber being cut and the machinery used.
- Consider use of low noise saw blades, in addition to other less noisy equipment, e.g. frame saws.
- Provide workers with appropriate PPE including hearing protection.

#### **2-5-Emissions to Air**

Air emissions from sawmill operations are generated from a number of sources. Combustion products emitted by boilers may include carbon monoxide (CO), nitrogen oxides (NOX), sulfur oxides (SOx) particulate matter (PM), and volatile organic compounds (VOCs) from bark and wood depending upon fuel selection. VOCs may also be emitted during kiln drying of wood and application of solvents, coatings, and lacquers. Wood dust and larger particulates are generated during sawing, machining and sanding operations. Sawmill operations may use controlled incineration to dispose of wood waste, which may result in emissions of carbon monoxide (CO), nitrogen oxides (NOX), particulate matter (PM), and volatile organic compounds (VOCs) from bark and wood. (EPA- 2005)

Management of combustion source emissions (including from biomass fuel) associated with heat- and power-generation activities, or from waste incineration, from sources with a heat input capacity up to 50 Megawatts is addressed in the General EHS Guidelines. Larger power source emissions are addressed in the EHS Guidelines for Thermal Power. Guidance on ambient considerations based on the total load of emissions is provided in the General EHS Guidelines.

Wood dust inhalation may cause irritation, asthma, allergic reaction, and nasopharyngeal cancer amongst wood processing workers. The potential hazard to human health depends on the type of wood being processed with the wood from some tree species having a more serious potential impact than others (e.g. hardwoods, such as oak, beech, teak, mahogany, walnut, mahogany, and birch). Dust exposure should be prevented and controlled through the adoption and maintenance of effective extraction and filtration systems\* as described in the 'Environment' section above and supplemented by the use of Personal Protection Equipment (PPE) such as masks and respirators, as necessary. (Pope, C. Adren-2002)

#### **Treatment & control methods:**

The following are recommended techniques to control air emissions associated with wood residue incineration and combustion in boilers:

- Provide consistent fuel supply:

- Wood waste fuel should be of constant moisture content. Separate storage of wet (e.g. sawmill chips) and dry (e.g. planer shavings) wastes should be maintained and stockpiles protected from the elements.
  - Fuel feeding to the boiler/ incinerator should maintain a constant proportion of wet and dry fuel.
  - Maintaining an optimal air: fuel ratio appropriate for different fuel mixtures. Install capability for independent adjustment of both the supply of wood waste and combustion air to the boiler / incinerator.
  - Where fly ash reinjection is used to improve furnace efficiency, the incoming ash stream should be presorted using sand classifiers. Small ash particles and sand should be sent to the ash pile.
  - Ash from incineration of wood waste should be stored in a contained, wind resistant area until it has fully cooled. Ash may be returned to the forest or other sites for use as a fertilizer and soil improver.
  - Use of cyclones, baghouse filters and / or electrostatic precipitators, and / or scrubbers to control particulate emissions to the site-specific requirements.
- Recommendations to prevent, minimize, and control emissions of VOCs during kiln drying of wood and application of solvents, coatings, and lacquers include:
- Collection and distillation recovery of cleaning solvents.
  - Reformulation of coatings to reduce VOC content including, where a high-gloss finish is not required, the use of waterborne coatings.
  - Enclosure of dip baths to the extent possible and provision of controlled solvent extraction;
  - Use of High Volume Low Pressure (HVLP) spraying or electrostatic spray systems to improve spray transfer efficiency.
  - Use of enclosed booths for spraying activities. Air recirculation into the spray booth should be used to reduce the volume of air that needs to be treated before release.
  - Removal of VOCs from the air stream either by combustion or absorption onto carbon filters. Combustion can be either thermal or catalytic. Absorption onto carbon filters is efficient but may not be feasible in areas where there is no system

for recovering the solvents.

Wood dust and larger particulates are generated during sawing, machining and sanding operations. Local extraction systems should be provided for locations at which these particulates are formed, including saws, sanding, shaping, and routing machines (ILO). 2015.

Cyclones or bag filters are typically employed to remove particulates from the air stream before release. Filtered air may be returned to the workplace which reduces space heating requirements where applicable. Good housekeeping practices should also be employed to minimize dust generation.

#### **2-6- Hazardous Materials :**

Facilities involved in application of wood preservative treatments or the coating of products may store large volumes of hazardous chemicals such as wood preservatives, paints, lacquers, and solvents. Wood preservation typically involves dipping or pressurized treatment processes utilizing pesticide-based preservatives diluted in water or oil. Chromated copper arsenate (CCA) is a common wood preservation chemical, however its use is being limited in some countries due to reported toxic effects on the environment. A variety of alternatives are available on the market including ACQ (containing copper oxide and quaternary ammonium), Copper Azole and Borates for use in dry situations, in addition to alternative building materials. (US EPA Advisory-2011)

Workers may be exposed to elevated levels of hazardous chemicals, including solvents<sup>10</sup>, during application of preservative treatments, painting or varnishing.

#### **Treatment & control methods:**

In addition to the recommendations for the safe storage and handling of hazardous materials provided in the General EHS Guidelines, the following measures, specific to wood preservative treatment facilities, should be adopted where appropriate:

- Storage tanks and components should meet international standards for structural design integrity and operational performance.
- Chemical storage and treatment sites and tanks should be situated in containment areas for example, a covered, walled, concrete area beneath which there is an impermeable membrane. Any spills into this area should drain into a tank / sump, located in a contained area from which leaks can be detected.
- Level gauges, alarms, and cutoff systems on storage tanks should be installed to decrease the risk of overfilling.

