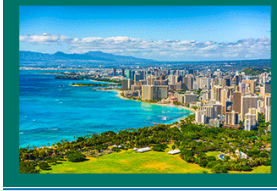
Implementation of health and safety management system to reduce hazardous potential in PT.XYZ Indonesia



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Implementation of health and safety management system to reduce hazardous potential in PT.XYZ Indonesia

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Abstract. PT. XYZ is a large automotive manufacturing company that manufacture, assemble as well as a car exporter. The other products are spare parts, jig and dies. PT. XYZ has long been implementing the Occupational Safety and Health Management System (OSHMS) to reduce the potential hazards that cause work accidents. However, this does not mean that OSHMS that has been implemented does not need to be upgraded and improved. This is due to the potential danger caused by work is quite high. This research was conducted in Sunter 2 Plant where its production activities have a high level of potential hazard. Based on Hazard Identification risk assessment, Risk Assessment, and Risk Control (HIRARC) found 10 potential hazards in Plant Stamping Production, consisting of 4 very high risk potential hazards (E), 5 high risk potential hazards (H), and 1 moderate risk potential hazard (M). While in Plant Casting Production found 22 potential hazards findings consist of 7 very high risk potential hazards (E), 12 high risk potential hazards (H), and 3 medium risk potential hazards (M). Based on the result of Fault Tree Analysis (FTA), the main priority is the high risk potential hazards (H) and very high risk potential hazards (E). The proposed improvement are to make the visual display of the importance of always using the correct Personal Protective Equipment (PPE), establishing good working procedures, conducting OSH training for workers on a regular basis, and continuing to conduct safety campaigns.
Keywords: Potential Hazard, OSHMS, HIRARC, FTA

1. Introduction

Today, the activity of a company is increasingly widespread, thus the greater the chance of potential hazards. In every production process, there are various potential hazards that can threaten workers' safety and health. Along with the advancement of knowledge and technology, the greater the challenge that must be faced by a manufacturing company, especially to overcome the problems of Occupational Safety and Health.

Division of stamping production and casting production is a division at PT. XYZ, where the production process at the plant has different potential hazard levels. The potential danger posed in these two divisions is very large, this is because plant stamping production is very closely related to press and dies machines weighing a few tons and also the noise level reaches 109 dB. Similarly, plant casting production, where most of the activity in the working environment is closely related to the temperature conditions that reach 700˚C. Based on these considerations, a good safety and health management system is needed to ensure that potential hazards in the area can be minimized.

The aim of the research done is to determine the identification of potential hazards at Stamping Division Production and Casting Production at PT. XYZ, knowing the risk assessment of the potential hazard identification results, as well as finding the root cause of why it can occur.

Based on the Manpower Minister Regulation of the Republic of Indonesia (Permenaker RI) No.5 of 1996, the Occupational Safety and Health Management System is part of the overall management system which includes the organizational structure, planning, responsibilities, implementation, procedures, processes and resources needed for the development, implementation, achievement, review and maintenance of occupational safety and health policies for the creation of safe, efficient and productive workplaces [1][2]. Hazard Identification, Risk Assessment, and Risk Control (HIRARC) are key elements in the safety and health management system that are directly related to hazard prevention and control [3][4][5]. According to the Occupational Health and Safety Assessment Series (OHSAS): 18001 (2007), HIRARC must be conducted throughout the organization to determine the organization's activities that contain potential hazards and have a serious impact on occupational safety and health [6]. HIRARC is one of the potential hazard identification methods with risk assessment as one of the key points to implement the Occupational Safety and Health Management System. The purpose of HIRARC is to identify potential hazards in a company to assess the probability of an accident or financial loss. According to AS / NZS 4360 (2004), the HIRARC method used for risk assessment can be seen in Table 1-Severity and Table 2 - Possible or Likelihood Rates [7].

