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Safety and Accident Prevention in the Textile Industry

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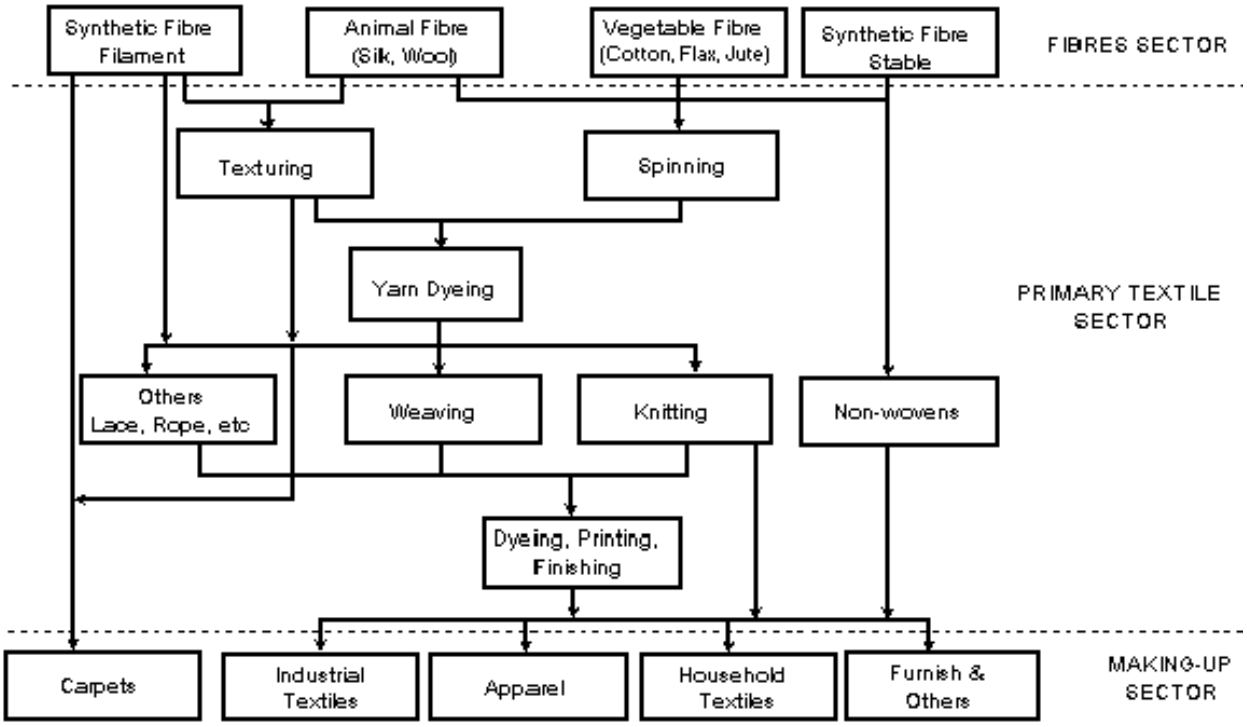
Abstract
This paper emphasizes the importance of safety in manufacturing and the various consequences of accidents in the textile industry. It explores different types of accidents in these environments, including slips, falls, and machine-related incidents. The impact of accidents extends beyond injured workers, affecting production, finances, and company reputation. The key to preventing accidents lies in a comprehensive framework. This framework should incorporate the experience of veteran employees, natural human instincts for safety, and data-driven analysis of past incidents. Manufacturers can leverage this knowledge by implementing targeted safety training, conducting regular inspections, and fostering open communication about potential hazards. Strong leadership commitment to safety initiatives further strengthens this approach. By combining these elements, manufacturing facilities can create a safer work environment for employees and ensure the overall success of their operations.

Keywords: Safety; Accident; Victim; Wastage; Costs; Environment

INTRODUCTION

The textile industry involves several key manufacturing processes, beginning with fibre production, where natural fibres like cotton and wool are harvested and processed, and synthetic fibres like polyester are chemically produced (Kadolph, 2010). Yarn manufacturing follows, involving spinning natural or synthetic fibres into yarns, often blending different fibres to achieve desired properties (Klein, 1998). Fabric production includes weaving and knitting, which interlace or interloop yarns to create fabrics, along with nonwoven techniques that bond fibres without weaving or knitting (Adanur, 1995).



