Study and Implementation of Hazard Identification and Risk Assessment in Engineering Industries

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Abstract: The Hazard Identification and Risk Assessment (HIRA) system can be used as a risk assessment tool to help users identify hazards and estimate the risk associated with each one. This risk assessment tool will detect potential hazards in each department's task. The risks associated with the hazard will be estimated and categorised once the hazard has been recognised. If the predicted risk goes into a higher risk group than the low risk category, possible control measures will be suggested. At the same time, the user can upgrade the existing information system by adding new work plans, tasks, and control measures.

Keywords: Control Measures, Foundry, Hazard, Identification, Risk

I. INTRODUCTION

The basic role of materials handling is to move materials, but the requirement for materials handling arose from the development of manufacturing systems, which began in the late eighteenth and early nineteenth centuries with the industrial revolution. Industries, supermarkets, offices, construction projects, and banks are all involved in the movement of goods. Men used to physically handle things, but throughout time they began to use mechanical principles such as the lever, wheel, and pulley, among others.

While materials handling does not add value to a product, it does add a considerable cost aspect. Material handling typically adds a considerable cost aspect. With specific expectations, materials handling costs between 20 and 35 percent of the product's cost. Previously, it was widely believed that the majority of these expenses were unavoidable and could not be avoided, but the necessity for material handling cost reduction through a systems approach is now becoming apparent. Not only does material handling occupy the majority of production time before, during, and after manufacturing, but it also consumes the majority of cost. Proper selection, operation, maintenance, and layout of these handling devices can save materials handling time and cost.

The materials handling problem must be investigated during the planning of the numerous machines and tools that will be required, as well as prior to the construction of the factory structure. Materials handling is a major factor when developing new plants, and contemporary materials handling devices can also be used to modify older facilities. These gadgets boost output, enhance quality, and speed up delivery times, lowering production costs.

Although there is no definitive definition of materials handling, attempts have been made to do so. Things handling is the science and art of moving, packaging, and storing substances in any form, and it includes the preparation, placement, and positioning of materials to make movement or storage easier.

In a manufacturing, distribution, or office context, materials handling occurs whenever a material is transferred. Stuff handling occurs during transportation, which can be by sea, air, or land, as well as moving material into and out of carriers. Material handling is the process of preparing, putting, and positioning things so that they may be moved or stored more easily. Handling of materials, articles, and equipment is one of the most common causes of injury in most industries. Before getting into the safety aspects of materials handling, it's worth taking a look at some material handling statistics.

The simple reality that human error is the primary cause of the majority of accidents justifies the use of mechanical rather than manual procedures whenever possible. Overloading, poor material management, operating at excessive speeds, lack of suitable space for operation, lack of skill, and an improper attitude on the part of the operator are all common hazards in the use of material handling equipment. Material handling is a science and an art that involves the movement, packing, and storage of materials.
Material handling is concerned with the following:

Movement

Within the plant, material handling entails the mechanical or manual movement of materials in batches or one by one. Material movement might be horizontal, vertical, or a combination of the two. The primary goal of a materials handling engineer is to determine the most efficient method of delivering raw materials to the operator and removing finished or processed goods from the work environment. He's also interested in learning how parts, materials, and final goods must be transported from one area to another.

Time

The proper materials must arrive at the right moment. Due to late or early receipt of materials at each location, material handling must ensure that no production process or customer (internal or external) demand is affected.

Quantity
Material handling must ensure that the correct quantity of materials (components, raw material, or semi-finished/processed item) is delivered to each site on a consistent basis.
Space
The materials handling flow pattern has an impact on space needs. Raw materials, parts, and semi-finished or final products all require storage space.

II. HAZARD IDENTIFICATION

Typically, an HIRA study is carried out by a group of competent specialists on the process, materials, and job activities. These teams are frequently led by people who have received formal training in risk analysis methods, and they use subject matter experts from engineering, operations, maintenance, and other disciplines as needed to apply the chosen analytical technique(s). A single expert can undertake a simple early-in-life hazard identification research; but, more hazardous or sophisticated process risk studies are often conducted by a multidisciplined team, especially during later life cycle stages. Early involvement of operating and maintenance workers in the assessment process will aid in the identification of dangers that may be eliminated or controlled most cost effectively. After the investigation is completed, management must determine whether or not to execute any risk-reduction recommendations.

