

## **Analytical Study for Risk Assessment (Case study: Atbara Flour Mill Factory)**

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### **Abstract:**

Flourmills are one of the workplaces with occupational health hazards due to irregular workplaces and environments where insufficient attention is paid to workers' safety. In this context, considering the extent of difficulties faced by workers in flourmills, hazards and risks that could affect the health and occupational safety of workers were investigated in Atbara flourmills. After referring to the study and evaluation of the manufacturing section, it is noted that the factory's safety department specializes only in security and fire safety and lacks occupational safety and health. Therefore, workers do not comply with personal safety equipment, especially in the workshop and on the first floor (machinery section), as workers in these two sections are the most exposed to danger. Additionally, there are no warning signs in any of the factory's departments.

**Keywords:** *Risk assessment, hazard in mill factory, milling machine, safety in mill factory*

## دراسة تحليلية لتحديد المخاطر- دراسة حالة مصنع مطاحن الدقيق بعطبرة

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مستخلص :

تعتبر مطاحن الدقيق من اماكن العمل التي تتعرض لمخاطر الصحة المهنية بسبب عدم انتظام أماكن العمل البيئة التي لا يتم فيها الاهتمام بسلامة العمال. وفي هذا السياق وبالنظر الى مدى الصعوبات التي يواجهها العاملون في مطاحن الدقيق فقد تم دراسة المخاطر التي يمكن ان تؤثر على الصحة والسلامة المهنية للعاملين في مطاحن عطبرة. بعد الرجوع الى الدراسة والتقييم لأقسام المصنع يلاحظ بان قسم السلامة الموجود في المصنع مختص فقط بالأمن والسلامة من الحرائق ويفتقر للسلامة والصحة المهنية لذلك هنالك عدم التزام بمعدات السلامة الشخصية من قبل العمال وبالأخص في الورشة والطابق الأول (قسم الماكينات) باعتبار ان عمال هذين القسمين هما اكثر الاماكن عرضة للخطر، وأيضا لوجود للوحات ارشادية بكل أنواعها في كل أقسام المصنع .

كلمات مفتاحية : تقييم مخاطر، المخاطر في مصانع الطحن، ماكينات الطحن، السلامة في مصانع الطحن

## **Introduction:**

Humans have played a great role in building civilization and progress over the past many years, especially in the industrial field. Despite the tremendous progress they have reached, what they invented in terms of machines, equipment, and modern devices to serve them and provide them with means of luxury has become dangerous to them when they are not well used (Hilmee, 2007)

Establishing safety conditions in the workplace is more effective than simply promoting awareness slogans. Industrial safety holds a significant position, receiving substantial focus and care from all operational entities. The primary goal is to protect the core elements of production: the workforce, which is the most crucial component, as well as public assets like machinery, equipment, materials, and the finished product. This protection contributes to the national economy, ultimately enhancing profit and productivity (AL-Rosan and Abo salah, 2011).

This study aimed to emphasize that the working environment should be free from risks of injury or disease. However, thousands of workers worldwide, particularly in developing countries, continue to be exposed to hazardous substances. Flour dust is one of these harmful substances to which flour mill workers are exposed. Inhalation of flour dust can lead to various lung diseases, with symptoms ranging from mild irritation to allergic reactions and chronic respiratory disorders, including asthma. Therefore, this study was conducted to assess the prevalence of respiratory issues among flour mill workers (Shimaa *et al.*, 2023)

Occupational respiratory diseases develop as a result of dust particles depositing in the lungs. Flour milling industries generate organic dust during various industrial processes, such as cleaning, milling, packaging, and loading, which release dust into the air that workers then inhale. Flour mill workers are at an increased risk of developing respiratory health issues due to exposure in their work environment; however, available data on these risks are limited. This study aimed to assess the prevalence of chronic respiratory symptoms, lung function, and associated factors among flour mill factory workers (Lagiso*et al.*, 2020).

