

The Impact Of Occupational Safety And Health Procedure Of The MDF Manufacturing Industry In Sri Lanka

Udara. S. P. R. Arachchige, D. D. Prabodhi Preethika, M. Kasiru Kalathma

Abstract: The evolution of industrialization over the past and recent decade is the huge turning point of humans. So this tendency has been given a significant impact on distributions of income and quality of life. Therefore increasing the size and complexity of industrial processes creates an increased scope for significant disasters. Besides that, it has enhanced the number of workplace accidents and injuries. In Sri Lanka, people are still not much more aware of health and safety for the worker in the manufacturing industry. This paper review, the safety and health practices that can be applied in the MDF manufacturing industry in Sri Lanka and identify the benefit of the Occupational Safety and health practices. Further, research conducted on OSH in MDF manufacturing industry in Sri Lanka to show the evidence of the importance of OHS practices in any industry. The data were collected from employees and villagers as well. This study also identified the type of hazards, injuries, and accidents happen in the MDF manufacturing industry as well as introduce and suggest risk assessment and analysis methods and implement the OSH program to achieve zero risks. Hence, this research aims to investigate how much concern to OHS in the MDF manufacturing industry, Sri Lanka.

Index Terms: Occupational Safety and Health(OSH), Hazard, MDF manufacturing industry, risk prevention.

1 INTRODUCTION

Sri Lanka is one of the most vulnerable countries and is ranked at a low level of OHS performance due to a lack of improvement measures [1]. A large number of organizations don't provide any such services. Small and medium-sized industries are hardly concerned with occupational and health and safety. History of the industrial health and safety in Sri Lanka extends as far back as 1896. This Ordinance mainly covered mines and allied industries. 1926 made applicable to all factories that existed in Sri Lanka at that time. Factories Ordinance (Act No 45 of 1942) 6 was promulgated from 1 January 1950. This Ordinance, Chapter 128 of the Legislative Enactments of Sri Lanka, is an Act that makes provision for safety, health, and welfare of workers in factories [2]. This paper starts with a review of OHS, its importance, and OHS hazards in the workplace. Secondly, it discusses the industry and its' process. Thirdly it reviews possible OHS hazard and the prevention methods of the medium density fibreboard (MDF) manufacturing industry. Finally, suggested risk assessment analysis methods and then the conclusion is presented.

An overview of occupational safety and health

Occupational health and safety (OHS) relate to health, safety, and welfare issues in the workplace. OHS include the laws, standards, and programs that are aimed at making the workplace better for the works, along with family members, customers. Every business or industry has safety risks. Occupational health and safety deals with all aspects of physical, mental, and social health and safety in the workplace. It acts as an umbrella for the company efforts to prevent injuries and hazards in all work environments. Every industry presents various kinds of safety hazards to its employees. Improving a company's occupational and health and safety standards ensures good business, a better company

reputation, and higher employee morale. Employees are considered as the company's greatest asset an employer has to assist in achieving a business objective, as well as to meet legal and moral obligations to provide, and maintaining a safe and healthy workplace. Workplace hazards generally fall into six groups, such as chemical, physical, biological, psychological, ergonomic, and radiation. OHS programs should also include material that helps to minimize the effects of the hazards and prevent accidents and occupational diseases [3]. As the study revealed, the MDF manufacturing industry cannot be accepted as a safe place for working compared to the other industries. But, currently, they have an OHS management process which is working successfully up to a level of 75%. However, the MDF manufacturing industry in other countries brings zero risks associated with the workplace.

Objectives and benefits of OHS practices

The aim of occupational health and safety is to:

- secure the health, safety, and welfare of employees and other people at work.
- protect the public from the health and safety risks of business activities.
- eliminate workplace risks at the source.

The benefits of following health and safety practices are to:

- protect workers from the suffering caused by accidents and ill health.
- reduce absences and sick leave.
- retain staff.
- maintain the organization's reputation.
- boost productivity and profits.
- reduce your insurance premiums and legal costs.