These steps that can be taken to implement the recommended practice. Each item is accompanied by several steps, with an emphasis on employee input and participation.

1. **Collect existing information about workplace hazards**
- Gather, organise, and discuss information with workers to establish what sorts of hazards are present and which workers are exposed or potentially exposed.
- Surveys or minutes from safety and health committee meetings are examples of worker input.

2. **Inspect the workplace for safety hazards**
- Inspect all activities, equipment, work places, and facilities on a regular basis. Encourage workers to join the inspection team and talk to them about any hazards they notice or report
- Keep track of inspections so that the hazardous situations can be verified afterwards. Take images or video of issue areas to help with later conversation and brainstorming about how to control them, as well as for learning purposes.

3. **Identify health hazards**
- According to the advice, detecting and analysing health threats may necessitate specific knowledge. Through OSHA's On-Site Consultation Program, small firms can get free and private occupational safety and health advice, including help identifying and assessing workplace hazards.
- Recognize and avoid chemical, physical, and biological hazards, as well as ergonomic hazards.

4. **Conduct incident investigations**
- Create a clear plan and method for conducting incident investigations so that they can begin right away when an incident happens. Who will be involved; lines of communication; resources, equipment, and supplies required; and reporting forms and templates should all be included in the strategy.
- Conduct investigations with the help of a trained team that comprises both management and workers.
- Look at close calls and near misses.
- Determine and investigate root causes in order to correct underlying programme flaws that led to the occurrences.
- To avoid recurrence, communicate the investigation's findings to managers, supervisors, and employees.

5. **Identify hazards associated with emergency and nonroutine situations**
- Determine foreseeable emergency scenarios and nonroutine jobs, taking into account the materials and equipment in use as well as the facility's location. Fires and explosions, chemical releases, hazardous material spills, start-ups after scheduled or accidental equipment shutdowns, and nonroutine duties such as infrequently conducted maintenance chores are all scenarios that could occur.

6. **Characterize the nature of identified hazards, identify interim control measures, and prioritize the hazards for control**
- Consider the severity of probable results, the likelihood of an incident or exposure, and the number of workers who might be exposed when evaluating each hazard.
- Protect workers with interim control measures until more permanent solutions may be adopted.
- Prioritize the hazards so that the ones that pose the most danger are dealt with first.

III. RISK ASSESSMENT

The goal is to ensure that no one is injured or falls ill, as accidents and illness may ruin lives and have a negative impact on your organisation if output is lost, machinery is damaged, insurance prices rise, or a lawsuit is filed.
The most crucial decisions we must make are whether a hazard is serious and whether we have adequate protections in place to ensure that the risk is minimised. When we estimate the dangers, we must keep this in mind. Electricity, for example, can kill, but it is rare to do so in an office setting if 'live' components are adequately insulated and metal casings are properly earthed.
There are five steps involved in risk assessment they are:
- Identify the hazards
- Decide who might be harmed and how
- Evaluate the risks and decide on control measures

- Record your findings and implement them
- Review your assessment and update if necessary

There are three types of risk assessment they are:

Qualitative Method

- A qualitative risk analysis uses a pre-defined grading scale to prioritise the detected project risks. Risks will be ranked according to their likelihood of occurrence and potential impact on project goals if they occur.
- Probability/likelihood is frequently graded on a scale of zero to one (for example, .3 equating to a 30 percent probability of the risk event occurring).
- The impact scale is determined by the organisation (for example, a one to five scale, with five being the highest impact on project objectives - such as budget, schedule, or quality).
- A qualitative risk analysis will also contain proper risk classification, whether source-based or effect-based.

Quantitative Method

- In order to establish a probabilistic analysis of the project, a quantitative risk analysis is a further investigation of the highest priority hazards during which a numerical or quantitative rating is awarded.