Flowchart of textile product manufacturing

After fabric production, the dyeing and finishing processes enhance the fabric's colour and properties. Dyeing can occur at various stages, from fibres to finished garments, while finishing processes improve appearance, performance, or feel (Shore, 2002). Finally, garment manufacturing involves cutting fabric into pieces and sewing them into garments, followed by quality control to ensure compliance with standards (Glock & Kunz, 2005). These interconnected processes are crucial for transforming raw materials into finished textile products efficiently and effectively.

Safety refers to a place or circumstance where any form of risk or danger has been successfully eliminated. In textile processing, safety does not just occur as a chance affair because it exists only when one is not exposed to any working environment; it is planned and worked for. For our purpose, safety can be defined as a positive, organized activity or program based on knowledge of the reaction between man and his environment which aids business enterprise by minimizing human, economic and sociological losses caused by injuries, health impairment, fires, explosions and other occupational accidents.

It is less ambiguous than the word 'accident', which often refers to an unwanted, unexpected outcome and activity; it may also refer to an event that is unexpected or without apparent cause; an unintentional act; a chance occurrence; or an unfortunate (especially harmful) event.

For example, a shuttle flies out of its path off the race board through the warp sheet and hits an operative on the temple. This will, of course, be described as an accident, but thinking deeply about it, it can be unexpected only if the weaving machine is sure to be in perfect working order and the correct processing technology and routine are observed. The 'accident' obviously cannot be said to be without an apparent cause. Superficially, it will look like an unintentional act; we know, of course, that the machine is not a living thing and cannot have intentions; there must have been a cause for the 'accident' which is directly related to improper maintenance practice. It may also be described as a chance occurrence, but we know that this chance will diminish to zero when correct processing procedures and maintenance are observed and the machine is in good working order. To call it an unfortunate event is merely offering a complimentary remark describing the incident. Sometimes, some 'schools of analysis' will refer to it as an 'Act of God', when their 'analysis' fails to show in the series of events a contributory act of commission or omission on the part of the victim.

To avoid ambiguity we will define an accident as "a series of coincidental events whose climax result in personal injury, property damage or both" (Brown, 1993).

From this definition, an accident may lead to some form of liability or consequence just as risk and danger. 'Accident' therefore refers to the manifestation of coincidences that may lead to personal injury, property damage or both, while 'safety' refers to freedom from risk or danger. In the former, there is a fight involved because the individual is exposed, and has to prevent the occurrence of the coincidences that may arise. This is synonymous to the case of the spinner who tries meticulously to avoid any form of accident while spinning. In the latter, however, the individual is away (in safety), free from the coincidences that may arise. This situation is synonymous to the case where a spinner avoids the colour kitchen. In one case, safety, one actually avoids any kind of unnecessary exposure to any equipment, facilities, or processing where one is not assigned to work. In the other case, one is by requirement necessarily exposed and must therefore take precautionary measures.

Having hopefully distinguished the various aspects, we shall proceed to look at the issues in greater detail. Both endeavours are very important and necessary. They can prove to have a profound effect on spoilages and wastage in a manufacturing outfit. This can be understood better if one considers the impact of an accident (Fawcett *et al,* 1983) :-

- To the victim and his family, it is the ultimate tragedy;
- To the witness, it is a profound and horrifying experience which in time becomes a conversation piece;
- To the company, it is a preventable and irreplaceable loss of an employee, production and the associated costs;
- To the public, it is a news item;
- To the legal courts, it may be an act of God;
- To the government, it is a statistic and
- To the nation, a tragic unnecessary loss.

2.0 SAFETY VERSUS ACCIDENT PREVENTION

From the aforesaid, safety is the most successful achievement of accident prevention strategies which in manufacturing circumstances can only be achieved by avoiding exposure to coincidences that may give rise to accidents. This will partly be achieved if workers don't stray to areas where they are not assigned duties. For instance, a weaver will be safe from accidents likely to occur in the dyeing and printing department if he avoids

the section. Specialization will greatly help matters. This leaves us with accident prevention which arises in the section where an individual is employed mainly because, working there, he is exposed to the coincidences that may cause injury, property damage or both.