Origin of the MDF manufacturing industry in Sri Lanka

In 2002 the MDF industry successfully installed and commissioned its first MDF production line in Sri Lanka. The skilled production team at the high technology factory produces MDF products in the range of 2.2 mm to 30 mm in standard and moisture resistant grades to exacting international quality standards [4]. Also, the majority of products in this factory are distributed around the world, and

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they were at the top of the world market, because of these reasons the revenue is higher than the cost of production.

The MDF manufacturing industry is capable of producing,

- **Normal MDF board:** Used in the furniture industry to make kitchen cabinets, wardrobes, cupboard
- **Shutter board:** This board is a specially formulated composite panel that has been developed for its works such as concrete shuttering and formwork applications due to its' high density and rigidity.
- **Laminating Board:** Used to an interior fitting for shops and showrooms and also partition the rooms.

Figure 1 is representing the set of MDF Board.



Figure 1: MDF 3mm standard 2440x1220mm [5].

MDF Board market

The global MDF market reached a value of more than US\$ 22 Billion in 2016 [6]. With the increase in technology, the MDF manufacturing industry was also increased rapidly. Besides that, several factors have for the increase of this industry over the normal wood industry.

- MDF is generally cheaper than plywood.
- The surface of MDF is very smooth, and we don't have to worry about knots on the surface.
- Because it's smooth, It's a great surface for painting and also it is a great substrate for the veneer.
- MDF is very consistent throughout, so cut edges appear smooth and won't have voids or splinter.
- Due to the smooth edges of the material, we can use a router to create decorative edges.
- The consistency and smoothness of MDF allow for easy cutting of detailed designs (such as scrolled or scalloped designs using a scroll saw, band saw).

Figure 2 is representing MDF production by major production regions worldwide.

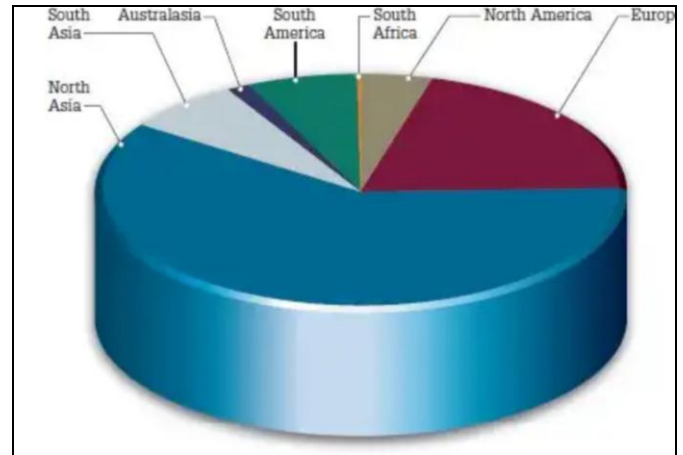


Figure 2: Global MDF production [6].

As shown in figure North Asia is the largest producing region comparison to other countries.

2 METHODOLOGY

Data collection

Interviews and questionnaires were developed to collect data.

- Date of field visit survey: 30/06/2019 and 07/07/2019
There were two types of questionnaires. One was delivered to the people who live nearby the MDF manufacturing industry. Most of them are between the ages of 60-70. Besides, there are some newcomers who lived there for 2-8 years. Vital information has been provided by the inhibitors in their 50-70 years of age. Then the other questionnaire was distributed among the workers of those manufacturing industry. Some of them are between the ages of 40- 50. There was also an employee who had worked for 15 years. The questionnaire generally categorized four areas, production process, update status of the OHS policies, the procedures for risk assessment, and the type of accidents.