A quantitative analysis:

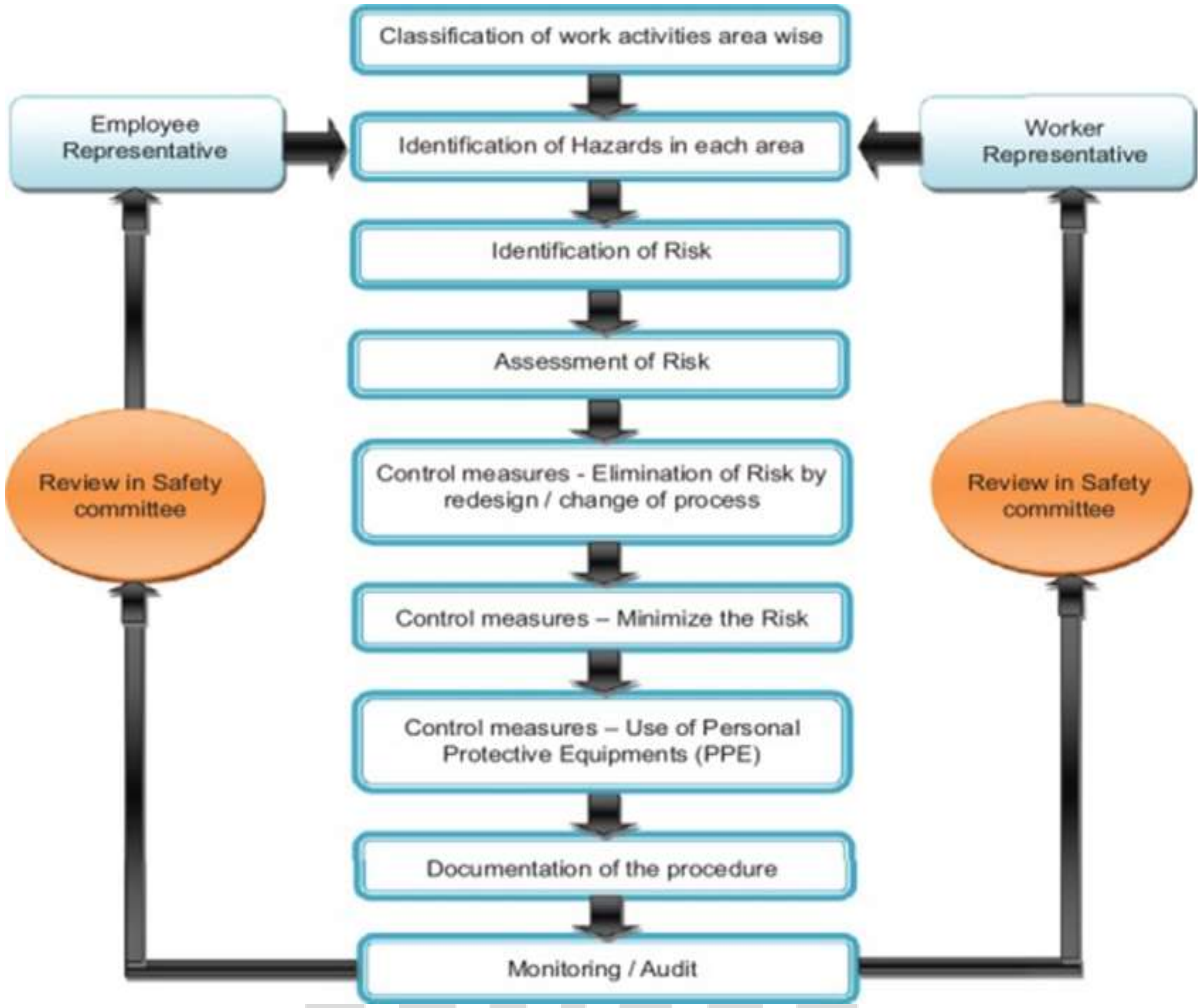
- Quantifies the project's possible outcomes and evaluates the likelihood of reaching certain project goals.
- Offers a quantitative method for making judgments in the face of uncertainty.
- Establishes cost, schedule, and scope goals that are reasonable and feasible.

However, semi-quantitative risk assessments are now commonly employed to address some of the drawbacks of qualitative risk assessments.

Semi-quantitative method

- Semi-quantitative risk assessment goes a step further than qualitative risk assessment by assigning values or multipliers to likelihood and outcome groups. It could also entail frequency levels being multiplied.
- It is impossible to remove all dangers. For hazards rated critical or high, immediate action is necessary, which may include directions to stop working and/or isolate the danger until permanent remedies can be installed. For moderate risks, documented control plans with roles and completion deadlines must be prepared.

