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Workplace Health and Safety Management Practices and Risk Assessment Towards Productivity in Plastic Industry

Mohsin Anwer Naqvi[1], Dr. Sandeep Yadav[2]
Department of Fire Technology & Safety Engineering[1,2]
VITM, Indore, India.[1,2]

Abstract:- Implementation towards healthy working condition plays an important role and creates positive impacts on economic and social development. Incident prevention tools like, incident investigation and pre job safety analysis can significantly reduced work place incident. In this study the cause of accident and how could prevent their occurrences were discussed.

Risk assessment as well as implementation towards product safety during manufacturing process is also discussed for rejection control or for enhancing the productivity. The data was obtained from different working area of the industry. The accurate information in questionnaires from the employees of the industry is collected, which took couple of weeks. After the collection of data it was analyzed for further improvement. Two machines were analyzed or monitored for comparing the new implemented strategies with the old or running one, for product safety during manufacturing process. The result shows that the safety culture among the workers in industry is increased and the risk of incident occurrence decreased.

Keywords: Safety management, Actual case study, Accident prevention tools, working parties, Manufacturing equipment's, Productivity.

I. Introduction

The plastic industry, being highly mechanized and chemical-intensive, exposes workers to multiple occupational hazards such as toxic fumes, high-temperature processes, mechanical injuries, and ergonomic strains. Ensuring workplace health and safety management practices is therefore a critical component of operational excellence in this sector. When safety protocols are effectively integrated with risk assessment frameworks, organizations can prevent accidents, comply with regulatory norms, and foster a culture of productivity. A safe work environment does not merely reduce risks—it also enhances employee morale and contributes significantly to higher production efficiency [1].

Plastic manufacturing processes rely on raw materials like PVC, polyethylene, and various additives such as plasticizers, stabilizers, and solvents. These substances may generate hazardous emissions and carcinogenic particulates if not handled properly. Additionally, extrusion, molding, and cutting operations involve heavy machinery with high-speed components, which can lead to injuries in the absence of proper safety measures [2]. Therefore, a strong safety management system is required to minimize occupational health issues such as respiratory disorders, skin allergies, burns, and repetitive strain injuries. Protecting workers is not only an ethical responsibility but also a legal requirement for maintaining business continuity [3].

II. Workplace Health and Safety Management Practices

Effective health and safety in the plastic industry includes a combination of engineering controls, administrative measures, and personal protective equipment (PPE). Ventilation systems and fume extraction units help reduce chemical exposure, while machine guarding, lockout/tag-out systems, and routine equipment maintenance prevent mechanical accidents. Administrative strategies such as safety audits, employee training, shift rotation, and emergency preparedness drills further reinforce hazard control. Use of PPE including gloves, goggles, anti-static footwear, and respirators forms the last line of defense. A strong safety culture ensures that workers are aware of potential hazards and actively participate in reporting unsafe conditions [4].

Risk Assessment

Risk assessment acts as the foundation of workplace safety by identifying hazards, estimating potential consequences, and determining preventive measures. In a plastic manufacturing unit, risk analysis may involve assessing exposure to chemicals during mixing, slip and fall hazards around cooling areas, fire risks in storage zones, and ergonomic risks in packaging tasks. Tools such as Hazard and Operability Study (HAZOP), Job

Safety Analysis (JSA), and Failure Mode and Effects Analysis (FMEA) are commonly used for systematic evaluation. The goal of risk assessment is to prioritize hazards and implement controls before they escalate into incidents [5].

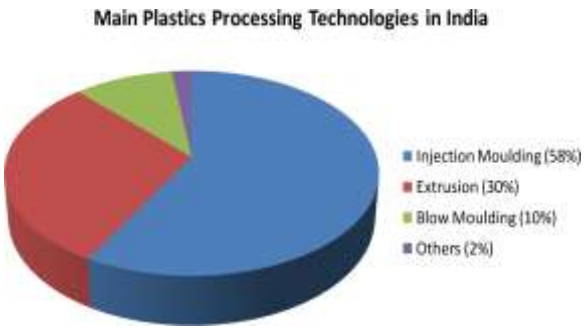

Fig.1. Plastic Industries distribution

For the plastic industry, workplace health and safety management practices, combined with a strategic risk assessment approach, are vital for protecting human resources and boosting productivity in the plastic industry. A proactive safety culture minimizes workplace injuries, improves employee well-being, and supports efficient production cycles. As environmental concerns and industrial standards evolve, embracing advanced safety frameworks will remain essential for sustainable growth and competitiveness in the plastic manufacturing sector [6]s.

Good workplace safety practices directly correlate with increased productivity. When workers feel protected and healthy, absenteeism decreases, job satisfaction improves, and workflow faces minimal disruption. Accidents can halt production for hours or days, leading to financial losses and reputational damage. By reducing downtime and compensation costs, safety investments yield long-term economic benefits. In the plastic industry, where competition and production targets are high, integrating safety with operational planning becomes a major driver of business sustainability [7].