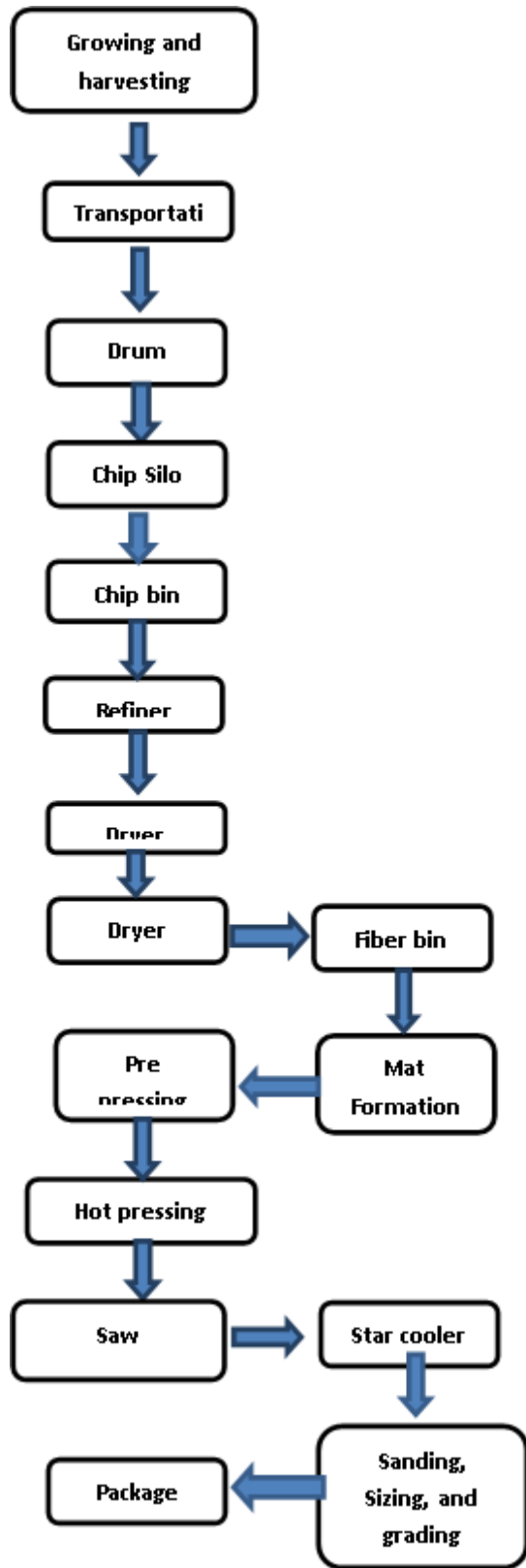


Figure 3: Sample of the survey.

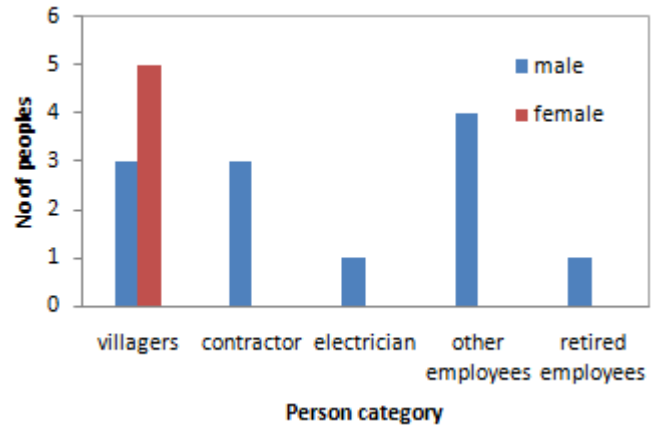


Figure 4: Process Flow Diagram of MDF manufacturing industry, Sri Lanka.

As Figure 3 indicates, the number of employees and other staff who participated in the questionnaire is generally low. Because they thought it would be a problem for their career. But villagers' participation was much higher compared to them.

Production Process

The flow diagram of the MDF board production is given in Figure 4.

Growing and Harvesting

Mainly, MDF products are made by using rubber and pine tree. Based on the data which we collected from the Sri Lankan industry, 'ginikuru' tree, 'pulun' tree, 'Imbul' tree, 'del' tree, and 'kos' tree also used for the production process of MDF board. The selected industry already has 150 hectares of rubber plantation sites near to their site. The harvesting process begins when the tree will grow up to 16 inch of diameter.

Transportation

Generally, trucks are used for wood transportation. After cutting down trees, they sent to the MDF plant for the production process.