Table 1. Severity Level

Level	Designation	Description
1	Insignificant	Events do not cause harm or injury
2	Minor	Inflict minor injuries, minor losses, and do not have a serious impact
3	Moderate	Severe injuries and were hospitalized, huge financial losses
4	Major	Cause severe injury, major financial loss, serious impact on production
5	Catastrophic	Resulting in dead and big losses until the cessation of all activities

Table 2. Likelihood Level

Level	Designation	Description
A	Almost Certain	May occur at any time under normal conditions
B	Likely	Occur several times within a certain period
C	Moderate	Risks can occur but not often
D	Unlikely	Sometimes it happens
E	Rare	May occur under certain circumstances

Based on the standard OHSAS 18001 (2007), Fault Tree Analysis (FTA) is a technique used to identify risks that contribute to accidents / losses. FTA is done with a top down approach, which begins with the assumption of failure or loss of a top event, then details the causes of a top event up to a basic failure [3]. Fault Tree Analysis is an effective method of finding the subject matter, as it ensures that an undesirable event or loss is caused not only to a point of failure. Fault Tree Analysis identifies the relationship between causal factors and is shown in the form of an error tree, which involves the use of simple logic gates.

2. Methods

Research begins with the identification of problems, obtained from field studies supported by literature studies. Because of the extent of the problem, the problem under study is limited to covering OSH management in one plant unit, namely Plant 2 Sunter. The next stage is data collection covering the potential hazards and implementation of OSHMS. Furthermore, a potential hazard analysis with Fault Tree Analysis (FTA) was conducted. The results concluded are taken into consideration to formulate the proposed improvement, so it is expected to reduce the risk of accident and occupational safety.

3. Results and discussion

3.1. Hazard Identification, Risk Assessment and Risk Control (HIRARC)

At this stage, hazard identification of potential hazards has been identified. Then measured risk based on severity (severity) and likelihood (level of possibility). Risk assessment provides scores of any potential hazard findings and calculates the Risk Priority Index (RPI) level for each potential hazard. Potential occupational hazards in the area of stamping production plant by using HIRARC method identified 10 potential hazards. Risk assessment on plant stamping production can be seen in Table 3. Then, the risk category is made on the risk matrix map based on the RPI value obtained from the risk assessment stage. This risk mapping indicates the position of the RPI in each potential hazard finding to find out which activities need action, based on high risk to extreme risk. Matrix analysis on plant stamping production can be seen in Table 4.

Table 3. Risk Assessment on Stamping Production Plant

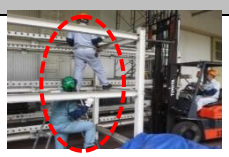
No	Location	Hazards	Picture	Effects	Severity	Likeli-hood	RPI	Risk Category
1	Kaizen Stamping	Working at altitude does not use safety guard		Operator dropped from a height	3	C	3C	H
2	Line Z Stamping	Operator is setting the material to the die		Operator can be slashed bymaterial	2	C	2C	M
3	Line Z Stamping	Operator is fixing the die inside the stamping machine area		Operator can be hitted by die	5	B	5B	E
4	Line Z Stamping	Operator is installing a cushion pin		Operator may have a back injury	3	B	3B	H
5	Line I Stamping	Operator is operating crane		Operator can be hitted by die	5	B	5B	E
6	Line I Stamping	Operator is doing press process		Operator's hand may be pinched by die	4	B	4B	E

Table 3. Risk Assessment on Stamping Production Plant (cont.)

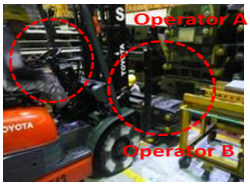
No	Location	Hazards	Picture	Effects	Severity	Likeli-hood	RPI	Risk Category
7	Line C Stamping	Forklift operator A puts the die, and Operator B places a mat for the die		Operator B maybe strucked by die / hitted by forklift	4	B	4B	E
8	Line C Stamping	Operator is not on track to cross		Operator may get hitted by a forklift	4	D	4D	H
9	Scrap Conveyor	The noise level in the area reached 109 db		Hearing function will decrease (because noise level above 80 dB)	4	A	4A	E
10	Line H Stamping	Operator is moving the material		Operators who are on the green line may be hitted by a forklift	4	D	4D	H

Table 4. Matrix Analysis on Stamping Production Plant

Likelihood	Consequence				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A (Almost certain)	H(9)	H	E	E	E
B (Likely)	M	H	H (4)	E (6,7)	E (3,5)
C (Possible)	L	M (2)	H (1)	E	E
D (Unlikely)	L	L	M	H (8,10)	E
E (Rare)	L	L	M	H	H

In addition to plant stamping production, risk assessment of potential hazards is also done in the area of plant casting production using the HIRARC method. The results are identified as 22 potential hazards and can be seen in Table 5.

