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Evaluation on the Effectiveness of Safe Work Practices (SWP) Via Observation and HIRARC Analysis at Assembly Process Area in Manufacturing Industry

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Abstract: A manufacturer of finished goods from raw materials used a variety of equipment and then sells those goods to consumers. The manufacturing sector had increased and the potential dangers to human physical, health and environmental posed by its operations activities had created awareness and brought safety issues among industry. AAC (Autoclaved Aerated Concrete) manufacturing for Assembly department area was selected for this study to evaluate the effectiveness of safe work practices associated with the daily process of activities. The objectives of this study is to identify hazard and work practice at assembly-process area using HIRARC before implement Safe Working Procedure (SWP), to propose procedures of Safe Working Procedure (SWP) based on identified hazard and common work practice at assembly-process area and to evaluate the effectiveness of work practice after implementation of Safe Working Procedure (SWP) at assembly-process area. For this study, hazard identification of potential hazards had been identified by conducting HIRARC at assembly department. The risk valued were a metric used in risk assessment that assigns a specific valued to the importance of each identified hazard. The study reveals that the assembly process were exposed to hazards during the process of assembling. This includes physical hazards, ergonomic hazards and health hazards. SWP methods had been conducted such as safety briefing, training and counselling session to evaluate the SWP effectiveness at assembly department area. Results had been evaluated by safety monitoring activity and accidents record observation at the department area. Effectiveness of SWP had shown satisfying improvement, such as PPE compliance improvement, safety work arrangement had improved and accidents KPI record of assembly plant had been reduced.

Keywords: SWP, Hazard, Effectiveness

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1. Introduction

Occupational safety and health (OSH) is defined in many ways. In general, the definition covers the practices of protecting employees from various risks. Good implementation of OSH in a workplace can be seen as good management to reduce potential loss cost and risk of accidental in workplaces which lead to the better financial performance of company [1]. Accordingly, information related to OSH might be relevant for economic decision making. The relevance of the information can be seen from the perceived commitment of reporting companies that investor might associate with employment environment [2].

In addition, performance of OSH has to be visible and traceable through external reporting so that the OSH compliance can be checked and audited by relevant regulators. From corporate reporting point of view, annual reports can lessen information asymmetry in regards with OSH issues between company and stakeholders [2].

Having external OSH reporting in corporate communication is a good practice because it demonstrates company's commitment and transparency to stakeholders [2]. World Health Organisation defines OSH as protection and promotion of the health of workers by preventing and controlling occupational diseases and accidents and by eliminating occupational factors and conditions hazardous to health and safety at work [1].

Whilst, British Standards Institution describes OSH as any conditions and factors that may affect workers, visitors and other human that present in the work place [3]. It has been argued that workplaces accidents, injuries and diseases have long been a cost for human, social and economic which detriment company and national interest. Most workers all around the world are unconsciously exposed to the health risk such as dangerous dust, smoke, noise and heat [4]. There had been many policies, guidelines and action is designed to prevent, control, reduce or eradicate occupational hazards and risk [5]. Yet, despite various strategies have been taken, occupational accidents and diseases continues to increase and its cost in aspect of mental suffering and economic burden have been agonising.

The increasing number of OSH related accidents might encourage poor perception towards companies [1]. It is thought that information related to OSH has to be externally reported through annual report so that all problems associated with OSH has been appropriately addressed [5]. Occupational health and safety in work environment is a serious issue that attracts the attention of both the government and the public.

Finally, employers are faced with more stringent laws to create safe work practices on environment for their employees. In framework of assembly operation on industrial development at AAC Manufacturer in Johor, big problems that always arise are work accidents, first aid injuries and negative impacts of the industry environment. Safe work practices aim to protect the workforce of its right to safety in the conduct of welfare work and to increase national production and productivity. More importantly, to ensure the safety of everyone else at production site and to maintain the source of production safely and efficiently.

2. Methods

2.1 Method of department observation

Before implementing SWP methods, this study carried out by performing observation and monitoring in the production area by following the safety inspection guideline by AAC manufacturing company on a weekly basis. This allows the method of data collection and observation to be carried out well. It can also provide input on observations conducted in the workplace area. In this way, the project had been carried out according to the safety methods that want to be applied to the factory. Contrarily,

observation and monitoring requires recognising potentially dangerous circumstances. Because it is the best method for identifying behavior that cause workplace injuries, workplace observation is important in this study.