Flour mill workers are susceptible to various health issues and risks due to the limited use of personal protective equipment (PPE). The purpose of the current study is to evaluate the impact of an educational program on occupational health and safety competencies among flourmill workers (Ali and Mohamed, 2023).

Occupational Safety and Health (K3) is crucial in the flour production industry, yet it often receives inadequate attention. Previous research has underscored the safety challenges arising from neglecting K3 standards, which can result in various industry hazards. Studies demonstrate that the HIRADC (Hazard Identification, Risk Assessment, and Determining Controls) method is effective in recognizing hazards, evaluating risks, and implementing control measures to improve safety management. The HIRADC approach follows three main steps: identifying potential hazards, assessing associated risks, and applying control strategies. Common hazards in flour production identified by research include exposure to flour dust, which may cause respiratory issues, the risk of fire or explosion from combustible dust, and physical injuries from machinery (Gunawan and Boni Sena, 2024)

## **Methodology:**

Traditional methods of risk assessment are moving towards the use of mixed approaches in modern times, with risk assessment tables being among the most common methods due to their ease of understanding and flexibility. These tables aim to classify risks according to their levels, which helps identify the factors affecting problematic events and understand the relationship between them. The risk of workplace accidents is defined as a combination of the probability of their occurrence and the severity of their consequences, and the classification of risks is based on this foundation. When risks are identified, they can be used as a tool to

prioritize analysis and reporting to management. Analyzing risks in complex work environments requires collaborative teamwork under the supervision of an experienced team leader, and the process of identifying and analyzing risks is a fundamental step in risk management.

The levels of lighting and noise were measured using two mobile applications due to the unavailability of measurement devices nearby. The first application, 'Sound Meter - Decibel Meter,' was praised by users for its accuracy in measuring sound levels. The second application, 'Lux Light Meter Pro,' was used to measure light intensity and also received positive user reviews for its accuracy.

### Risk Assessment:

#### Risk assessment for laboratory:

The laboratory is considered as one of the most important that aid in production. Table [1] shows the information that was recorded during the field visit to the laboratory

**Table (1): Explains an analytical study of the laboratory:**

Field Study		Laboratory					
Illumination	Ventilation		Noise	Escape routes	Pollution	Floor	Electric protection
	Air Purifiers	Ventilators					
77 LUX	There is tow fans for air purification	Very good	No noise	One door for entry and exit	No pollution	Almost slippery but not dangerous	Electricity is very safe

Every worker in any facility has the right to own Personal Protective Equipment to ensure their protection from surrounding hazards. Table [2] illustrates the importance, availability and extent of commitment in the laboratory

**Table [2]: Personal Protective Equipment, the Importance and Extent of commitment in the laboratory:**

	Safety Tools						
	cloth	Gloves	Masks	Shoes	Helmet	Glasses	Fire extinguishers
Importance	Important	Important	Important	Important	Not Important	Important	Important
Availability	Not available	Not available	Not available	Not available	—	Not available	available
Extent of commitment	—	—	—	—	—	—	Committed to it

Figure (1) provides a detailed illustration of a horizontal cross section of the Laboratory highlighting its design and main components