IV. METHODOLOGY



Control of risk
Risk rating can prioritize hazards with the highest potential to cause an injury so that they can be eliminated first [Table4.4(a)and 4.4(b)]

Process steps	Effectiveness
Eliminate the hazard completely	100%
Engineering control measures: Create a barrier between the person and the hazard	70-90%
Administration: Regulation, law, procedures, etc.	10-50%
Provide personal protective equipment	20%

Table 4.4(a) (Control measures and its effectiveness)

Risk	Description	Action
16-25	Extreme	Immediate action to control the hazard as detailed in the hierarchy of control. Actions taken must be documented on the risk assessment form including date for completion
11-15	High	Immediate action to control the hazard as detailed in the hierarchy of control. Actions taken must be documented on the risk assessment form including date for completion
6-10	Medium	Planned approach to controlling the hazard and applies temporary measure if required. Actions taken must be documented on the risk assessment form including date for completion
1-5	Low	It may be considered as acceptable and further reduction may not be necessary. However, if the risk can be resolved quickly and efficiently, control measures should be implemented and recorded

Table 4.4(b) (Control measures based on risk rating)

The following steps were taken for the control of risk:

- Quick attention to critical or high-risk hazards
- Effective temporary solutions until permanent fixes were applied
- Long-term solutions for those risks which can cause long-term illness
- Long-term solutions for those risks with the worst consequences
- Training of workers on the risks, which continue to remain and its control measures
- Regular monitoring to check whether control measures are intact or not.

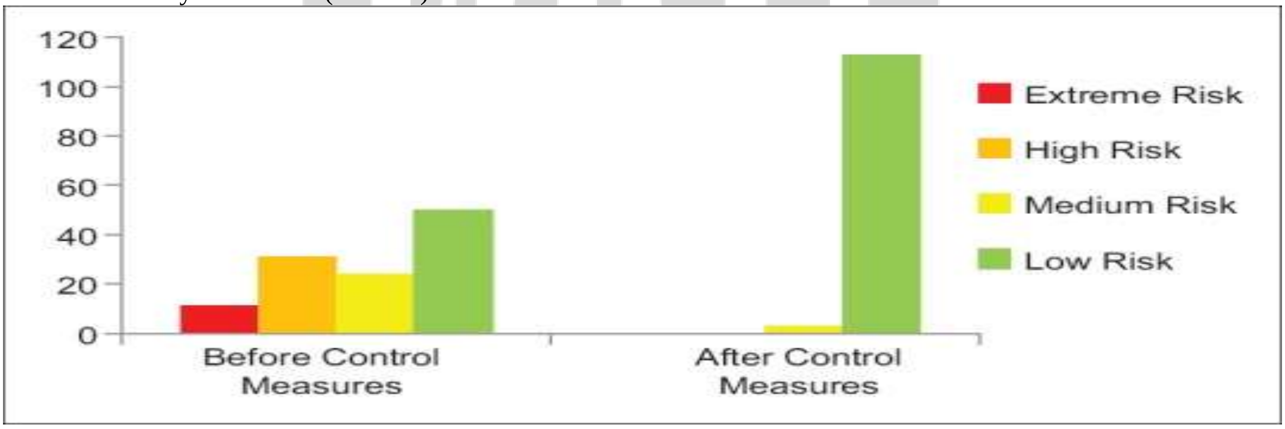
Documentation of procedure

Documenting the process aids in ensuring that the risk control measures suggested are implemented as planned. It will also aid in the management of other hazards and risks that are comparable to those already recognised. The risk management process should be documented adequately to show that it was carried out correctly. This information should include:

- Hazards identified
- Assessment of the risks associated with those hazards
- Decision on control measures to manage exposure to the risks
- How and when the control measures are implemented
- Evidence of monitoring and reviewing of the effectiveness of the controls.

Monitoring and review

It involves reassessment of the risk to see whether there is a reduction of risk rating from critical and high risk to a level considered As Low as Reasonably Practicable (ALARP).



Graph Chart For Reduction of extreme and high risk rating to acceptable risk rating after control measures

V.CONCLUSION

As a result, material handling is a necessary and unavoidable part of foundry operations. It provides a significant portion of its income to accidents. As a result, proper and safe material handling skills, together with improved working conditions and the most up-to-date material handling techniques, result in an accident-free environment.

It is clear from the preceding accident study that mechanical handling is superior to manual handling. Because the foundry process includes a lot of material handling, new technologies such as robotics and other comparable technologies may be incorporated to improve materials handling, and it is up to the management to decide.

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