

# Hazard identification and Risk assessment (HIRA) in Textile Industry

Ashokkumar T C<sup>1</sup>, Dr Muthukumar K<sup>2</sup>, Manojkumar R M<sup>3</sup>

<sup>1</sup>PG student, Industrial Safety Engineering, Bannari Amman Institute of Technology, TamilNadu, India

<sup>2</sup>Professor, Industrial Safety Engineering, Bannari Amman Institute of Technology, TamilNadu, India

<sup>3</sup>Senior Safety Officer, Jay Jay Textile Mills Private Limited, TamilNadu, India

\*\*\*

**Abstract** – This manuscript contains the details on the hazards and risk level present in one of south India's leading textile industry. This study also briefs about the need, method and result of the HIRA technique. The HIRA technique is adopted in the old rotary printing department and dyeing department to assess the risk levels in terms of quantified values. The control measures were also developed for each area and activities identified with potential safety issues. It is found that the identified hazards majorly categorized under Physical, chemical, ergonomics, material handling, health and electrical hazards. The risk level is quantified for all the hazards in the printing and dyeing department by multiplying the values of severity and probability.

**Key Words:** Rotary printer, Loop ager, A-Frame, HIRA, ALARP

## 1. INTRODUCTION

The Textile industries are considered as the heart of the manufacturing sectors as they top the list in their numbers. There are about 1381 mills in Tamilnadu with an average number of employees accounting about 27. The textiles industry can be further divided into five different functional units as listed below,

- Ginning unit
- Garment unit
- Spinning unit
- Dyeing unit
- Weaving unit

Faisal Hannan 2015 and Nimkar 2016, drafted the HIRA chart specifically for the Textile industry and also stated that HIRA is one of the tools in safety engineering used to identify the hazards in the workplace. The usual HIRA sheet would entail the following: The activity for which hira is to be conducted, Nature of the work (Routine / Non- Routine), type and description of the hazard present, the Consequence or impact due to the hazard, Details of the persons under risk, The existing control measures for each particular hazard, The existing risk level for the existing control measures, The additional control measures for each particular hazard, The risk level with additional control measures, By whom the action is to be taken.

The JIG Standard: Hazard identification and risk assessment, 2018., defined the Risk level as a combined element of the Severity and likelihood of the hazard. The maximum level of

the risk would reach 25 concerning the chart -Prepared by the textile industry as shown in figure.1.

		Consequences				
		Insignificant (1) No injuries / minimal financial loss	Minor (2) First aid treatment / medium financial loss	Moderate (3) Medical treatment / high financial loss	Major (4) Hospital / large financial loss	Catastrophic (5) Death / massive financial loss
Likelihood	Almost Certain (5) Often occurs / once a week	Moderate (5)	High (10)	High (15)	Catastrophic (20)	Catastrophic (25)
	Likely (4) Could easily happen / once a month	Moderate (4)	Moderate (8)	High (12)	Catastrophic (16)	Catastrophic (20)
Likelihood	Possible (3) Could happen or known to happen / once a year	Low (3)	Moderate (6)	Moderate (9)	High (12)	High (15)
	Unlikely (2) Hasn't happened yet but could / once every 10 years	Low (2)	Moderate (4)	Moderate (6)	Moderate (8)	High (10)
	Rare (1) Conceivable but only on extreme circumstances / once in 100 years	Low (1)	Low (2)	Low (3)	Moderate (4)	Moderate (5)

Figure.1. Risk Quantification Chart.

Padmini D.S et al.,2010 in their study stated that the hazards evolved in the Textile industries are grouped under the Machine/ mechanical hazard, Electrical hazard, Health Hazards, hazards in material handling Ergonomic hazards, and another similar kind of hazards. Thillainatarajan.,2019 in their study explained the occupational health hazards in the textile sectors such as Byssinosis, bronchitis, diffused lung disease, and other breathing issues which are mainly caused from the improper machine Condition, Ergonomic issues, ambient issues such as humidity, lighting and ventilation.

Nazia Malik et al.,2010 examined the workers in the textile industries and found that the workers are mostly uneducated and that is the important factor which makes them fail in understanding the importance of safety in the workplace, it is also equally important that the management should commit containing various potential safety issues.