- Tankers delivering bulk shipments of treatment chemicals should employ spill prevention measures, as discussed in the General EHS Guidelines. (HSE), UK. 2004)
- A contained and impermeable post treatment dripping zone should be located within the total containment area. Residue from dripping timber should be collected for reuse.
- Treatment chemicals which can be heat-cured onto wood should be adopted to prevent leaching properties. The curing machine should be located within the containment area.
- Treated wood that is cured may be stored in the open. If not cured, wood should be covered and storm water should be collected and treated, as described above in the 'Wastewater' section.
- Substitution of solvent-based coatings and adhesives with less toxic alternatives.
- Use of automated techniques for coating and adhesive application.
- Use of local exhaust ventilation in areas with high chemical vapor concentrations, such as manual spray, rolling, and brushing, in addition dip coating and other automated coating processes. Manual spraying and dip coating should be undertaken in separate, ventilated areas using enclosures or capture hoods supplemented by the use of PPE such as masks and respirators, as necessary.
- When necessary, workers should have adequate protective clothing to prevent chemical contact with the skin, eyes, or via inhalation.

### **2-7-Explosion**

Wood products manufacturing, particularly when machining dried wood, may produce fine combustible dust which can be explosive in air. Where solvents are used for the application of coatings by spraying there is a high risk of solvent explosions.

Explosion risk can be minimized by application of the prevention and control of dust accumulation as described in the 'Environmental' section of this guideline.

**Treatment & control methods:**( Tzanakis N.-2001)

In addition, recommendations to prevent and control the explosion hazard related to dust and solvents include:

- Regular housekeeping to ensure that dust is removed from the facility, including a biannual blow down or vacuuming of the entire facility (e.g. roof rafters).
- Eliminating all sources of ignition from the working environment, including:
  - Use of electrical equipment of at least IP64 rating

- Elimination of naked flames, such as burner flames, welding or cutting torches, matches, cigarette lighters, and heaters
- Control of hot surfaces, such as operating internal combustion engines, frictional sparks, heated wires, glowing metals, and overheated bearings
- Control of portable, battery powered equipment e.g. radios, mobile phones etc.
- Safe use of certain chemicals, for example peroxide hardening products which can be self-heating or result in spontaneous combustion
- Installation of spark detection and dousing systems in dust control equipment

The solvents most commonly used in these coatings include toluene, xylenes, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), and methanol. The acid-catalyzed coatings contain formaldehyde. All of these solvents have short term effects such as irritation of the eyes, nose, and throat, and headaches, dizziness, confusion, fatigue, and nausea. The longer-term effects include reproductive problems, central nervous system disorders, and damage to the lungs, liver, and kidneys. (US OSHA- 2015).  
<https://www.osha.gov/SLTC/woodproducts/>

- Electrical grounding of conveyors and dust control systems to prevent discharge of static electricity
- Use of explosion relief panels on all dust moving equipment and in buildings;
- Mills and plants should be equipped with adequate and accessible firefighting equipment including automatic sprinkler systems;
- Workers should be trained in emergency evacuation procedures and first line of attack fire fighting techniques.

### **Results:**

1. Among the most important technological developments in Egypt, the expansion of the industrial panels mix wood fibers with other materials such as linen, cotton, straw, paper and plastic for the production of composite wood panels are easy to use, durability, and resistance to fires and fungi, but the results from various industrial processes for sawmilling and Wooden Products many risks that threaten the environment and workers in the field.
2. From more risks to workers in the field of wood industries are physical risks resulting from misuse of the machines, and workers' lack of awareness of how best to run and reduce the risks resulting from Lifting, Repetitive Work, and Work Posture

3. From the most important risks to the environment and workers in the field of wood industries is solid waste generating and lack of awareness of how to deal with it and recycled for use again
4. More risks to the environment and workers in the field of wood industries resulting from the hazardous chemicals used in the manufacture, storage, timber and wood products and dust resulting from various industrial processes and Lack of awareness of the way disposal and treatment.
5. Issued by industrial processes in the field of wood industries noise exceeds the limit, resulting in injuries to employees.
6. Available in the international book of The Environmental, Health, and Safety Guidelines EHS what is protective of human health and the environment. And it is related to projects and facilities such as sawmilling and furniture manufacturing, include information relevant to glue laminated boards and beams ,preservative treatment of timber and timber products, Plywood or other wood-derived board.
7. Following the international and federal environmental regulations & The Environmental, Health, and Safety Guidelines EHS for Sawmilling and Manufactured Wood Products help wood factories owners to avoid hazards which happening in Wood Furniture industries in Egypt.

#### **Recommendations:**

- 1- Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®) occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),<sup>12</sup> the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),<sup>13</sup> Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),<sup>14</sup> Indicative Occupational Exposure Limit Values published by European Union member states,<sup>15</sup> or other similar sources.
- 2- Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive)<sup>16</sup>.
- 3- The working environment should be monitored for occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals<sup>1</sup> as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional guidance on occupational health and safety monitoring programs is provided in the General EHS Guidelines.

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