Table 5. Risk Assessment on Casting Production Plant

No	Location	Hazards	Effects	Severity	Likelihood	RPI	Risk Category
1	Line Melting Casting	Setting ladle to dolly burner using forklift	The operator may be hit by heavy objects	5	B	5B	E

Table 5. Risk Assessment on Casting Production Plant (cont.)

No	Location	Hazards	Effects	Severity	Likelihood	RPI	Risk Category
2	Line Melting Casting	Put ingots into the furnace	Operator can be exposed to heat materials	3	B	3B	H
3	Line Melting Casting	Forklift enter to pouring work area	Operator may be hitted by forklift	4	D	4D	H
4	Line Melting Casting	The liquid from furnace 6 is poured into furnace 3 through ladle transfer	Operator can be exposed to heat materials	3	B	3B	H
5	Line Melting Casting	Sprinkle the husks into the walls of the furnace (full open robuta)	Operator can be exposed to heat materials	3	C	3C	H
6	Line Melting Casting	Other operators passing forklift unloading area	Operator may be hitted by forklift	4	D	4D	H
7	Line Melting Casting	Push the dolly material into the front of the furnace across the crane path	The operator may be hit by heavy objects	5	B	5B	E
8	Line Melting Casting	Reversing the slag box	Operators may be knocked by objects for himself	2	C	2C	M
9	Line Melting Casting	Take the liquid from the furnace	Operators may be contactedwith hot material	3	B	3B	H
10	Line Melting Casting	Check the temperature of the furnace fluid	Operator can be exposed to heat materials	3	B	3B	H
11	Line Melting Casting	Sprinkle kagaraito evenly over the furnace liquid	Operator can be exposed to heat materials	3	B	3B	H
12	Line Melting Casting	Clean up the remaining charging around the furnace	Operator can be exposed to heat materials	4	B	4B	E
13	Line Melting Casting	Bring the ladle from the furnace to the pouring area	Operators can be wedged by machine	4	C	4C	E
14	Line Melting Casting	Fix the furnace and pull the hose and cross the crane path	Operators may fall because there are objects blocking	3	C	3C	H
15	Line Melting Casting	Moving the pallet forks of a fork into a wooden pallet	Operator may be hitted by forklift	4	C	4C	E
16	Line RCS Casting	When the hopper is up / down can overwrite other team members who pass	Operators can hitted by hopper	4	C	4C	E

Table 5. Risk Assessment on Casting Production Plant (cont.)

No	Location	Hazards	Effects	Severity	Likelihood	RPI	Risk Category
17	Line RCS Casting	When sacks up / down can be fall other team members who pass.	Operators can hitte by the sack	3	C	3C	H
18	Line Molding Casting	Operator standing on H-Beam with a height of ± 3meter	Operators can fall from a height> 2meter	3	D	3D	M
19	Line Melting Casting	Operator is too close to the hopper door	Operators can fall from a height> 2meter	3	C	3C	H
20	Line Melting Casting	Lifting the sand from the pit using a hoist	Operators can fall from a height> 2meter	3	C	3C	H
21	Line Core Casting	Lifting die from floor to dolly transfer	Operator may hitted by die	5	B	5B	E
22	Line Core Casting	Delivery sand to zone B with forklift, other operators working in forklift path	Operator may hitted by forklift	4	D	4D	H

Then, based on the value of RPI is made a risk matrix map. This risk mapping shows the position of the RPI in each potential hazard finding. This is to find out what activities need to be taken to reduce the risk of work accident. Matrix analysis on casting production plant can be seen in Table 6.