Hafiz Danish Ashraf et al.,2009 has proposed that the noise level in the industrial premises should only be within the noise range as described in the regulation. It is the management obligation to take necessary actions to contain the exceeding noise level. Tiwari meenaxi et al.,2012 reported that the musculoskeletal disorders are caused by unusual and extreme body postures adopted in the workplace by the workers.

## 2. METHODOLOGY:

There are certain procedures about how HIRA can be undertaken. The HIRA technique can be implemented by

performing four different sequential procedures such as hazard identification- Consideration of the Potential harmful elements, risk assessment- rate the risk as values ranging from 1 -25, risk analysis- the analysis of the severity and its

likelihood and the Monitor and review- developing the additional Control measures.

### 3. HAZARD IDENTIFICATION AND RISK ANALYSIS IN PRINTING AND DYEING UNIT.

SI No	Machine/ Location	Hazards	Existing Control measures	Risk Level			Additional Control Measures	Residual		
				P	S	R		P	S	R
<b>MACHINE HAZARDS</b>										
1	Rotary printing machine no.1 trench cover	Trench cover getting rusted and damaged. At any time it can break	No existing control measures	4	3	12	Need to provide new trench cover which should not rust easily.	1	3	3
2	Walking path (near colour room)	Trench cover getting rusted and damaged. At any time it can break	No existing control measures	4	3	12	Need to provide new trench cover which should be rust easily.	1	3	3
3	Rotary printing machine no.2	Machine cover is in the open condition. Rotating parts are inside. Operators may get caught between rotating parts	No existing control measures	3	4	12	Need to close the door once maintenance work has been completed.	1	4	4
4	Rotary printing machine no.1	Steam line insulation damaged	Insulation provided but got damaged	3	4	12	Need to provide full cover insulation.	1	4	4
5	Loop ager machine no.1	Duct exhaust pump insulation damaged	Insulation provided but got damaged	3	4	12	Need to provide full cover insulation.	1	4	4
6	Loop ager machine no.1	Cables are kept backside corner of loop ager 1	Nil	3	3	9	Need to remove cables	1	3	3
7	Rotary printing no.2	Safety guard not fixed in floor. A-frame may damage the motor	Guard is there, but not fixed.	3	3	9	The mechanical team should fix the guard on the floor.	1	3	3
8	Old Color room	Safety material cage not properly maintaining. At the emergency situation, it cannot be used.	Safety material provided but not maintained properly	3	4	12	Department in charge needs to take strict action and keep material safely.	1	4	4
9	Loop ager machine no.1	Oil leakage and insulation also not provided.	No existing control measures	3	4	12	Need to arrest oil leakage and provide insulation	1	4	4

10	Loop ager machine number one	Steam coming out from steam line while heat setting	Insulation provided	3	4	12	Need to arrest steam leakage	1	4	4
11	Rotary Printing machines	Operators walk and stand on the machine while checking print. If he slips, hand/leg may crush inside between the gaps.	No existing control measures	3	4	12	Need to change the work practice. Check the print after fabric coming out.	1	4	4
12	Loop ager machine no.1	Fabric roll kept on thermic oil lines and steam lines	Insulation provided	3	5	15	Need to remove fabric rolls and kept in separate racks	1	5	5
<b>ELECTRICAL HAZARDS</b>										
13	Electrical cable trench near machine no.1	Electrical cable trench is in an open condition. Water getting stagnated inside.	Cover provided, but the open condition	3	5	15	Close the trench and wiring should properly be insulated	1	5	5
14	RP machine no.1 feeding pump	Water continuously coming out from the motor. It may contact with live electrical parts.	Earthing cable was provided but not properly grounded.	3	4	12	Arrest leakage from the motor. The motor should be covered fully and earthing cable should be properly grounded.	1	4	4
15	Screen washing area tiles	Tiles were broken, sharp edges may cut the employees leg.	No existing control measures	4	4	16	Need to change all broken tiles.	1	4	4
<b>OTHERS</b>										
16	Colour room	Tiles were broken, it may cut the employees leg and water getting stagnation	Already informed to management	4	4	16	Need to take strict action	1	4	4
17	Colour room	Pipeline gets damaged and water leakage	Already informed to management	3	3	9	--	1	3	3
18	Colour room	Side Cover is in hanging condition. It may fall at any time.	Already informed to management	3	3	9	Need to take strict action	1	3	3
19	Empty can storage room	Empty chemical cans stored under electrical panel	Nil	3	5	15	Need to remove cans and provide rubber mat and guard around the panel	1	5	5