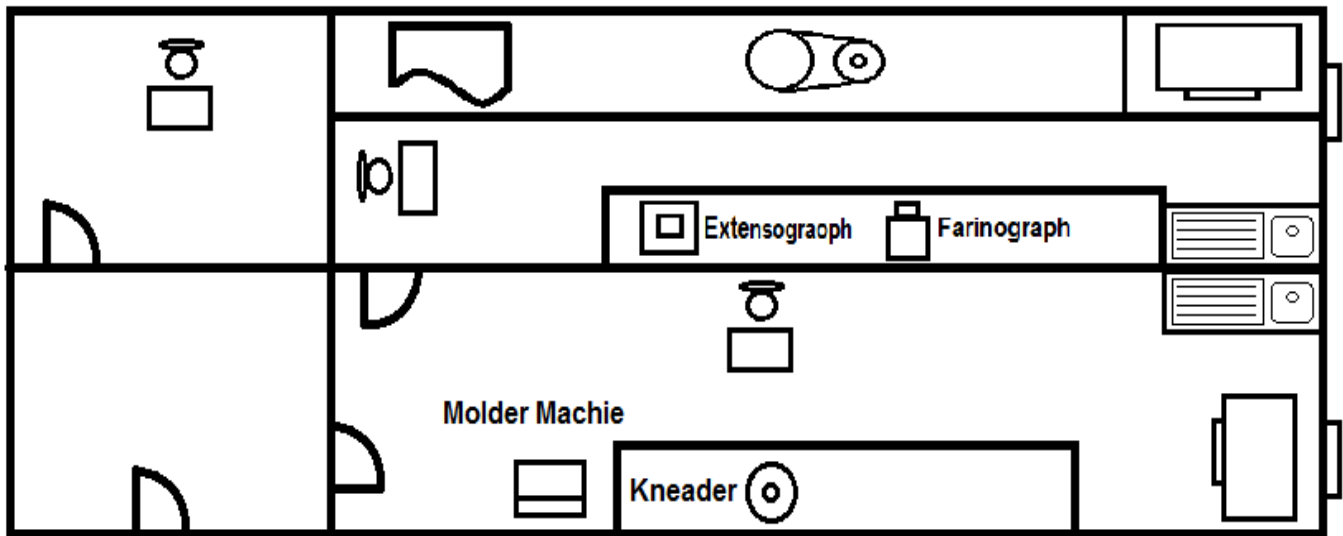


Figure (1): Plan of Laborato

**Risk assessment for workshop:**

The workshop is considered as the most important department in any facility to ensure the continuity of production. Table [3] shows the information that was recorded from the workshop.

**Table (3): Explains an analytical study of the workshop**

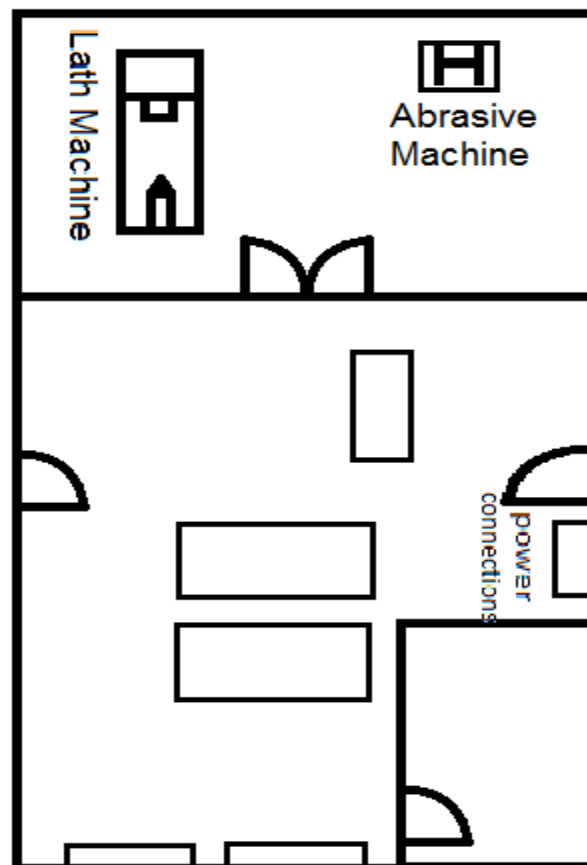
Field Study		Work shop					
Illumination	Ventilation		Noise	Escape routes	Pollution	Floor	Electric protection
	Air Purifiers	Ventilators					
Natural	Very good	Very good	No noise	Two doors for entry and exit	No pollution	There are obstacles	safe power connections

Every worker in any facility has the right to own Personal Protective Equipment to ensure their protection from surrounding hazards. Table [4] illustrates the importance, availability and extent of commitment in the workshop

