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A Case Study on Fire and Safety in Industries

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ABSTRACT: Safety is considered a top priority due to its significance in safeguarding human lives and properties, especially in high-risk industrial sectors such as aviation, oil and gas, construction, transportation, steel manufacturing, and mining industries. These industries are plagued by workplace injuries, illnesses, and fatalities because of the dangerous work environments. As such, it is very vital to integrate safety into every work process in any industrial environment just like quality is built into products and services. It is important to establish and execute an effective safety management system to prevent the risks of irreversible accidents. This chapter begins with a background to safety management in industrial engineering and a discussion of the various issues of industrial safety management. It follows with an extensive description of existing and commonly used safety performance measurement methods. Several case studies are used to explain the methods and explore the important application areas relevant to most industrial sectors. The techniques and tools for safety data collection, analysis, and sharing are introduced together with their applications for safety management. The last section explains how emerging technologies can be implemented in most industrial sectors to enhance safety management. Fire prevention and protection in industrial plant basically include procedures for preventing, detecting and extinguishing fires. There is much to be done to promote safe systems for fire prevention in India. The systems should be designed to protect the employees and property and to assure safe working systems. Fire prevention and protection in any industrial plant include fire detection system, fire alarm system, fire prevention plan and employing legal requirements relevant to fire and safety management. The basic principles for avoiding fires are well known and relatively simple to implement. Handling fire issues effectively is not always easy, though. It requires careful consideration about the hazards of our operations, the development of effective strategies for handling these hazards, and constant vigilance to ensure these methods are implemented effectively. The conclusion of the project is to justify for maintaining the absolute health and safety precautions and measures by using several modern technologies in the field of industries and at various work places and implementing programmers of development in the source of safety management and risk factors and through many other newly developed equipment's. Mainly all these are taken into the consideration for the safety of every living being. Mainly to control the risk of action of combustion of fire and to propagate the agenda of the life of human beings so that the property and the machinery present in the industries doesn't get effected. The main purpose of fire safety is to protect human life. This includes safely evacuating buildings in the event of a fire, as well as preventing fires and quickly detecting and extinguishing flames to minimize the risk of injury and death. Fire safety also aims to protect properties, both tangible and intangible. Include buildings, equipment, materials, documents, data and information, among others. Fire prevention is an important part of fire safety. The measures to reduce the risk of fire, such as installing fire detection and alarm systems, fire suppression systems, safe electrical and mechanical systems, and adopting safe workplace practices.

I. INTRODUCTION

Fire safety is the set of practices intended to reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent ignition of an uncontrolled fire, and those that are used to limit the development and effects of a fire after it starts. Fire safety is the set of practices intended to reduce destruction caused by fire. Fire safety measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to limit the spread and impact of a fire. Job Description Fire Technology and Industrial Safety Management inspects different structures to ensure compliance with central/state government laws and with approved plans, specifications and standards, or inspect fire prevention systems and investigate fire sites to determine cause of fire. Industrial fire protection is a set of measures to prevent or reduce accidents and losses that may result from fire. These policies ensure the safety of lives and property at the workplace. The study on fire and safety in industries is of paramount importance to ensure the well-being of workers, protect assets, and prevent catastrophic events. Fires in industrial settings can lead to significant human casualties, property damage, environmental pollution, and economic losses. Therefore, understanding the principles of fire behavior and implementing effective safety measures is crucial for industrial organizations. This study aims to investigate various aspects of fire and safety in industries, including fire prevention,

detection, suppression, and emergency response. By examining the causes of industrial fires, analyzing fire dynamics, and evaluating existing safety protocols, this study seeks to identify potential vulnerabilities and propose practical solutions to enhance fire.

1.1 OBJECTIVES

Following are the main objectives of the project

- 1 To study various fire and safety measures and mechanism in industries.
- 2 To visit at-least one industry on the aspects of health, fire and health.
- 3 To suggest various advanced and superficial fire and safety methods, equipment for zero risk.
- 4 To study literature review about fire and safety in industries.