Workplace observation is the first step in the study. The data collected from the study was based on walk-through workplace observation. Workplace observation conducted to ensure proper occupational health and safety management in the workplace. In this study, the observation is focused on the process of the assembly. During the process of workplace observation, all work activities were identified. The possible hazards were identified via observation and given the likelihood and severity ratings.

2.2 Identify hazards

Identify hazards is the most important. The company's infrastructure, procedures, and operations are the first items of information needed. Risks can only be analyzed after they have been spotted. After determining the severity of the risks posed by a location, the hazards are prioritized based on the potential harm they might do to people and the environment. Assembly process area consists hazards and risks that exist and arise when doing the work process included slip and fall, falling object, sharp edge, pinch point and the risk of being hit by trolley. After workplace observation activity, HIRARC and risk will be analyzed and SWP method were conducted for improvement of safety at assembly area. At this stage, hazard identification of potential hazards had been identified. The severity (impact) and likelihood (level of possibility) of a risk were then being observed and reviewed. The HIRARC approach was used to identify possible hazards in the assembly process area and its surrounding.

2.3 Likelihood of an occurrence

The value in this study area was determined by the likelihood of an incident occurring. Workers' experience, analysis, and measurement were used to assess likelihood in the industry. The degrees of probability varied from "most likely" to "inconceivable." Refer to Table 1, which details several likelihood ranges and their ratings.

Table 1: Likelihood of an occurrence

Likelihood	Situation	Rating
Most likely	The most likely result of hazard	5
Possible	As good a chance of occurring and is not unusual	4
Conceivable	Might be occur at sometimes in the future	3
Remote	Has not been known to occur after many years	2
Inconceivable	It’s practically impossible and has never occurred	1

2.4 Severity of hazard

There are five different levels of severity. Severity was measured by the level of risk to an individual's health, the environment, or personal property. Refer to table 2 for an example of how to rate severity levels.

Table 2: Severity of hazard

Severity	Situation	Rating
Catastrophic	Numerous fatalities, irrevocable property damage and productivity	5
Fatal	Approximately one single fatality major property damage if the hazard is realized	4
Serious	Nonfatal injury, permanent disability	3
Minor	Disabling but not permanent injury	2
Negligible	Minor abrasions, bruises, cuts, first aid type injury	1

2.5 Risk analysis

Risk might be presented in a variety of ways depending on the findings of the study to assist risk management decision-making. Presenting findings in a risk matrix is an effective technique to present the risk in a workplace for risk analysis that used likelihood and severity in the quantitative method. To get the risk value, table 3, which shows an example of a risk assessment matrix.

Risk is calculated using the following formula:

L x S = Relative Risk

L = Likelihood

S = Severity

2.6 Safe work practices methods

After observing department safety act and conducting HIRARC on assembly process area safe work practices method being implemented and proposed for improvement at the department area. The methods were conducted based on guideline of industry supervisor and certified person for proper way of conducting SWP at department area. Safety briefing, counselling session, safety induction and training method was used for conducting safe working procedure at assembly process area.

2.7 Safety briefing

Safety briefing for Assembly method operation is important for the work process before, during and after work. For this method, briefing for operator is being conducted for safety reminder before starting work at plant area. It also complied to new engineer and supervisor. The methods of safety briefing were shown in Figure 1.

Figure 1: Safety briefing for assembly method

2.8 Assembly work instruction

Work Instruction (WI) for assembly process complied with safety rules had been made to be used as a guideline by operators and supervisors and more importantly to propose safety rules and methods during work operation at the assembly area. This instruction also will be used for safety manager and safety supervisor for training purpose at the department. This WI had been endorsed by the safety manager and factory manager so that it gets approval to carry out all safety activities in the assembly area.

2.9 Department training

Safety training for safety arrangement on wire mesh operation were conducted to implement the safety act and behavior for operators at the department. This method is carried out according to the situation before and after accident at the workplace. Before conducting the training, a discussion with the supervisor was conducted to obtain permission and approval from the supervisor to conduct training for operators in the department. The supervisor along with training conductor was together carried out the training at the workplace area. translators being used to facilitate the communication process with foreign workers. Training attendance was used for record purpose. Assembly training conducted were shown in Figure 2.