Drum Chipper

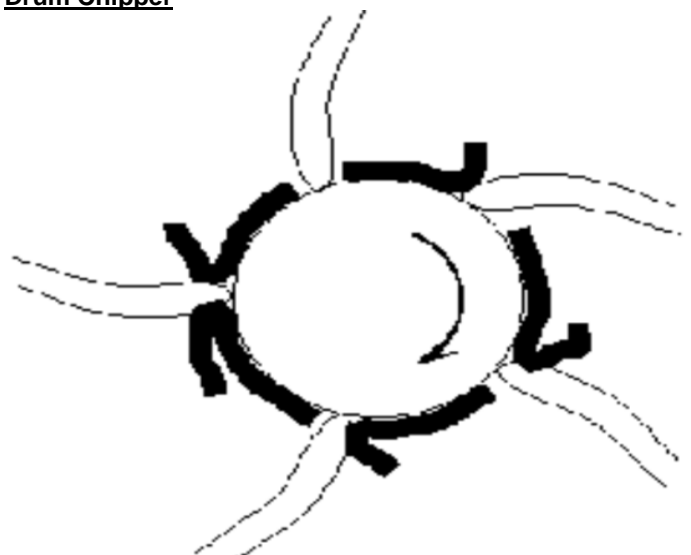


Figure 5: Bark removing process [8].

The suitable logs have to collect for the MDF plant, and those are sent to the drum chipper. Here, the bark from the log is removed to get the better quality of the final product. The chipper drum support to reduce the logs into evenly shaped chips. The Figure 5 shows the bark removing process. Generally, the next step of the MDF board manufacturing is chip washer. This process is done to check out the defects of the chips, remove bits of bark, dirt, dust, and so on. The study revealed that the MDF manufacturing industry doesn't use any kind of chip washer for its production process.

Chip silo and Chip bin

Then the good material is collected and sent into the chip silo through a conveyer belt again. Chip silo acts as a chip store. Then those materials again sent into the chip bin. MDF manufacturing industry in Sri Lanka uses two kinds of chip bin for their production process. There is a sensor which is fixed in the chip bin. When the first bin is filled up to 50% (this is detected by the sensor in the chip bin), the material is sent to the second chip bin. There is an ADI screw feeder which is located at the end of the chip bin. From that, chips are grind together, and steam is injected to heat and soften the material. Usually, chips are compacted using this ADI screw feeder into small plugs which are heated for 30 to 120 seconds. Thus the result softens the wood. Then the heated material is sent into the chip column.

Refiner

Then using feed screw, materials (fibers) are pushed into the chip refiner from the chip column. Here, the material is crushed again and compressed. Also, the water will be removed. Chip refiner also knew as a defibrillator. In a defibrillator, chips are fed for a few minutes under high temperature while they are ground to form a pulp. When the pulp is getting out from the chip refiner, it is mix with resin and wax while the fibers are still wet. The wax improves the moisture resistance of the finished board, and the resin initially helps to reduce clumping or stop the pulp from forming bundles.

Dryer and dryer cyclone

Then wet material is blown into dryer and dryer cyclone respectively. When material passed through the dryer, it dries out quickly, and moisture level (12%) of the material will be controlled. The drying process is doing using hot air.

Fiber bin

After finishing the drying process, the material is stored in fiber bin for an unspecified length of time, but the board making process is usually continuous from here on. Figure 6 shows the complete production process of the MDF manufacturing industry.

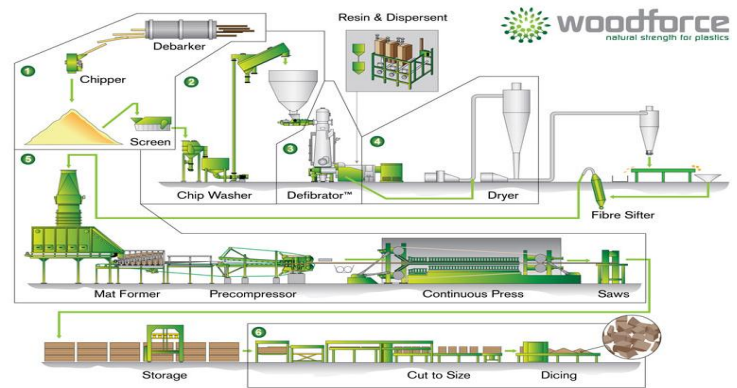


Figure 6: Overall MDF manufacturing Process [10].