20	Loop ager backside	Old sewing machine kept near the backside	Nil	3	3	9	Need to remove and utilize properly	1	3	3
21	Loop ager electrical panel	Sample fabric rolls kept very close to the electrical panel. If short circuit it is lead to fire hazard.	Nil	3	5	15	Need to remove fabric rolls and provide rubber mat and guard around the panel	1	5	5
22	Empty can storage room	Open wires	Nil	2	5	10	Need to cover wires.	1	5	5
23	Rotary printing and loop ager machines duct	Dust accumulation on duct	Cleaning	3	4	12	Periodic cleaning must be carried out and the supervisor must ensure cleanliness regularly. Photos should be sent to the safety department with date and time.	1	4	4
<b>MATERIAL HANDLING</b>										
24	A-frame	Due to overload, employees getting strain while moving A-frame.	No existing control measures	3	3	9	Training must be provided for workers on ergonomic practices that are to be followed in material handling.	1	1	1
25	A-frame	Due to overload, A-frame may tilt.	Advised printing department to do not load more than 1000kgs	4	5	20	A-frame should not load more than 1000 kgs. The mechanical team should periodically check the A-frame condition.	1	5	5
26	A-frame	Chances of workers foot getting hit by A-frame during transport of fabric roll.	Safety shoe provided for protection ( Many operators were noticed not wearing safety shoe) and safe handling training is given.	3	2	6	Strict compliance to be adopted for the benefit of workers. (Incentive for the day will be cut if the operator is found to be without PPE)	3	1	3
<b>HEALTH HAZARD</b>										
27	Rotary printing and colour making room	Employees working with bare feet and bare hands. Chemical infection may happen.	Safety shoe, gumboot and gloves are provided for protection ( Many operators were noticed not	4	3	12	Strict compliance to be adopted for the benefit of workers. (Incentive for the day will be cut if the operator is	2	1	2

			wearing the mask)				found to be without PPE)			
28	Rotary printing and colour making room	Inhalation of chemical fumes during the machine's normal operation and while colour mixing	Mask is provided for protection ( Many operators were noticed not wearing a mask)	4	3	12	Strict compliance to be adopted for the benefit of workers( Incentive for the day will be cut if the operator is found to be without PPE)	2	1	2
<b>ERGONOMIC HAZARD</b>										
29	All employees	Strain caused due to improper loading and unloading operation.	No existing control measures	2	3	6	Training must be provided for workers on ergonomic practices that is to be followed in material handling.	1	2	2

Table.1. HIRA Chart – Old rotary printing process

SI No	Hazards	Consequences	Existing Control measures	Risk Level			Additional Control Measures	Residual		
				P	S	R		P	S	R
<b>MANUAL CHEMICAL HANDLING, LOADING &amp; STORAGE</b>										
1	While mixing the dyes and chemical there is a chance of chemicals will splash on the eye.	Eye injury, Chemical burn, etc.,	PPE's are given. Chemical safety training is given	3	3	9	Should be regularly trained on the safe handling of chemicals	2	3	6
2	while carrying chemical from store to the machine there is a chance of chemicals will spill.	Eye injury, Chemical burn, etc.,	PPE's are given. Chemical handling safety training is given	3	3	9	Should be regularly trained on the safe handling of chemicals	2	3	6
3	While mixing the dyes and chemical there is a chance of inhalation of dye particles	Respiratory problem	PPE's are given. Chemical handling safety training is given	3	3	9	Stickily adopted to use PPE. Should be regularly trained on the safe handling of chemicals	2	3	6
4	There is a chance of a violent reaction if some of the chemicals get reactive	Scalding accidents	Chemical handling safety training is given. Reactive chemicals kept separately	2	4	8	Should educate the workers about the reactivity of chemicals	1	4	4
<b>OTHERS</b>										

