HAZARD IDENTIFICATION AND RISK ASSESSMENT IN WATCH MANUFACTURING PROCESS

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Abstract: *There are different types of hazards in the watch manufacturing process. The processes involve handling of various hazardous chemicals and usage of different machines. The tool used here is Hazard identification and risk assessment, or HIRA system. It is a risk assessment tool that can 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 categorized once the danger has been recognized.*

Keywords: risk, hazard, safety, and analysis.

1. INTRODUCTION

In this plant division the focus is on manufacturing watches and wearables. The manufacturing process involves use of chemicals, flammable gases and number machines that contributes to different types of hazards. Thus, the project mainly focuses on identifying these hazards and methods to reduce its risk value. Hazard Identification Risk Assessment (HIRA) is involving in identifying all the hazards and evaluating its risk level. It discusses about what are the things that can go wrong, how bad it could it be and how often it might happen.

2. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Hazards are the sources which can make potential damages. No industry can be fully free from its own hazards and risks. To reduce these hazards various hazard identification process is to be carried out. Hazard Identification and Risk Assessment is a tool used to identify the hazards and rating the hazards based on its risk level. After identifying the hazards, they are analyzed qualitatively and quantitatively to check whether they are in the acceptable level. HIRA is a combination of qualitative and quantitative method. The quantitative methods analyze various data numerically. The steps involved in HIRA are

- Work Activities Classification
- Hazard Identification
- Risk Assessment
- Monitor and review

2.1. WORK ACTIVITIES CLASSIFICATION

The initial step is to identify the various work activities carried out in the process. This level includes dividing the process into multiple baby activities. The concept of working, machines used, control methods, special hazards are identified in this level. The activities maybe routine or non-routine. Defining the work activity by their routine whether it is daily done or weekly or monthly sometimes.

2.2. IDENTIFICATION OF HAZARDS

Hazard identification is an important factor in any process to be safely carried out. Identification of hazards involves serious field work to track different potential hazards. The team must be possessing some knowledge on identifying these hazards. Apart from the team itself, feedback from the workforce also helps in make the task quite efficient. Every sub-activity must be clearly studied and identified its hazards. Using Failure Mode Effective Analysis helps the process more efficient since it addresses all the hazards in case of any system or other related failures to the process.

2.3. RISK ASSESSMENT

Risk assessment's purpose is to analyze the risk and hazards identified before. It discusses about who might get harmed and the consequences of the identified hazards in different ways, the guidelines to mitigate or reduce its risk level, evaluating the

hazards basis on its risk priority number and implement precautionary measures to avoid them. Basically, qualitative, and quantitative are the two methods used for the risk assessment. Risk assessment normally compares the estimated risk against the risk criteria using various scales. Hierarchy of controls are then implemented to control the identified hazards in different forms. Elimination is most adopted method in controlling the hazards since it drastically reduces the risk level.

2.3.1 RANKING

The method we used to rank the identified hazard is Risk Priority Number (RPN). Ranking of risks is a quantitative method in which we get the values. Ranking values for each hazard are calculated based on three factors:

- Probability of occurrence
- Severity rate
- Hierarchy of controls

Risk Score = Probability Rate X Severity Rate

Probability of occurrence

Probability of occurrence is an assessment of how likely a hazard can occur. A hazard that is frequent may result in high probability of damage. A rating scale of 1 to 5 is given based on the table 1.

Table 1- Probability of occurrence

Rating	***Description***	***Examples of Description***
5	Almost certain	Event occurs often and constant exposure to hazard. Very high probability of damage.
4	Likely	Event might probably occur and known history of occurrence. Frequent exposure to hazard. High probability of damage.
3	Possible	Event could occur at some time and history of single occurrence. Regular or occasional exposure to hazard. Moderate probability of damage.
2	Unlikely	Event is not likely to occur and known occurrence. Infrequent exposure to hazard. Low probability of damage.
1	Rare	Event may occur occasionally and no reported occurrence. Rare exposure to hazard. Very low probability of damage.

Severity rate

The severity rate plays an important role in the hazard assessment process. A hazard that may have less probability of occurrence but having higher severity rate may causes serious damage. Severity rate tell us about how hard it damages the people and the surroundings. A rating of 1 to 5 is given based on the table 2.

Table 2 - Severity rating

Rating	**Parameter**	**Severity**
5	Numerous fatalities, irrecoverable property damage and productivity	Catastrophic
4	Approximately one single fatality major property damage if hazard is realized	Fatal
3	Non-fatal injury, permanent disability	Serious
2	Disabling but not permanent injury	Minor
1	Minor abrasion, bruises, cuts, first aid type injury	Negligible

2.4 MONITOR AND REVIEW

Monitoring and reviewing should be planned and is a part of the assessment process. Every hazard that are identified and rectified must be recorded. And any changes made in the process are also recorded accordingly which will be helpful in further proceedings. The process must be reviewed annually assuring its appropriate operations and checked for its risk levels. This helps management in improving the control methods and thus reducing the hazard level.

3. MANUFACTURING PROCESS

The manufacturing processes involves different types of machines, tools, and chemical handling. The only heavy machine used in the process is hydraulic press machine all others are light machines since the component manufactured is smaller size. The hazardous chemicals are stored and handled in safe manner. Other processes include electroplating, oiling, annealing and polishing. The chemical treatment process is one division that includes major number of hazards.

4. RESULT

Major hazards and its solutions.

1. Transfer of Isopar liquid (flammable) using mechanical hand pump – Since it is a flammable liquid using mechanical frictional pump may produce heat and induce fire. To avoid this a diaphragm type can be used which has no frictional part in contact with the liquid transfer

2. Heat stress in annealing process – working prolonged period on hot area results in heat stress among workers. Installation of local ventilation and heat ventilation system in the work area will solve this problem.

3. Auto bowl motor in open condition – Any rotating parts in work area without guard could result in accident. A secure safety guard can be installed around the auto bowl.

4. Handling of Cyanide – Even though the cyanide is used in very little quantity and handled in very careful manner we cannot agree it is safe. The cyanide must be substituted with some other less hazardous chemical.

5. Electric Shock – Electroplating shop is the place where electrical circuits are used among the large quantity of liquids (which is a good conductor) for the process. This electric apparatus switches can be covered with silicon covers which could prevent contact with liquid and thus avoids short circuits.

6. Fall of person due to slippage – The shop is highly spilled liquids on the floor that cause slip of persons working in the shop. To avoid this, rough surface platform can be installed with acid proofing for which acidic chemicals are used in the shop floor.

7. Injury of hand by case pipe fixing machine – This happens when the operator has to hold the case pipe against the spindle for mounting it on the case. For this a magnetic spindle which is capable of holding the case pipe on its own can be installed. Also, a sensor at the mounting area of the case can be used and used interlinked with the ON switch to avoid the injury.

8. Hand injury by the water-resistant testing machine – The closing lid of the water-resistant testing machine is heavy and if not held by one position it may fall over to its close position that may injure hand it is placed over there. This can be avoided by providing spring tension to the closing lid of the machine.

5. CONCLUSION

HIRA investigation was carried out in the different process involved in manufacturing watch. Hazard Identification and Risk Assessment tool was used to identify various hazards and Risk priority number with risk matrix were used to quantify the risk levels. Major hazards are identified and suitable solutions to reduce the risk levels are given.

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