Question 2: Is there a better OHS policy?

This question was addressed to determine if there is a good OHS plan and policies in the MDF manufacturing industry. Figure 7 demonstrates that 55% of people disagreed with the question while others were agreed with it.

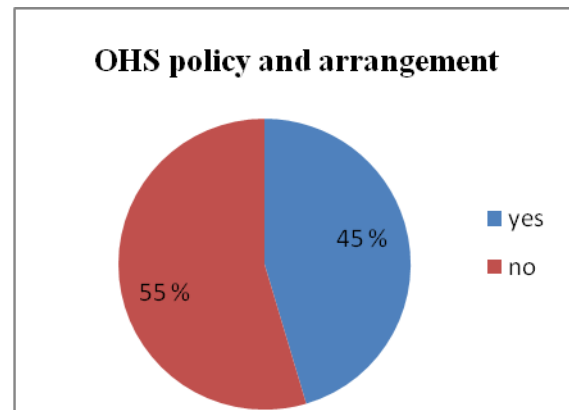


Figure 7: OHS policy and arrangement.

Based on that, the effective management of OHS policies is very important in controlling hazards and accident in the MDF manufacturing industry.

Question 3: Have health and OHS policies updated?

Figure 8 indicates that the percentage of health and OHS policy updated.

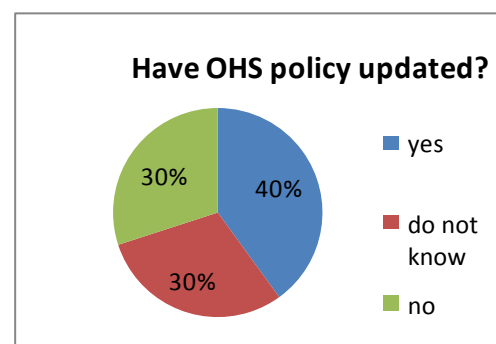


Figure 8: updating OHS policies.

According to Figure 8, 40% of people have stated that their policies were updated when the working environment change

30% of people have stated that their OHS policies not updated. Chart 3 said additionally that there were remaining 30% of the workers not aware of the updating of their OHS policies.

Question 4: Procedures undertake for the risk assessment

The question addressed to determine whether the company had procedures for undertaking risk and assessment or not. Figure 9 demonstrates that 40% of people disagreed with the question, while others were agreed with it. Besides this, the study was also able to know the ongoing risk assessment process of the company.

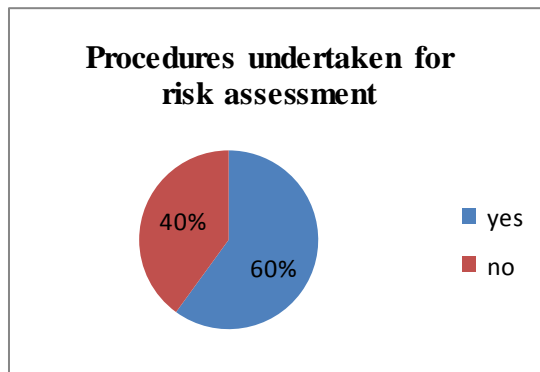


Figure 9: Procedures undertake for risk assessment.

Question 5: Type of accidents

This question was aimed at determining the type of accidents. Figure 10 indicates the 31% of hazards were due to physical, while 13% of hazards were due to psychological hazard.

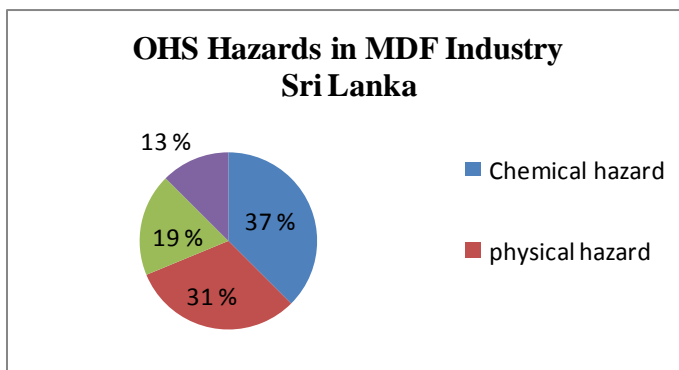


Figure 10: Types of hazard.