Figure 2: Briefing session before training

2.7 Unsafe act counselling session

Counseling were conducted for the purpose of giving warnings about safety in the workplace. Enforcement of counseling for operators had been strengthened to guarantee the safety of the behavior of employees in the department. The counseling form were used for the purpose of recording the work that had been counselled. The record was intended to follow up further action against the employee if he commits misconduct in the future. Figure 3 show counselling session for operator that had been conducted.

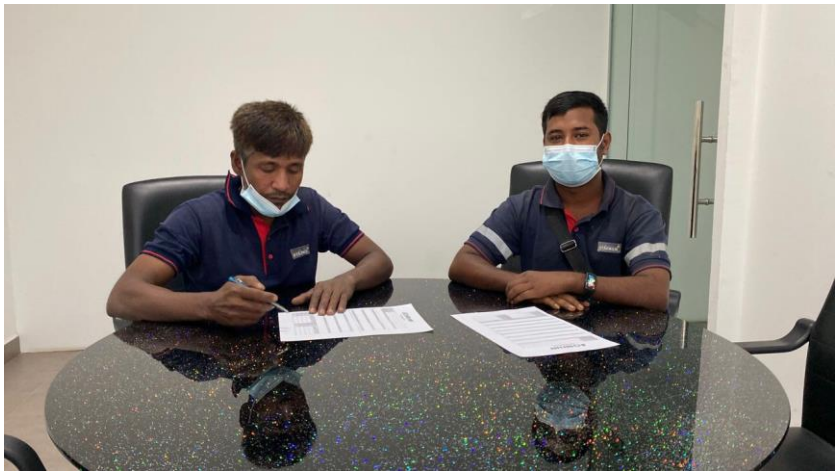


Figure 3: Counselling session for unsafe behavior at production

3. Results and Discussion

3.1 Results of safe work practices implementation

After implementing various methods of safe work practices for the assembly process, there were some changes that occur after conducting the SWP. The effectiveness of this implementation were analyzed by department observation and monitoring activity. Among them were compliance with PPE at work, safe working methods when operations are getting better and accidents record had been reduced at the department area from time to time. Below shows some of the changes and improvements that occurred after latest observation and monitoring at the department area.

3.2 Improvement of PPE compliance

Compliance with PPE such as safety helmet, safety shoe, eyewear and safety harness had been properly followed by the operator when conducting operations. This matter is also monitored by the supervisor department to further strengthen PPE compliance at the workplace, especially involving heavy work activities such as grinding, lifting and installing wire mesh. Figure 4 had shown improvement of PPE at workplace area.

Figure 4: PPE compliance improvement

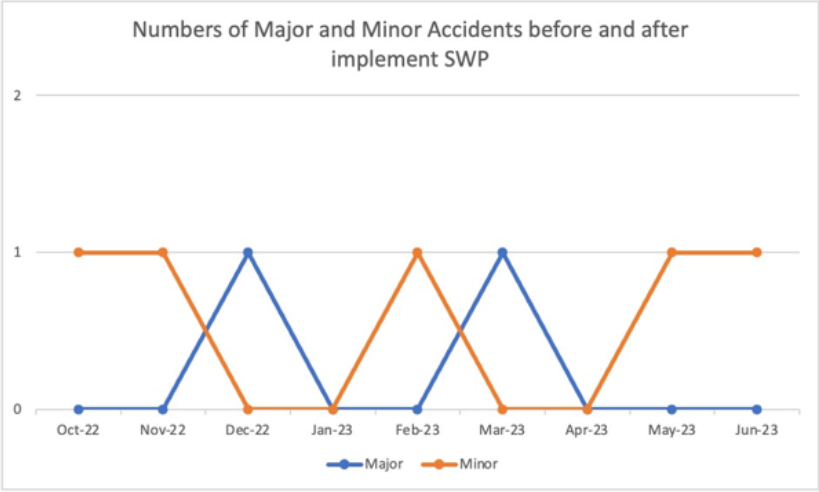
3.3 Improvement of safety arrangement for work process

Safety arrangement at Assembly workstation had shown excellent improvements in terms of workplace management, department supervisor monitoring, and more convincing safe working methods. This proved that the emphasis on safety in the assembly department shows a positive impact from supervisors and operators. Figure 5 show supervisor on arrangement of work operation before starting the process.