1.2 SCOPE OF THE WORK

The main purpose of fire safety is to protect human life. This includes safely evacuating buildings in the event of a fire, as well as preventing fires and quickly detecting and extinguishing flames to minimize the risk of injury and death. Fire safety also aims to protect properties, both tangible and intangible. This includes buildings, equipment, materials, documents, data and information, among others. Fire prevention is an important part of fire safety. This includes measures to reduce the risk of fire, such as installing fire detection and alarm systems, fire suppression systems, safe electrical and mechanical systems, and adopting safe workplace practices. In the event of a fire, the goal of fire safety is to limit the damage caused by fire. This includes containing the fire to a specific location, limiting damage to equipment and materials, and reducing the time required to recover operations. Fire safety also aims to maintain continuity of operations during and after a fire. This includes ensuring that businesses can continue to operate normally after a fire, minimizing the impact on operations and the personnel involved. Safety is very important role in safety management in workplace of industries.



Elements of process and safety

II. LITERATURE REVIEW

Fire system safety risk cognition model and evaluation of major public safety risks - Wen Li, Xuesong Lu, Xu Dong, 02 September 2022, Volume 10 – 2022.

Along with the expansion of city scale, and the increase in the density of population and buildings, the occurrence of a major public fire safety incident in cities will lead to a serious threat to the overall public safety and the sustainable economic and social development of the relevant region. Compared to the previous simple risk assessment model, the fire accident risk point system discussed in this study is taken as the main line of risk assessment, and the transformation process of the risk points from inherent risk, to initial risk, and then to a real risk is explored, redefining the major risk assessment model and risk perception path. The static risk characterization method of the inherent attributes of dangerous equipment, facilities, materials, places, processes, and operations, in a fire safety system, is

studied. Combined with the possible degree of occurrence of fire risk points during daily operations and management, the initial risk of fire risk points under local dynamic conditions is determined.

FIERAsystem: A Fire Risk Assessment Tool to Evaluate Fire Safety in Industrial Buildings and Large Spaces - Nouredine Benichou, George. V. Hadjisophocleou, August 2005, Vol. 15

The development of FIER A system, a new computer model to evaluate fire protection systems in industrial buildings, has been described. The model provides information on the safety and cost of candidate fire protection systems. The development of this model is expected to assist engineers and building officials in evaluating, in a clear and concise manner, fire protection systems in a building and to determine whether a selected design satisfies the established objectives for the building. This type of model will also facilitate the introduction and use of performance/objective based codes. In this study, FIER A system was used to assess different fire scenarios in an aircraft hangar. Two different design fires in a paint workshop adjacent to the main hangar were considered.

III. METHODOLOGY

The methodology states the safety parameters deals with risk assessment, fire prevention measures, fire detection systems, fire suppression systems and emergency evacuation plans. The role of fire and safety in industries is to handle regulatory compliance, continuous monitoring and maintenance, incident response and investigation and safety culture. Every industry carry a safety equipment's at the time of emergency those are fire extinguishers. And many of the systems that need to be carried out in fire safety of industries are passive fire protection, fire alarm systems, fire sprinkler and fire pump systems, special hazard fire suppression systems, preventative maintenance and real-time monitoring systems. The main reasons for the fire accidents and disasters are combustible dust, hot works, flammable liquids and gases, electrical hazards. Through providing fire safety training and programmes like implementing regular housekeeping routine, inspect and maintain your equipment and system the cause of fire accident gets reduced. And there are many of the top companies the world which carries proper fire and safety instructions and named as best in safety those companies are TATA, Godrej, Honeywell India, Johnson controls Pvt Ltd, Dragger India, and 3M India. In future generations many of the technologies should be included like IOT enabled detectors, IOT in fire systems, Mass notification systems, Voice alert systems, and Machine learning. Mainly the PPE (personal protective equipment) and emergency exits plays a very major in the safety of industries which may prevent or minimize exposure to hazards such as Biological hazards, Chemical hazards, Radiological hazards, Electrical hazards, and Mechanical hazards etc... many programmes to be implemented in various industries such as safety programs, safety training, safety analysis, safety development. The general points on fire and safety in every industry are avoiding overload circuits, turn off essential electrical equipment at the end of each workday, keep storage areas, work areas, pathways, corridors, clear of rubbish, immediately report hazard to superiors, exercise evacuation plans, establish and maintain communication link with DFSCD. Several parameters play a crucial role in ensuring fire and safety in industries. These parameters encompass various aspects of fire prevention, detection, suppression, and emergency response.