III. Previous Work

This section highlights the existing work in the domain, along with its salient features:

Morrish Colin et.al discussed about the accident and investigation of the incident and pre-job safety analyses which helps to reduce workplace incidents. He states that working parties must work together to make these safety tools effective, in which staff units are work together in a co-ordinate manner and they must be shown the value of their work in preventing accidents with the help of examples of actual accidents investigated in the factory during his work experience. He discussed that how he causes of the accidents are explored with close reference to how pre-job safety analyses could have prevented their occurrence.

Anju Singh et.al gave details about small and medium enterprises which are also the main pillar of an economy for any country. The author also discussed about major minor accidents about old machineries, lack of awareness in worker towards the safety point of view, ergonomics problem etc, and also the implementation of working procedure with which the working condition creates positive impact on economic development.

Lynda S. Robson et.al discussed about the exploratory study sought out or to identify the factors important to large improvement in workplace occupational health and safety (OHS) performance. The methods he were used to systematically identify 12 organizations in a workers' compensation database that had made large and intentional improvement I workplace OHS performance. He used four elements for Cross-case analysis and consideration of existing literature led to a 12element conceptual model with organizational learning at its core in initiation of BTC (Break through changes): external influence, organizational motivation to improve OHS, new OHS knowledge and a knowledge transformation leader.

Marcus Runefors et.al gives knowledge about the existing safety culture in shipping companies or on board ships can enable the formulation of effective interventions to maintain and improve safety culture and safety in the organization. For the safety culture, he developed the questionnaires data that are often used. In his study he proposes a work process that facilitates the analysis and interpretation of the relationships between safety culture aspects using questionnaire data. These were found to be an excellent way to estimated complex relationships in the quantitative data and to facilitate the understanding of the safety culture concept.

Michael Appiah Adu et.al discussed that the study drawn only from hospitals and this are the limitation which are generalization of the result across varied specialization or organizations the authors has discussed about the safety and healthy working environment which has received numerous research attentions over the years. This research seems to have been conducted in the

construction industry, with little attention in the health sector. There are many couple of studies conducted that suggest pressure in hospitals. The aim of his study was to examine how pressure influence safety behavior in the hospitals. General safety climate significantly correlated positively with safety behavior and negatively with work pressure.

Hasse Nordlof et.al analyzed that this study will not applicable for the industries other than manufacturing, and also to other countries or a cross-national research project, preferably with a larger sample size and this study could not able to focus on how companies' OHSM practices can be measured in a successful manner. In this study the author discussed about the companies which need to ensure a functioning occupational health and safety management (OHSM) system to protect human health and safety during work, but generally there are differences in how successful they are in these practices.

IV. Methodology

The methodology is presented in this section. Actual case history of the incidents can be represented by the investigation to the person who wants to study them in briefly and wants to prepare conclusion and procedure to prevent the reoccurrence of the incidents. It will better; to design the procedure; making studies or investigations should carried out when the plants were being designed so that avoidance of the incident, plant modification as well as the method of working could have made altogether. It is better to be aware of the hazards than not noticing them and also aware as well as to prepare what lies ahead [14].

Hazards identification, their assessment, evaluation and measurement both qualitative as well as quantitative rectification, technological and operational control measures, management safety system, administration and organization in safety are very remarkable tools.

Among the many methods the most remarkable are [15]:

- Hazards and operability studies
- Hazards analysis- also called as Risk analysis, Risk assessment, Probability risk assessment and also quantitative risk assessment.
- Regular safety audits at workplace.

Planning:

By adopting the systematic planning procedure it is possible to identify the significant hazards and the control of risks associated with the activities of the organization as well as any related legal requirements.

The following points are as follows:

1. In the planning schedule overwork and stress should avoided and must be taken into consideration.
2. The supervision at the greater level during the work pressure or stress must be taken into an account. Shut-down, starts up, emergency planning must be monitored and met by the management.
3. Special attention should be paid to the physical fitness of the employees with respect to their job.
4. Employees and their representative should participate in decision making from where they exist for concerning their activities for the organization.

Safety Management Systems:

For maintaining, developing, implementing, achieving the industrial safety policies the safety management system includes the organization structure, planning activities, responsibilities, practices, procedures, processes. With respect to target the goals to achieve the fulfillment of the system it demands the critical and systematic assessment of the existing standard of the safety.

For smooth and effective functioning of an industry, Health and Safety is one of the most important aspects. An accident free industrial environment will be ensured with good health and safety performance. For the identified hazards, their evaluation as well as risk control must be needed to adopt a systematic approach.

V. Results

The results are presented next:

Case 1: Heavy load plate falls on the supervisor's foot.

At the workshop or also can say tool room the supervisor doing the mould maintenance, as we know that the moulds are very heavy in weight, if it falls, than one can got serious injuries, may be get fractured to the body part. Inside the mould there are many parts which are assemble one of them is the ejector plate.