In addition, the study was able to found out that all these accidents are caused by the carelessness of the employees. No matter how much the industry tried to protect the employees, it only depends on the employee's care.

1. Possible risk and OHS Hazards and causes in the industry-

identification of OHS hazards and causes (Study based on a questionnaire survey)

1. Chemical Hazards

• **Dust and smoke**

The process of the MDF board manufacturing contains a mixture of softwood dust and hardwood dust. Also, there will also be free formaldehyde, dust particle onto which formaldehyde is absorbed and potentially, the resin binder itself

and its derivatives. According to the data collected from the employees, most of the dust and smoke generation is happen when the raw material has been pressed. Under this situation, this softwood dust, hardwood dust, and formaldehyde are considered to be hazardous to health. Both softwood and hardwood dust are causes of respiratory problems other related health issues. Hardwood dust can also cause nasal cancer.

2. Physical hazards

• **Fall from height**

Generally, every MDF manufacturing industry is repairing and maintaining their machines per week. Mostly, ladders and scaffoldings are used for that. In many cases can occur because that equipment is unsuitable for the work being carried out such as overreaching on an unsuitable ladder, working platforms or scaffolding.

• **Accidents and injuries caused by faulty or unsafe or misused machinery.**

For example, a crush injury caused as a result of missing or inadequate guards on a factory machine or an electric shock or burn caused by faulty electrical equipment or machine.

- **Leg, foot injuries due to machines.**
- **Foot injuries due to dropped articles.**
- **Cutting fingers due to sharp edges.**
- **Sprains, wounds hernias, fractures.**
- **Excessive noise.**
- **Fire accidents.**

Because of the ignition and combustion characteristics of machine material, their process caused to create a fire incident. And also a huge amount of dust and waste particle caused to create fire incident as well.

3. Ergonomic hazards

• **Injuries caused by lack of proper training and unsafe use of work equipment**

4. Psychological hazard

- **Shift work.**
- **Workload.**
- **Dealing with the public.**
- **Discrimination.**
- **The threat of danger.**
- **Stress.**

2. **Public Comments identified through the Survey-Identification of OHS issues (Study based on a questionnaire survey)**

➤ **Effect of dust**

In the early days of the MDF manufacturing industry, the dust from the factory was not only harmful to their workers but also harmful to the surrounding houses. According to the villagers' statement, all the doors and tables covered with dust at their houses. Also, the questionnaire section has given proved that the dust was mixed with water resources, and as result, water became contaminated. Because of this, people around the industry filed a lawsuit. As a result of this opposition of the people, the MDF manufacturing industry decided to solve this environmental disaster itself. By 2010, they were able to mitigate most of the environmental damage from the factory.

➤ **Effect of waste discharged from the factory**

The bark and organic waste that leaves from the drum chipper process was dumped to water in early times of the industry. Due to that, water resources are heavily polluted. In the early days of the MDF manufacturing industry, most of the waste discharge to nearby rivers and lakes.

➤ **Effect of the sound**

The sound from the MDF manufacturing industry spread up to 3 km area.

3. **Employee Comments identified through the Survey-**

When the employees were inquired based on the information of the villagers, they mentioned that the company had already solved those OHS issues.

➤ **Solution for the smoke**

Usually smoke passes to outside through the dryer clone. Now, at the top of the dryer clone, they fixed a duck, and pull the smoke to the ground using a blower. This happened around 2014.

➤ **Solution for the waste**

They stopped the way of wastewater disposal process and start a water treatment plant. All of the wastewater cleaned and get back into the boiler process again. In addition, based on the employee questionnaire section, the study was able to found that the security mask which was provided from the factory is not enough to protect from the hazardous dust.