**Table (4): Personal Protective Equipment, the Importance and Extent of commitment in the workshop:**

	Safety Tools						
	cloth	Gloves	Masks	Shoes	Helmet	Glasses	Fire extinguishers
Importance	Important	Important	Important	Important	Important	Important	Important
Availability	Not available	Not available	Not available	Not available	Not available	Not available	available
Extent of commitment	—	—	—	—	—	—	Committed to it

Figure (2) provides a detailed illustration of a horizontal cross section of the workshop highlighting its design and main components

**Figure (2): Plan of Workshop**

**Risk Assessment for First Floor – Milling Machines:**

Table (5) shows the information taken from the first floor (milling machines) to identify the existing hazards.

**Table (5): Explains an analytical study of the first floor – Milling Machines:**

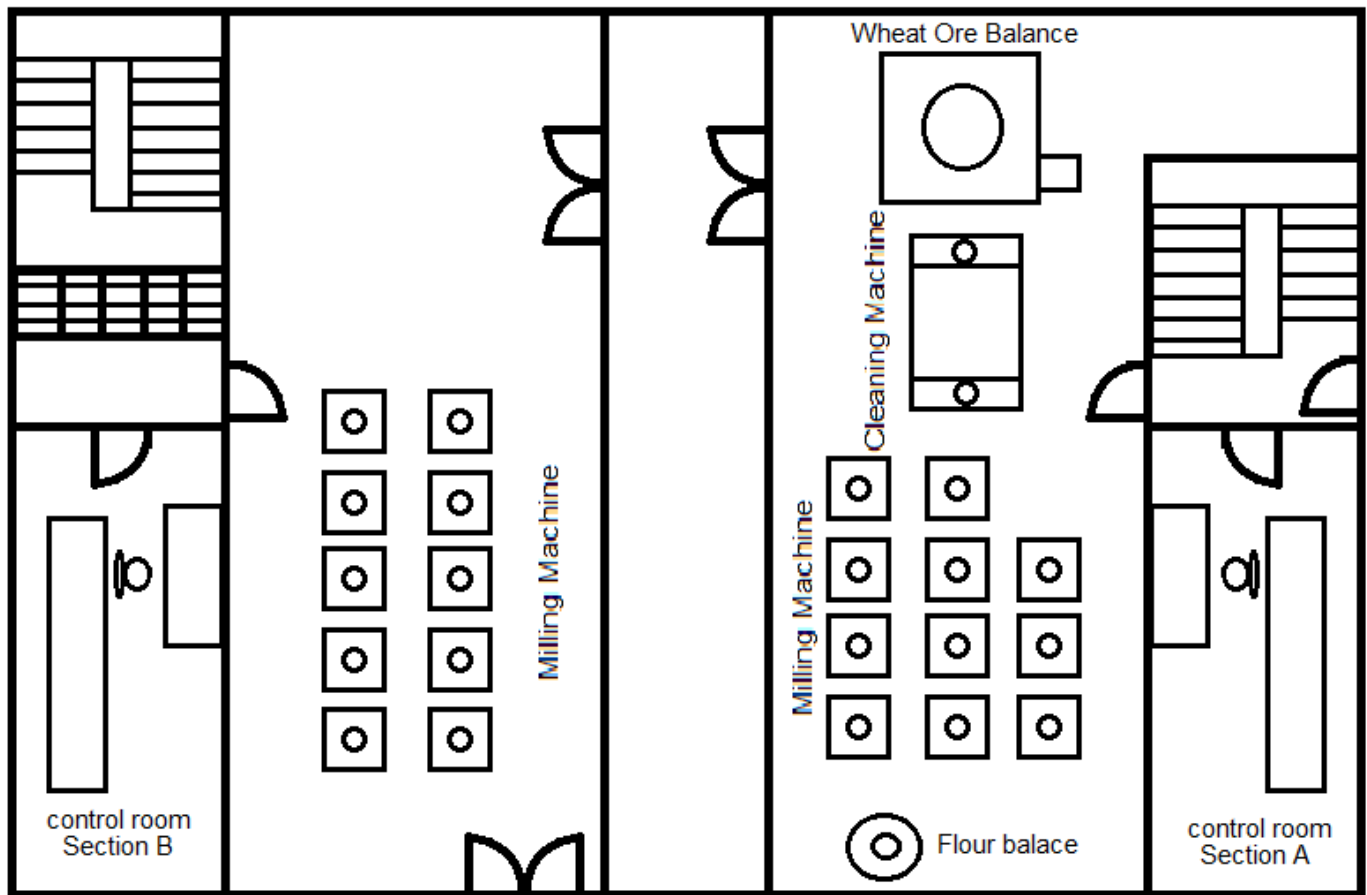
Field Study		First floor – Milling Machines					
Illumination	Ventilation		Noise	Escape routes	Pollution	Floor	Electric protection
	Air Purifiers	Ventilators					
405 LUX	Directly from the milling machine, but there is flour in a small proportion	Very good	In the machine shop 840 Db In the control room 110 dB	Two doors for entry and exit	there is flour in the air in a small proportion	It must be cleaned constantly so as not to be slippery	safe power connections