The plate is also contains much load. The helper holds the plate vertically by his hands and the supervisor is cleaning the plate. As the balance of the plate is depends on the helper. By mistake the plate slips by the operator's hands and fall on the legs of the supervisor. As the plate was very heavy it damaged the leg (i.e. fracture) of the supervisor. As well as the plate also got damaged as it is made of the stainless steel, a minor crack has came on the top of the plate, which will also cost more for repairing if it possible.

Fig.2. overhead crane installed for the mould maintenance.

Fig.3. Platform for maintenance.

These two cases correspond to Heavy load plate.

Case 2: Grinding machine's gate opened by the operator at the running time.

The rejected material from the production area shifted to grinding area. In which the bottle is cut into small pieces by grinding machine, which having sharp blades. The sharp blades wheel is rotating by 40 hp motor which is connected to the shaft and v-belt. The speed of wheel rotation is very high.

The operator is new joining in factory he opens the door of the machine at the running time, due to this the small pieces of bottle move upwards direction as the rotation of the wheel is very high, which cause injury to the operator eyes. The limit switch is installed to the machine gate for safety purpose.

Fig.4. Open gate of grinding machine, inside the machine the sharp blades are there which can cause serious injury.

If the doors opens at the running time, the limit switch will disconnect the power of the machine and towards the worker safety the gaggles is provided to machine operator which is compulsory to wear at the running time of machine to protect the eyes from injury.

Fig.5. Limit Switch Installed

The next case corresponds to failing of fire extinguishing:

Case 3: Fire extinguisher fails at workplace.

The operator is cleaning the mould by the alcohol, which is flammable liquid. The operator wears the gloves for the protection. The gloves get full contaminated from the alcohol as he cleaning the mould. After cleaning the mould nozzle needed heating from external source, for this the LPG cylinder is used. The operator did not remove the gloves and burns the cylinder; due to this the fire occurs in the gloves which are contaminated by alcohol.

Fig.6. Dry powder fire extinguisher.

The first extinguisher gets fail to extinguish the fire because dry power extinguishers consists of particles having irregular shapes, which results in a poor flow of powder under discharge condition. This type of extinguishers is replaced by cleaning agents' types of

extinguishers, so that protection from fire can be done easily and strictly instructed to the worker to follow the procedure of working at the particular place. The powder residue can cause damage to sensitive electronic equipment such as circuit boards, computers, production machinery etc. The ammonium phosphate within the extinguishing agent can undergo hydrolysis to form phosphoric acid, which is extremely corrosive to ferrous metal and alloys, and may also attack some plastics, rubber and coatings.

Job First Safety Analysis:

A job safety analysis (JSA) is a procedure which helps to integrate accepted safety and health principles and practices into a particular task or job operation. In a JSA, each basic step of the job is to identify potential hazards and to recommend the safest way to do the job. There is also the other terms used to describe this procedure, they are; job hazard analysis (JHA) and job hazard breakdown.

Risk Assessment Towards Safety:

A risk assessment will identify risks within the process again, not only risk that hurt people but risk that impede production. In this study the analysis is discussed to improve the efficiency of process during manufacturing a product. The manufacturing are the step through which raw material are transformed into final product. Manufacturing system can be defined as the arrangement and operation of machine, tools, material, people and information to produce the value added physical, informational or service product whose success and cost is characterized by measurable parameters.

The result shows that the risk of incident occurrence and the safety behavior among the health of the workers in the factories is increasing day to day when the safety policies are adopted by the industry. The tools like competition in markets, efficiency in all phase are seems to be effective. Top management commitment was found to be more useful in order to manage safety in the workplace. Workers were adopting the safety policies and involving in the other activities, as they are getting motivation from top management. Safety increases after implementing the safe and clean technology. Due to the use of new technologies the risk decreased. Reduced risk in ergonomics problem due to automation in some of the machines, implementation of safety committees, machine guarding, etc. Increase in the productivity seems due to implementation of new strategies in the manufacturing process.

VI. CONCLUSION

The main contribution of this study is that workplace perspectives on safety and awareness on safety issues amongst the workers, recommendation like implementation in old technologies were put into practice. This study investigated on different phases that may influence safety management practices in the factory. The tools which were used for reducing the incidents occurring were discussed also with two example of the actual case of incident. If these tools are will be in practice then the positive outcome will seems towards safety. Implementation towards the improvement of the manufacturing process efficiency was discussed and applied the new strategies. Some points were discussed below:

- **Controlling the wastage of the raw material and also operator safety by installed automatic conveying system.**
- **Process efficiency improved after implementation that is made new water tank.**
- **Security of the critical process parameter by password in old machine.**
- **Change the type of the fire extinguishers.**
- **Prepared the new strategies for workers safety.**
- **Limit switch is installed in grinding machine for worker safety.**

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