4. **Accident and injuries-**

- In 2010, a man had a finger injury(lose fingers) while working in the power saw.
- A leg injury happened due to drum chipper.
- No death has been reported.
- Fire accidents happen per each month.

5. **Currently progressing safety and health activities-**

- Currently, MDF manufacturing industry in Sri Lanka used PPE safety equipment for their employees.
- Eyes: Safety goggles and glasses, weld masks, face shields,
- Ears: Earmuffs, earplugs
- Head: protective helmets, bump caps, hairnets
- Torso/back: Fall restraints, reflective vests, aprons, back braces
- Hands/arms: heavy-duty work gloves, rubber(latex) gloves, protective sleeves, wrist supports
- Body: unique overall for their workers, supplied-air respirators for lab works, a normal mask for other labours.

Figure 11 shows the safety equipment used by the MDF manufacturing industry.



Figure 11: PPE equipment [8].

• **Fire protection**

The research was able to find that, the fire systems and water sprinklers are fixed with fire alarms in each of the buildings of that MDF manufacturing industry. This system has smoke detectors and heat detectors. These sensors are set to detect certain levels of heat or smoke that could be an indication of fire. A loud bell or a siren sometimes accompanied by blinking or flashing lights for individuals who have hearing problems, blast to alert occupants in the building.

• **Smoke detector**

Smoke detectors are fixed on each electrical panel room to detect the fire of wire, insulation or transformer oil. All smoke detectors are connected to fire detectors. Here, CO₂ will inject when the sensors detect the fire.

• **Conduct Safety Meeting**

In the MDF manufacturing industry, safety officers will conduct the safety meeting in section vice per every three months. Those meetings contain important information on equipment safety, general workplace safety, dealing with violence and harassment in the workplace, and how every employee can contribute to company safety. And also, safety officers are encouraging employees to take responsibility for workplace conduct and safety.

➤ **Provide health insurance**

'The employee group health insurance' is the medical insurance plan that provides health care coverage to all the employees of a company. So in the MDF manufacturing industry, all the employees have health insurance.

6. **Risk assessment and analysis methods**

Solutions that can be carried out as an industry

Solution for the dust

- Use a safer product such as solid wood, composite panels with no added formaldehyde or products with low formaldehyde emissions.
- Use proper ventilation. For example, local exhaust

ventilation can be used for it, from that it will extract dust and gases at the point of generation. It consists of several components such as a hood, duct, fan, filter and exhaust duct. It may be attached to the machine. There are other exhaust systems that filter wood dust and send the gas outside. We can use any kind of system for reducing dust.

- Use good hygiene methods such as washing whenever we get dirty and shower and launder clothes at the end of the day.
- Keep the work area clean, so that dust will not go to the air while working.
- Never use compressed air to clean the work area or clothing because it also generates some harmful dust.

➤ **Inspection, testing and maintain the fire protection system at least per week.**

There is a need to do regular visual checks of each fire detection systems, protection device and make sure everything is still working in operating condition. Therefore well trained qualified tester has to come in and test the equipment to see whether they will perform during an emergency or not. Also, the manufacturers of each part of the fire protection system will require certain maintenance to keep the various components in good shape and to get better performance.

Solutions that can be carried out as a personal

➤ **Personal management**

To create a safe environment, it is important that our personnel awareness about industrial safety. Every employee should be aware about the near-miss, unsafe condition and possible risk occurring in the industry.

➤ **Risk management**

Every higher-level member in the industry should know about the steps of risk management, identifying hazards, how to assess risk and control them.

➤ **Reporting**

Setting up automated reporting systems.

➤ **Train for competence and safety in the workplace**

Always employees should train well and make sure they have the correct information and develop the skills they need to prevent hazards and accidents.

➤ **Teamwork**

Employers should team with contractors and suppliers and other employees to manage the safety of the workplace. All the people in the industry should work together to eliminate hazards, manage the relationship among others.