Every worker in any facility has the right to own Personal Protective Equipment to ensure their protection from surrounding hazards. Table [6] illustrates the importance, availability and extent of commitment in the First floor – Milling Machines.

**Table [6]: Personal Protective Equipment, the Importance and Extent of commitment in the first floor – Milling Machines:**

	Safety Tools						
	Cloth	Gloves	Masks	Shoes	Earplugs	Glasses	Fire extinguishers
importance	Important	Not Important	Important	Important	Important	Important	Important
Availability	Not available	—	available	Not available	available	available	Available
Extent of commitment	—	—	Not Committed to it	Not Committed to it	Not Committed to it	—	Committed to it

Figure (2) provides a detailed illustration of a horizontal cross section of the first floor – Milling Machines highlighting its design and main components



**Figure (3): Plan of first floor – Milling Machines**

### Discussion:

The safety assessment at Atbara Mills, based on the field study, highlights key areas for improvement in workplace safety, particularly in the laboratory, workshop, and the first floor (milling machinery section). Here's an analysis of the current situation and recommendations for reducing risks in these high-exposure areas:

### Laboratory

The assessment shows that the lighting level in the laboratory is 77 lux, which is below the minimum acceptable level, as the recognized standard for laboratories is 100 lux.

### Ventilation:

The laboratory has **two air purifiers** that help maintain a suitable temperature, but it's essential to ensure their adequacy for providing good ventilation.

### Personal Protective Equipment (PPE):

Regarding PPE that should be used in the laboratory, the following items are essential:

- **Appropriate clothing:** The clothing should be heat-resistant and non-flammable to protect workers from high temperatures.

- **Gloves:** It is preferable to use silicone gloves that can withstand heat and protect hands when handling ovens and hot materials.
- **Masks:** Masks should be provided to prevent inhalation of fumes generated from the ovens, ensuring respiratory safety.
- **Protective footwear:** Workers should wear shoes that protect their feet from potential accidents or hot materials.

**Recommendations:**

1. **Improve Lighting:** Work should be done to increase the lighting level in the laboratory to reach the recommended level (100 lux) by adding additional light sources or improving the existing lighting.
2. **Evaluate Ventilation:** An assessment of the air purifiers' efficiency should be conducted to ensure adequate ventilation in the laboratory, possibly by adding fans or an additional ventilation system.
3. **Enhance Use of Personal Protective Equipment:** Emphasizing the importance of using PPE through training and awareness is crucial to ensure the safety of workers.

Improving these aspects will contribute to creating a safe and healthy working environment for employees in the laboratory.

**Workshop:**

The assessment shows that the lighting level in the workshop relies primarily on natural light, resulting in levels below the recommended minimum of 200 lux. Ventilation also depends on natural airflow, which may be insufficient for workshops where various processes release fumes and air pollutants.