Figure 5: Work arrangement before operation

3.4 Accidents KPI improvement

The implementation of SWP in the workplace had shown improvement in the record accident that occurred at the assembly area. This show that the SWP methods that were carried out and proposed are effective in the enforcement of safety measures in the workplace. Figure 6 had shown assembly performance target for production by accidents record that had been observed.



RECORD OF ACCIDENTS BEFORE AND AFTER SWP

BEFORE SWP: OCTOBER 2022 – MARCH 2023

AFTER SWP: APRIL 2023 – JUN 2023

Figure 6: Assembly performance target

In accordance with the results across all assembly performance and improvement at the assembly process area, it had shown that the target desired by the assembly department had achieved a good level of work in production. With regard to the accidents that had occurred, it had also shown a good level of reduction when there were only small accidents compared to before the implementation of the SWP where it only involved minor property damage in the operational area. Operators and supervisors provide good cooperation in making safe work methods successful.

For the overall of the result, throughout the period from April 2023 to June 2023, it showed a good level of performance when there was no accident report regarding first aid and major accident which happened often which there were only 2 minor accidents before the implementation of SWP which had 3 minor accidents and 2 major accidents from month of October 2022 to March 2023.

4. Conclusion

As for the conclusion, assembly process consists hazards and potential of risk in their safety. Employees can injure themselves and hazard identification were important factors to consider that it indicates to low the potential of hazard and eliminates the risk to employers. Employers should be taking any precautions such as, instruct, train, counselling, briefing and supervise to low the risk and control the hazard and always remind employees of safety working because assembly is handling with variety of dangerous objects. Employers need to have training and understand the manual first before operating it. Machines used in assembly are dangerous as it mainly used to sharp material hence, they are especially dangerous, and employees need to have proper precaution in prevention for injuries from bruises, cuts, punctures, nicks, and gashes by having proper safeguards. Therefore, employers should be training the employees on how to recognize all types of hazards that related to their assigned job tasks by knowing principal hazards of assembly process.

Furthermore, there are many types of hazards, non-compliance safety and unsafe act that employers should not be ignored in assembly process at AAC manufacturing industry and still need to take an action to reduce or improve. To comply with study objectives, hazard identification that had been identified using HIRARC for identifying dangers and risks that often occur in the work area were the purpose of improving safety and health at the workplace. HIRARC that is carried out is followed up with monitoring and observation activities to analyze hazards that exist when the activity process is being carried out. This activity gets support from the supervisor to enable the observation activity to run well and smoothly. Next, SWP methods and procedures that had been proposed such as training, safety briefing and counseling were going well and hope it can be continued to being applied for the value of safety at the workplace. SWP methods carried out show that the safety department cares about matters related to safety in the work area to prevent unwanted accidents from happening. Lastly, the effectiveness of various methods of SWP implementation had shown good improvement from time to time and had been supported by department supervisor while hoping this activity can be used to further improve the effectiveness of SWP in work practice at the department.

In conclusion of this study, research on safe work practices in manufacturing industries is generally lacking and needs to be strengthened. Future research should focus on safety management systems and the role of a safer design on the environment including equipment and machinery. The effectiveness of safer working methods should be evaluated and measures to improve safety working process. Comparative research into the effectiveness of occupational safety practices in our country with other developed nations will be helpful. For manufacturing industries, industry administration and workers for improvement in occupational safety and health is needed. Mishaps at the job environment ought to be kept with the participation from both managers and representatives on top of customary authorization from the legislature. Occupational accidents are avertable and occupational incidents can be omitted through proper safety measures. The administration, staffs and DOSH must consolidate strengths and attempt to forestall future occupational safety practices by increase staff and management training for

workers. To develop a good safe work practices at workplace, the rules from government, employer and workers need to combine together.

Besides, Safe Work Practices (SWP) methods that have been implemented should not be ignored and make it a long-term guideline for the guidance of supervisors and safety managers in the future. The SWP that is implemented is to make better safe working methods to strengthen safety and health in the workplace.

Finally, the effectiveness of the safe working method that has been achieved is not the end point for a safety management, this should make this effective implementation method a motivation to further strengthen and apply better safety values in the future. By following SWP methods thoroughly can get lot of advantages such as they can cut the cost for accidents or health insurance of employee.

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