5	Contact with sharp edges in the trolley	Cut injury	The operator must take precautions during movement	3	2	6	Sharp should grind properly and damaged handle should be removed	1	2	2
6	Strain caused due to improper loading and unloading operation.	Back strain	No existing control measures	2	3	6	Training must be provided for workers on ergonomic practices that are to be followed in material handling.	2	1	2
<b>DYEING MACHINE</b>										
7	Chances of getting burn injury if touch the machine with bare hand while loading and unloading the fabric into the machine.	Burn Injury	1. Nitrile and PVC gloves are provided.	3	3	9	Operators should be regularly trained and create awareness about hazards.	2	3	6
8	Chances of hitting the passengers or workers while moving the trolley.	Leg or hand injury	Safety shoes are provided	3	2	6	Strict compliance should be adopted. Operators should be regularly trained.	2	2	4
9	workers foot may get affected due to chemicals and water spilt on the floor.	Foot injury	Safety shoes are provided	4	3	12	Stagnation water should be cleaned regularly. Strict compliance should be adopted. Operators should be regularly trained and create awareness about hazards.	2	3	6
10	Chances of getting burn injury if contact with the steam line	Burn Injury	Awareness training is providing regularly.	2	3	6	All steam line should be insulated and barricade the area if it able to touch easily by workers	1	3	3
11	Chances of operator slip and fall from the stand during operating the machine.	Can lead to head injury/ Body injury	The operator must take precautions.	3	2	6	The slippery surface should be cleaned immediately. Operators should be regularly trained and create awareness about hazards.	2	2	4
12	Chances of slippage from wet and water stagnation in	Leg injury	The operator must take precautions	3	2	5	water should be cleaned regularly.	1	3	3

	ground									
13	Chemical spillage in the machine area.	slippage causing injury	No existing control measures	3	2	6	Periodic cleaning must be carried out./ Any spillage must be reported immediately	3	1	3

**Table.2. HIRA -Dyeing unit**

**RESULT AND DISCUSSION**

Risk analysis for different activities was undertaken in the dyeing unit and old rotary printing unit. It is found that the risk level was ranging from 5 to 12 for the dyeing process and 6 to 20 for the printing process and also the risk level is qualitatively assessed into low, medium, high, very high through contour colorings. As a result of this study, various hazards were identified and the practical control measures were developed.

**CONCLUSION**

This study has delivered various hazards under mechanical, electrical, material handling, chemical, ergonomic, and the temperature extreme aspects and also control measures following the hierarchy of elimination substitution engineering administration and PPE. It has been observed that several processes carried out in the dyeing and printing unit has a very high level of risk which requires immediate control measures. This study also reveals that the risk rating of a medium level is associated with several activities for which control measures have been recommended.

**REFERENCES**

1. Textile Business-JJG, "Hazard identification and risk assessment Standard", March 2018.
2. D.S Padmini., "Unsafe work environment in garments industries", journal of environmental research and development, volume 7 no.1A 2012.
3. Thillainatarajan, "Review on Occupational Health Diseases in the textile industries", International Research Journal of Engineering and Technology, Volume: 06 Issue: 10, Oct 2019
4. Nazia Malik., "Role of hazard control measure in occupational health and safety in the textile industry of Pakistan, Pak j.agri sci vol 47(1), 72-76,2010.
5. Hafiz Danish asraf., "frequency of hearing loss among textile workers of wearing units in Karachi, Pakistan.
6. Tiwari meenaxi., "Causes of Musco- skeletal disorders in the textile industry", Issn 2329-3563.vol 1(4),4850,December 2012.
7. Vasim khatik., "The pioneering study on identification of fire hazards in cotton ginning industries of nandurbar region of Maharashtra", volume-2, Issn 2277-8179.
8. Nimkar 2016,'Chemical Safety at the Workplace in Textile Industry' NimkarTek Technical Services Pvt Ltd.
9. Faisal Hannan 2015, Risk Assessment and Evaluation of Basic Health and Safety Facilities (A Report of Textile Industry Gujrat, Pakistan) (2014) Safety View Magazine.