3.1 TECHNOLOGIES INCLUDED

Some of the technologies that are implemented in the industry to come up with innovative solutions include

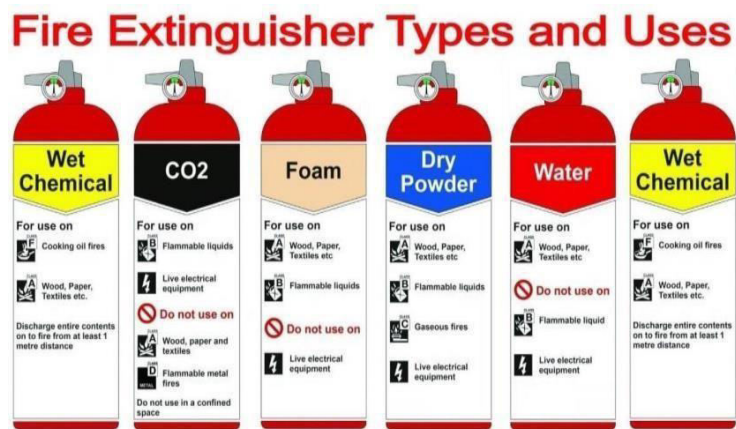
1. IOT enabled detectors
2. IOT in fire systems
3. Mass notification systems
4. Voice alert systems
5. Machine learning

Fire safety is one of the various industries which can realize the huge benefits of the Internet of Things. The IOT has resulted in much of the world evolving into smarter & more connected. With IOT, now safety alerts can be sent to a large number of people fast & effectively. Therefore, much leading fire safety organizations have launched IOT-enabled fire detectors. The reason why many leading organizations are rendering connected smoke detectors for residential use is that they have the capability to communicate with the Thermostat, which can close the furnace during a fire.

3.2 INDUSTRIES THAT USE FIRE AND SAFETY

1. Gas, oil and mining plants
2. Energy plants

3. Warehouses
4. Steel plants
5. Medical manufacturing companies
6. Industrial buildings/industrial facilities
7. Paper mills
8. Engineering operations
9. Installation maintenance
10. Fuel storage operations
11. Large scale commercial buildings (educational institutions etc...)
12. Refineries
13. Chemical plants
14. Petrochemical plants
15. Power plant



TYPES OF FIRE EXTINGUISHER

3.3 REASONS FOR DISASTER

1. Combustible dust

Causes of industrial fires - Combustible dust Often overlooked, and highly deadly, combustible dust is a major cause of fire in food manufacturing, woodworking, chemical manufacturing, metalworking, pharmaceuticals, and just about every other industry you can name. The reason is that just about everything, including food, dyes, chemicals, and metals even materials that aren't fire risks in larger pieces has the potential to be combustible in dust form.

2. Hot work

Hot work is one of the leading causes of industrial fires across all industries. Although hot work is commonly equated with welding and torch cutting, there are many other activities including brazing, burning, heating, and soldering that pose a fire hazard. This is because the sparks and molten material, which reach temperatures greater than 1000°F, can easily travel more than 35 feet.

3. Flammable liquids and gases

These fires, which often occur at chemical plants, can be disastrous. To see what these look like, check out this post at Industry Tap. It features videos from five chemical plant explosions that were the result of explosions of flammable materials, such as rocket fuel (which produces a flammable gas), acrylic acid, and crude oil.

4. Electrical wiring

Electrical fires are one of the top five causes of fires in manufacturing plants. Here a non- exhaustive list of specific electrical hazards

1. Wiring that is exposed or not up to code
2. Overloaded outlets
3. Extension cords
4. Overloaded circuits
5. Static discharge The damage caused by these fires can quickly compound thanks to several of the other items on this list. Any of the above hazards can cause a spark, which can serve as an ignition source for combustible dust, as

well as flammable liquids and gasses.