3.0 CAUSES OF ACCIDENTS

In textile processing accidents are usually caused by :-

a. Faulty machinery, equipment and facilities as well as inferior raw materials. This might have arisen as a result of poor cleaning and maintenance practices, old age, depreciation and obsolescence, and wrong operation and control procedures. Faults can be detected sometimes by routine visual examination, evaluation of noise quality, testing of the products and in some cases, observation of warning signals from the machines or equipment.
b. Improper location, installation, operation, control, application or utilization of materials, machinery and facilities. Usually, this is as a result of an act of commission or omission on the part of the worker.
c. Poor or unconducive working environment. This refers to space organization, floors (which may be littered with dirt or may be slippery), access ways, ventilation, relative humidity (RH), temperature, and management of corrosive, inflammable and explosive materials (which may cause fires and/or explosions) as well as the relationship between workers.
d. Combination of two or more of these (a-c)

4.0 TYPES OF INDUSTRIAL ACCIDENTS

Industrial accidents are unplanned events occurring in industrial settings, leading to injury, illness, or property damage. These accidents have significant consequences, including loss of life, economic costs, and environmental harm. Understanding the various types of industrial accidents is crucial for implementing effective safety measures and preventing occurrences.

Mechanical accidents, which involve machinery or mechanical components, are among the most common in industrial settings. These accidents can result in machine entanglement, crush injuries, and equipment malfunctions, often caused by lack of proper maintenance, inadequate safety measures, or operator error (Goetsch, 2019).

Chemical accidents involve the release of hazardous chemicals, leading to fires, explosions, or toxic exposures. Examples include chemical spills, gas leaks, and explosions, typically resulting from improper storage, handling errors, and inadequate ventilation (Crowl & Louvar, 2020).

Electrical accidents occur due to the misuse or malfunction of electrical equipment. They include electric shocks, arc flashes, and electrical fires, often caused by faulty wiring, improper grounding, and a lack of personal protective equipment (Jones & Jones, 2021).

Fire and explosion accidents result from uncontrolled fires or explosions in the workplace. These include industrial fires, boiler explosions, and dust explosions, which can be caused by flammable materials, equipment failures, and static electricity (Routley & Rutala, 2018).

Fall accidents occur when workers fall from heights or slip, trip, and fall on the same level. Examples are falling from ladders, scaffolding, or roofs, usually due to a lack of fall protection, slippery surfaces, and poor housekeeping (Hsiao, 2016).

Confined space accidents involve incidents in confined or enclosed spaces. These accidents can lead to suffocation, entrapment, and toxic exposure, often caused by inadequate ventilation, lack of emergency procedures, and improper entry practices (Finkelstein & Kowalski-Trakofler, 2017).

Ergonomic accidents result from poor workplace design, leading to musculoskeletal disorders. These include repetitive strain injuries, back injuries, and carpal tunnel syndrome, usually caused by poor workstation design, repetitive motions, and improper lifting techniques (Bridger, 2018).

Environmental accidents involve incidents that cause environmental damage, often involving hazardous materials. Examples include oil spills, chemical leaks, and air pollution, typically resulting from equipment failure, operator error, and natural disasters (Coppola, 2020).

Transportation accidents involve industrial vehicles or transportation-related activities within industrial sites. These include forklift accidents, vehicle collisions, and railcar accidents, often caused by operator inattention, inadequate training, and poor traffic management (Salvatore & Murphy, 2019).

Radiation accidents involve exposure to ionizing or non-ionizing radiation. These include radiation leaks and improper handling of radioactive materials, often caused by equipment malfunction, human error, and inadequate safety measures (Metzger, 2017).

Understanding the various types of industrial accidents is crucial for implementing effective safety measures

and preventing occurrences. Proper training, rigorous safety protocols, regular maintenance, and the use of appropriate personal protective equipment are essential strategies to mitigate these risks.

5.0 CONSEQUENCES OF ACCIDENTS

Industrial accidents in the textile industry can have a range of severe consequences, affecting not only the immediate victims but also the broader organizational, economic, and social spheres. Here are the primary consequences, detailed with references:

Human Consequences

1. Injuries and Fatalities: Industrial accidents often result in serious injuries or fatalities. These can range from minor cuts and burns to severe injuries such as limb amputations, spinal cord injuries, or death. The textile industry, which involves the use of heavy machinery, chemicals, and potentially hazardous processes, is particularly susceptible to such incidents (Goetsch, 2019).