Table 6. Matrix Analysis on Casting Production Plant

Likelihood	Consequence				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A (Almost certain)	H	H	E	E	E
B (Likely)	M	H	H (2,4,9,10,11)	E (12)	E (1,7,21)
C (Possible)	L	M (8)	H (5,14,17,19,20)	E (13,15,16)	E
D (Unlikely)	L	L	M (18)	H (3,6,22)	E
E (Rare)	L	L	M	H	H

3.2. Fault Tree Analysis (FTA)

The next stage is to find the cause of the incident related to the highest risk and extreme risk by using fault tree analysis (FTA). The peak events identified in plant stamping production are 9 occurrences of high risk and extreme risk potential hazards. In the casting production plant, there are 20 occurrences of high risk and extreme risk potential hazards. Here are the results of FTA analysis of some potential hazard causes in stamping production plant and casting production plant which can be seen in Figure 1 and Figure 2.

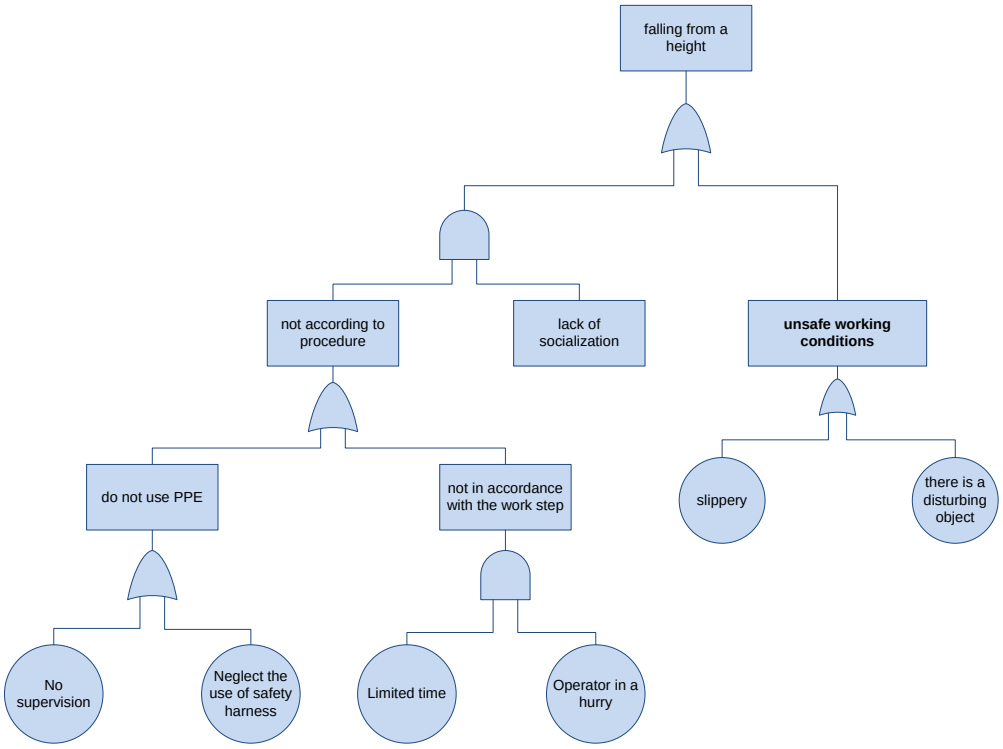


Figure 1. Causes of Potential Hazards of Falling from Height in Stamping Production Plant

3.3. Recommendation for Improvement

Based on the results of risk assessment data processing using HIRARC method, can be grouped several proposed precautions based on the assessment of the high risk and extreme risk hazards. Recommendations for improvement on stamping production plant and casting production plant can be seen in Table 7 and Table 8.