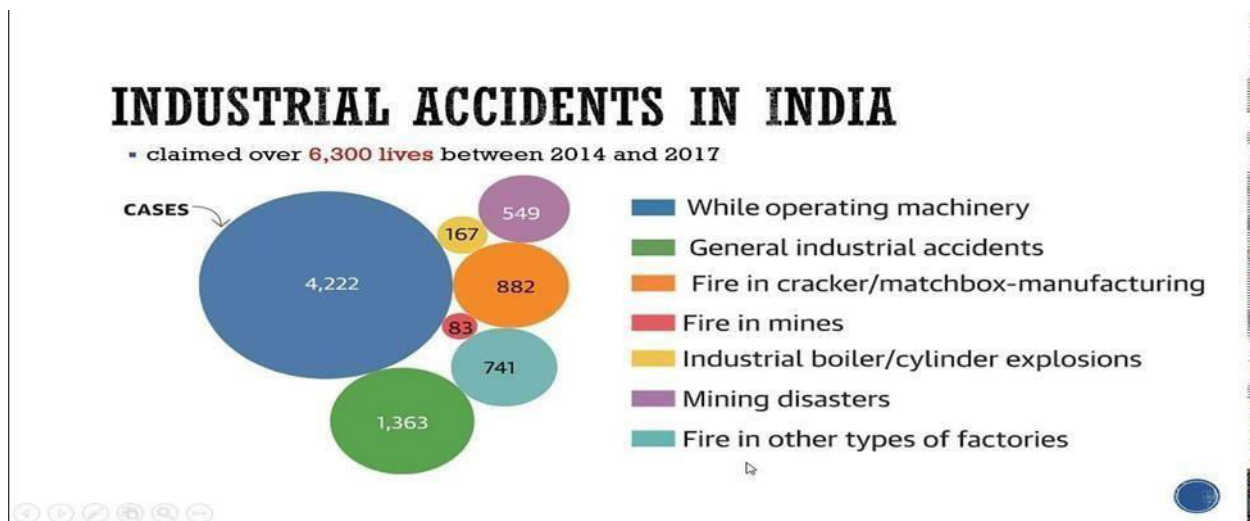
5. Machinery and equipment's

Faulty equipment and machinery are also major causes of industrial fires. Heating and hot work equipment are typically the biggest problems here in particular, furnaces that aren't properly installed, operated, and maintained. In addition, any mechanical equipment can become a fire hazard because of friction between the moving parts. This risk can be brought down to practically zero simply by following recommended cleaning and maintenance procedures, including lubrication.

Strategies for preventing fires due to equipment and machinery issues fall into three main categories

1. Awareness
2. Cleaning and housekeeping
3. Maintenance
4. Awareness

IV. CALCULATIONS



Industrial Accidents in India in the Year 2014 - 2017

Due to machinery	=	4222
Due to general accidents	=	1363
Due to fire in crackers	=	882
Due to cylinder explosion	=	167
Due to mining disaster	=	549
Due to fire in industries	=	741
Due to fire in mines	=	83
Fatalities	=	6300

V. CONCLUSIONS

1. In conclusion, fire safety is a critical component of a productive working environment. It prevents disruptions, instills a sense of security among employees, and fosters teamwork. Businesses should view fire safety not as a mere regulatory requirement but as a strategic tool forenhancing productivity.
2. It is important to invest in proper fire safety measures, keep equipment and systems in good working order, and ensure that people are properly trained to handle emergency situations
3. In conclusion, fire in workplaces should be avoided at all times because besides the damage ofproperty and loss of lives, there are people whose career might be ruined by such incidences. Similarly, fire causes organizations to fall back as they struggle to recover the losses incurred.
4. Fire safety is the set of practices intended to reduce destruction caused by fire. Fire safety measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to limit the spread and impact of a fire.
5. Safety is everyone’s responsibility hence employees, management, EHS department, production department, maintenance department and many more have to work at their level to maintain safe working environment.

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