2. Health Issues: Exposure to hazardous chemicals, dust, and other harmful substances can lead to long-term health issues, including respiratory problems, skin conditions, and chronic diseases like cancer. Workers in textile factories may face exposure to dyes, solvents, and other chemicals that can have lasting health impacts (Crowl & Louvar, 2020).

Economic Consequences

3. Financial Losses: Accidents can lead to significant financial losses for textile companies. These losses can arise from damaged machinery, halted production, legal costs, and compensation claims. The cost of medical treatment and rehabilitation for injured workers also adds to the financial burden (Jones & Jones, 2021).

4. Productivity Loss: Accidents disrupt the normal workflow, leading to production delays and decreased productivity. The time required to investigate accidents, repair damaged equipment, and implement new safety measures can result in considerable downtime (Routley & Rutala, 2018).

5. Increased Insurance Premiums: Frequent accidents can lead to higher insurance premiums for textile companies. Insurers may increase rates to cover the higher risk associated with a company that has a history of workplace accidents (Hsiao, 2016).

Legal Consequences

6. Regulatory Penalties: Failure to comply with occupational safety and health regulations can result in substantial fines and penalties. Regulatory bodies may impose strict sanctions on textile companies that do not adhere to safety standards (Finkelstein & Kowalski-Trakofler, 2017).

7. Legal Liabilities: Injured workers or their families may file lawsuits against the company, seeking compensation for injuries, pain, and suffering. Legal battles can be lengthy and costly, further straining the company's resources (Bridger, 2018).

Organizational Consequences

8. Damage to Reputation: Accidents can severely damage a company's reputation, leading to a loss of trust among employees, customers, and stakeholders. A tarnished reputation can affect business relationships and lead to a decrease in sales and market share (Coppola, 2020).

9. Workforce Morale: Accidents negatively impact the morale of the workforce. Fear and anxiety about workplace safety can lead to decreased job satisfaction, lower productivity, and higher employee turnover (Salvatore & Murphy, 2019).

Environmental Consequences

10. Environmental Damage: Accidents involving chemical spills or fires can cause significant environmental damage. Contaminants can pollute the air, water, and soil, leading to long-term ecological consequences and potential legal actions from environmental regulatory bodies (Metzger, 2017).

Social Consequences

11. Community Impact: Accidents in textile factories can have broader social implications, especially in communities where the textile industry is a major employer. Job losses and economic instability can affect entire communities, leading to social unrest and decreased quality of life (Goetsch, 2019).

6.0 EFFECTS OF ACCIDENTS ON SPOILAGES AND WASTAGES

Accidents of any type may cause:-

- Stoppage of machine and processing, resulting in loss of productivity and increase in wastage. For example, if the drawing process is disrupted, there will be a back accumulation of card or combed slivers which will generate storage problems or force the preceding operations to stop.
- Damage or even loss of machine or equipment may spoil the process (e.g. in dyeing and printing) and necessitate repairs or even replacement. Procurement of parts or purchase of the replacement workmanship, downtime cost, and loss of productivity will all add up to reduced efficiency.
- Injury, disability or death of an employee will result in loss of productivity, possible stoppage of the machine or activity or both, spoiling it or operating it in an improper, less efficient manner.

This results in waste especially if the worker is involved in waste handling.
- Injury, disability or death will result in temporary loss of productivity due to low morale of workers, especially those who were witnesses to the incident.

7.0 COST IMPLICATION OF ACCIDENTS

Disruption of processes, reprocessing, generation of waste and its disposal, replacement of broken or worn out parts, procurement of replacements, total labour input, medical bills of injured employees as well as attendant wastages are parts of the general cost incurred by the company. Additional cost may include death benefits of dead employees, cost of recruitment and training of replacements. Further, the frequency and the manner in which issues like accidents are handled by management affect the company's image. The image of a company cannot be bought but earned. Far-reaching consequences can be experienced when workers have low morale and along with the local community, decide that the company does not bother about staff safety and welfare. In such circumstances, where there exists an active union, there may be increased demands for higher wages, improved conditions of service, job securities and restructuring of management.

All these result in loss of production, machine downtime, depreciation and sales as well as an increase in the cost of managing inventory. No matter how comprehensively insured, the company's cost reduction from the settlement will be determined to a great extent by the results of cause analysis.

8.0 REASONS FOR SAFETY AND ACCIDENT PREVENTION CAMPAIGNS

All safety codes and regulations today were informed by a combination of past experiences, lessons taught surviving injured and others concerned, natural and logical safety instincts as well as results of cause analysis.