Other solutions

- **Make safety a key part of your business**
- **Investigate incidents**
- **Maintain records**
- **Talk regularly with your employees**
- **Select the proper PPE**
- **Maintain hazard identification methods**

a) 'What if' method

This method identifies hazards, possible accidents, qualitatively evaluates the consequences and determines the adequacy of safe levels.

b) Checklist method

The following hazard identification checklist can be done.

3 CONCLUSION

The questionnaire survey was very effective to observe the actual safety situation of the MDF manufacturing industry in Sri Lanka. So that, based on the information obtained from the questionnaire we can come to a conclusion as follows. Any industry has followed a security procedure for their employees. Sometimes it can be enough or not. But according to this research, ongoing security procedure has been successful in the MDF manufacturing industry, Sri Lanka. But the number of hazards and accidents happened due to the negligence of the employees is much higher than the number of hazards happens due to the negligence of the industry. Therefore our research has proven that it is better to take care of ourselves, whether in the workplace or in ordinary life.

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Survey Name: _____ Survey Date: _____
 Work unit: _____ Area/Room: _____

If 'No' is selected, please correct the hazard and note the date.

		Yes	No	n/a	Data Corrected
ADMINISTRATIVE					
1.	Does the staff know how to report an incident/injury/safety concern?				
2.	Work unit emergency call list available?				
FIRE PROTECTION					
3.	Smoke detectors tested annually?				
4.	Emergency Action Plan/Fire protection plan communicated?				
5.	Portable Extinguishers-Accessible, the location marked, checked monthly maintained annually?				
6.	Automatic fire sprinkler systems maintenance inspection quarterly?				
7.	Fire hoses and hose cabinets inspected?				
8.	Evacuation plan posted?				
MAINTENANCE					
9.	Are machinery and equipment regularly maintained?				
PERSONAL PROTECTIVE EQUIPMENT					
10.	PPE used in the correct manner?				
11.	PPE has worn by workers when required?				
12.	Workers trained incorrect use of PPE?				
13.	Correct and appropriate PPE supplied?				
14.	PPE checked and maintained regularly?				
15.	Appropriate dust mask regularly supplied?				
SECURITY					
16.	Security measures in place?				
17.	Adequate lighting within and around workplaces?				
18.	Car parks well lit and secure				
19.	Are there sufficient exits to permit prompt escapes in case of Emergency?				
SIGNS					
20.	Suitable warning signs in place?				
21.	Exits clearly marked?				
22.	Are doors, passageways, or stairways that are neither exists nor access to exits and when could be mistaken for exits, appropriately marked 'NOT AN EXIT', 'TO BASEMENT', 'STOREROOM'?				
23.	Are all signs are visible?				
24.	Names of health and safety representatives clearly displayed?				
FIRST AID					
25.	Workers have access to first aid equipment and facilities.				
26.	First aid kit provided in vehicles?				
27.	Contents of the first aid kit decided to sing a risk assessment process				
28.	First aiders are provided with adequate PPE and immunization				
29.	Emergency phone numbers displayed?				
30.	Workers, have access to trained first aid personnel at all times?				
NOISE					
31.	Hearing protection supplied if noise cannot be controlled any other Way?				
32.	Workers wear hearing protection in areas designed as hearing Protection areas.				
ELECTRICAL					
33.	Are all plugs insulated?				
34.	Is electrical equipment protected from physical damage?				
35.	Is electrical equipment approved for all locations				
36.	Are holes and opening in electrical boxes covered or plugged?				
37.	Are all electrical receptacles of grounded type?				
38.	Is extension cord in good condition?				
39.	No broken plugs, sockets or switches?				
40.	No leads on the floor where work may damage them.				
41.	Emergency shutdown procedure in place.				
LADDERS AND SCAFFOLDING					
42.	Used safely.				
43.	In a good state of repair.				
44.	Slip resistance surface.				
45.	Edge protection installed?				
46.	Ropes, pulleys, and treads in a good state of repair.				
VENTILATION					
47.	Air conditioning system inspected, tested and maintained regularly.				
48.	Suitable PPE supplied and maintained where contaminants unable to be removed.				
49.	Adequate natural ventilation				
50.	Thermal comfort maintained (consider humidity, temperature, air Speed)				