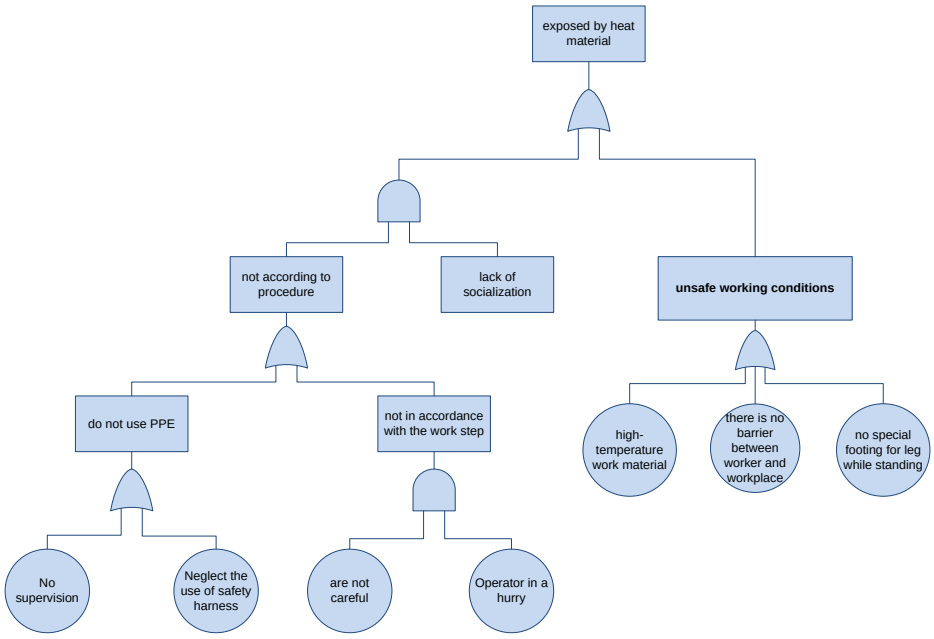


Figure 2. Causes of Potential Hazards of Hot Material Affected in Plant Casting Production

Table 7. Recommendation for Improvement on Stamping Production Plant

No.	Hazard Potential	Cause	Consequence	Action
1	Working at an elevation does not use complete PPE	1. Not using PPE 2. Low awareness and knowledge of occupational safety and health 3. No supervision from management 4. There are objects that interfere / obstruct 5. Slippery conditions 6. Work time in a hurry	Falling from a height	1. Create a visual display so that workers always wear PPE (safety harness when working at altitude) 2. Create clear and correct working procedures 3. Perform OSHMS training to workers on a regular basis
2	Operator is installing cushion pin	1. Cushion is too heavy 2. There is no cushion lifting tool, so it must be done manually 3. No supervision from management	Back injuries	Designing a system of common use cushion, eliminating the need for disassembly cushion

Table 8. Recommendation for Improvement on Casting Production Plant

No.	Hazard Potential	Cause	Consequence	Action
1	Setting ladle to dolly burner using forklift	1. No supervision from management 2. There are objects that interfere / obstruct 3. Slippery conditions 4. No boundaries	Crushed by heavy objects	1. Create clear and correct working procedures 2. Create a barrier 3. Routine supervision 4. Perform OSHMS training to workers on a regular basis
2	Put ingots into the furnace	5. Not using PPE completely 6. No supervision from management 7. No boundaries	Crushed by very hot material	5. Create clear and correct working procedures 6. Create a barrier 7. Routine supervision 8. Perform OSHMS training to workers on a regular basis 9. Using PPE completely

4. Conslussion

Based on the results of data processing and analysis that has been done, can be drawn conclusion as follows:

1. Identification of the greatest potential hazard is found in the casting production plant that is 22 potential hazards.
2. Based on Hazard Identification risk assessment, Risk Assessment, and Risk Control (HIRARC) found 10 potential hazards in Plant Stamping Production, consisting of 4 very high risk potential hazards (E), 5 high risk potential hazards (H), and 1 moderate risk potential hazard (M). While in Plant Casting Production found 22 potential hazards findings consist of 7 very high risk potential hazards (E), 12 high risk potential hazards (H), and 3 medium risk potential hazards (M).
3. The proposed improvement are to make the visual display of the importance of always using the correct Personal Protective Equipment (PPE), establishing good working procedures, conducting OSH training for workers on a regular basis, and continuing to conduct safety campaigns.

5. References

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