For Personal Protective Equipment (PPE) in the workshop, the following items are essential to ensure workers' safety:

- **Heat-resistant clothing** that can withstand high temperatures, protecting the body from hot surfaces and intense heat.
- **Heat-resistant gloves** to protect hands during operational processes.
- **Masks** to prevent inhalation of fumes and contaminants generated by different operations.
- **Protective footwear** to safeguard feet against heavy or sharp objects.
- **Helmets** to protect the head from potential impacts or falling objects.
- **Safety goggles** to shield the eyes from sparks or flying particles during operational activities.

Providing this essential PPE, along with improving lighting and ventilation levels in the workshop, will significantly reduce occupational and health risks and enhance a safer, more comfortable working environment for all employees.

**First floor – Milling Machines:**

The lighting level in the laboratory is 405 lux, which is close to the permissible level, as the recommended standard for such areas is 500 lux. In terms of ventilation, there are exhaust fans present, but they are insufficient to achieve an adequate level of airflow.

Regarding Personal Protective Equipment (PPE) in the laboratory, it is essential to provide the following items to ensure the safety of workers:

- **Appropriate clothing** that protects the body while remaining comfortable during work.

- **Gloves** to protect hands from direct contact with materials during milling operations.
- **Masks** to prevent inhalation of flour dust generated from the milling process, helping to protect the respiratory system.
- **Protective footwear** to safeguard the feet from heavy or sharp objects that may fall during work.
- **Helmets** to protect the head from potential impacts or falling objects.
- **Safety goggles** to shield the eyes from dust and flying particles during operational activities.

Improving lighting and ventilation levels, along with providing suitable personal protective equipment, will significantly enhance the safety of workers in the laboratory and reduce health risks.

### Risk Identification and Analysis

#### Risk Identification and Analysis for laboratory:

The aim of risk assessment is to ensure that hazards are eliminated or risks minimized by the correct application of relevant standards. Table [7] illustrates these hazards present in the laboratory and how to mitigate them.

**Table [7]: Risk Identification and Analysis for laboratory:**

Name of assessor		Rowyda AwadElssid Haj Hamed Mohammed		Date	19-9-2023	
Time	11:00	Work area	Atbara Flour Mill Factory			
Task being assessed		Laboratory				
What is the hazard?	Who might be harmed?	How might people be harmed?	Existing risk control measures	Additional controls	Action/monitored by whom?	Action/monitored by when?
Fire Hot Equipment	Technician work at lab	Burns	Pot holder	-Wiring Silicon heating glove. -provide safety signs	Stores manager Stores manager	2 days 2 days

#### Risk Identification and Analysis for workshop:

The aim of risk assessment is to ensure that hazards are eliminated or risks minimized by the correct application of relevant standards .Table(8) illustrates these hazards present in the workshop and how to mitigate them.

Table (8): Risk Identification and Analysis for workshop:

Name of assessor	Rowyda AwadElssid Haj Hamed Mohammed			Date	26-9-2023		
Time	10:00	Work area	Atbara Flour Mill Factory				
Task being assessed		Workshop					
What is the hazard?	Who might be harmed?	How might people be harmed?	Existing risk control measures	Additional controls	Action/monitored by whom?	Action/monitored by when?	
1	Slips and trips The floor is untidy and tools are scattered	Technician and all workers on site	Wound	—	1- Designated walkways (indicated by yellow paint line). 2- Designated storage areas 3- Good housekeeping (mechanics know how to store unused equipment etc. in the designated areas) 4- Provide safety signs.	Workshop manager Workshop manager Workshop manager Safety manager	1 month 1 month 1 week 1 month