Cause analysis is one of the most important and necessary factors in the war against accidents. To be effective the method of analysis must be accurate, thorough, logical, impersonal, simple and readily understood by all parties concerned.

However, there are certain types of accidents whose causes remain the same through the years; only the victims are new. As a general example, over the years, policemen have been knocked down by vehicles while crossing the highway. This does not mean that they have never heard of it; in fact, they have the education and technical knowledge about crossing a highway. But because they have the skill and experience acquired through practice, they know that they can cross the road safely, and do this so automatically that they allow themselves the luxury of daydreaming in the process. Now, most people have a short concentration span even under ideal conditions because the opposing factor, distraction, is always present. Distraction consists of external (noise and motion) and internal factors (never – ending thought process that are the price of intellect). The cumulative opposing activities could lead to temporary mental lapses. Although the causes of this are varied and complex, they flourish in an atmosphere of monotony. In the typical case, a policeman can get knocked down by a vehicle because being subjected to the influence of monotony, he experiences a temporary mental lapse and in particular the slightest change in repetitive function, either human or mechanical will cause an accident. Such is the spectre of monotony and complacency, sometimes brought about by routine. Workers therefore need to be constantly reminded about safety and accident prevention.

As seen earlier, the financial implications of an accident could be significant if not enormous. The company must therefore be seen to have proper consideration and respect for its workers in order to reduce undesirable high employment turnover, bad injury and damage experience and cut down the attendant cost.

Another reason for the campaign is legal. Legislation all over the world specifies minimum employee and environmental protection standards. Failure to observe this strictly may call for legal action against the company, its employees and the government; this cost can be significant.

9.0 SAFETY AND ACCIDENT PREVENTION

Safety is the result of a perfect accident prevention scheme. There is usually agreement on the work and desirability of safety's objective, yet enforcement is a problem. In addition to posting appropriate precautions, careful instructions and indoctrination of all personnel are necessary for effective compliance. Safety programs that yield constant, low frequency and severity rates are a result of the cooperative efforts of all workers. A prerequisite to successful cooperation is the realization that 'safety is efficiency'; one cannot exist without the other (Erick, 1980). It should usually start from the conception to the design of the plant. The following tabs are relevant:-

- The design of the building and the machine and equipment layout should take into cognizance 'safety first and always'

- Machines and equipment that produce hazardous gases, fumes and effluents should be placed downstream along the direction of wind flow.
- Good earthing should be provided for buildings and installations requiring it.
- A good and accessible network of drainage should be provided.
- Sources of energy should be well insulated, leak-proof and fool-proof, and should be accessible for regular maintenance purposes.
- Fire fighting equipment, alarms and extinguishers should be installed at strategic locations on the premises.
- Wide and high exit doors should be provided for safe and quick exit even in cases of emergency. They should be conspicuously labelled.
- Good ventilation and mill weather control devices should be provided.
- Well-constructed smooth platforms, ladders, stairways and access ways.
- Safety showers where corrosive and toxic chemicals are used.
- First aid boxes placed at strategic locations and quick access to good medical facilities.
- Safety storage facilities for all sorts of materials
- New workers must be well educated on the characteristics and processes of the facilities and materials they are using.
- Moving parts of machines and equipment must be avoided when in operation unless it is safe.
- Depending on the process, correct working gear – gloves, boots, goggles, masks, etc. must be worn by workers.
- All chemicals should be handled with extreme care and inhalation should be avoided.
- Boilers and equipment generating radiation should be safely isolated.
- The working area must be clean and clear, free from unnecessary obstructions.
- As much as possible, all speeding machine parts should be covered.
- Workers must avoid playing and throwing objects around the mill.
- Machines and equipment must be inspected, cleaned and maintained regularly. Broken and worn-out parts must be replaced immediately.
- The working area must have adequate lighting,
- Discipline must be maintained

10.0 SUMMARY AND CONCLUSION

Accidents have important consequences, ranging from minor to destruction of the factory. Liabilities to the company may not only be enormous in terms of spoilage and waste as well as their associated costs but may have serious effects on the individual(s) involved, the local community and even the economy. Adequate accident prevention programs, enlightenment as well as reminders added with full co-operation of workers in compliance will facilitate the achievement of a safe safety level. Safety is the ultimate aim of accident prevention.

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