Name of assessor	RowydaAwadElssid Haj Hamed Mohammed			Date	26-9-2023		
Time	10:00	Work area	Atbara Flour Mill Factory				
Task being assessed		Workshop					
What is the hazard?	Who might be harmed?	How might people be harmed?	Existing risk control measures	Additional controls	Action/monitored by whom?	Action/monitored by when?	
2	Slips and trips Obstructed walkways	Technician	Stumble	—	1- Designated walkways (indicated by yellow paint line). 2- Designated storage areas 3- Good housekeeping (mechanics know how to store unused equipment etc. in the designated areas) 4- System for random housekeeping checks to be bought in. 5- Provide safety signs.	Workshop manager Workshop manager Workshop manager Workshop manager Workshop manager	1 month 2 month 1 week 1 month 1 month

**Risk Identification and Analysis for first floor – Milling Machines:**

The aim of risk assessment is to ensure that hazards are eliminated or risks minimized by the correct application of relevant standards. Table (9) illustrates these hazards present in the first floor – Milling Machines and how to mitigate them .

**Table (9): Risk Identification and Analysis for first floor – Milling Machines:**

Name of assessor	Rowyda Awad Elssid Haj Hamed Mohammed			Date	27-2-2024		
Time	12:00	Work area	Atbara Flour Mill Factory				
Task being assessed		first floor – Milling Machines					
What is the hazard?	Who might be harmed?	How might people be harmed?	Existing risk control measures	Additional controls	Action/ monitored by whom?	Action/ monitored by when?	
1	Noise	Machinery control technician	Affects the ear	—	-Using sound absorbing materials.	Finance director	6 months
	Excessive noise From milling machines				-Setting up a health surveillance program for relevant workers.	Finance director	6 months
					-Wearing earmuffs	Safety manager	1 months
					-Provide safety signs	Safety manager	1 months

Name of assessor	Rowyda Awad Elssid Haj Hamed Mohammed			Date	27-2-2024		
Time	12:00	Work area	Atbara Flour Mill Factory				
Task being assessed		first floor – Milling Machines					
What is the hazard?	Who might be harmed?	How might people be harmed?	Existing risk control measures	Additional controls	Action/ monitored by whom?	Action/ monitored by when?	
2	Hazardous substances	Machinery control technician	Breathing problems	—	1-Installation of special towing fans.	Finance director	3 months
	Spread flour in the air				2- Wearing mask(N95 Respirator)	Safety manager	1 months
					3- Maintenance program for all ventilation systems.	Safety manager	1 months
						Safety	1 months

					4- provide safety signs	manager	
3	Work equipment	Machinery control technician	Injured	—	1- Close the belt's box	Workshop manager Workshop manager	1 month
	The belt box was opened in the tow machines				2- Fixed, enclosed guards that encase or surround the dangerous part.		1 month
					3-Give the maintenance workers specific information to understand the maintenance requirements of the equipment and are able to keep the equipment in safe working.	Workshop manager	1 month
					4- Provide safety signs	Workshop manager	1 month

**Conclusions:**

Increasing awareness of workplace risks and taking appropriate measures to protect the safety and health of employees is crucial within the scope of occupational health and safety efforts. In this study, various hazards faced by flour mill workers and the necessary measures to reduce these hazards have been comprehensively addressed. In addition to potential risks such as careless behavior, rotating machinery, and exposure to flour dust, issues such as deficiencies in signage. Measures taken to mitigate these hazards and steps that need to be taken have been outlined, emphasizing key points to be considered as regarding occupational health and safety. In order to eliminate the negative effects of flour dust on workers' health, proper operation of the necessary ventilation system must be ensured. In areas where dust exposure is high, it would be advisable to use appropriate personal protective equipment such as masks. Periodic maintenance should be carried out on the electrical system and guards should always be used on machinery with rotating parts.

**Recommendations:**

Identifying potential workplace hazards and taking the necessary precautions against those hazards is critical to ensuring the safety and health of employees. Employers and employees who are aware of occupational health and safety issues and take the necessary precautions will ensure that everyone has a safe working environment. Therefore, it is important to continually review workplace risks and take preventive measures by require workers and technicians to comply with Safety and Occupational Health standards Create and install instructional signs in all areas.

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