

## INDUSTRIAL ACCIDENTS IN INDIA: CAUSES AND PREVENTIVE MEASURES

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### ABSTRACT

*Industrial accidents in India have posed recurring threats to worker safety, public health, and environmental integrity. Industrial accidents in India continue to be a major concern, affecting human lives, the environment, and the economy. Despite having legal frameworks and safety regulations in place, lapses in implementation, human error, outdated technology, and insufficient risk management contribute to frequent accidents across various sectors. These incidents, often preventable, reveal systemic failures in safety protocols, regulatory enforcement, and emergency preparedness. This paper explores the root causes of industrial accidents in India and proposes comprehensive preventive measures to mitigate future occurrences. The analysis draws from major incidents, existing legislation, and modern safety practices to advocate for a robust industrial safety framework.*

Keywords – Industrial accidents, Legal Frameworks, Causes, Preventive Measures, Lapses in Implementation, Human Error, Outdated Technology, Safety Protocols, Regulatory Enforcement, Emergency Preparedness, Modern Safety Practices.

### INTRODUCTION:

India's industrial sector has grown rapidly over the years, contributing significantly to the country's economic development, technological advancement, and employment generation. However, this growth has also been accompanied by an increase in industrial accidents, raising serious concerns about workplace safety, environmental protection, and regulatory accountability. From minor incidents in small factories to large-scale disasters such as the Bhopal Gas Tragedy in 1984 and the Vizag gas leak in 2020, these events reveal deep-rooted issues in the way industrial safety is managed in India.

Industrial accidents can result from a range of factors, including human error, lack of proper training, poor maintenance of equipment, outdated infrastructure, and weak enforcement of safety norms. Often, industries operate

without fully complying with safety regulations, especially in the unorganized sector where oversight is limited. In some cases, economic pressures and production demands lead to the deliberate neglect of safety protocols.

In addition to human casualties, industrial accidents can cause severe damage to the environment—contaminating water bodies, polluting air, and affecting biodiversity. The social and psychological impact on affected communities is equally significant, as people are often displaced, lose livelihoods, or suffer long-term health issues.

This research paper aims to explore the key causes behind industrial accidents in India, critically examine the effectiveness of existing safety laws and regulations, and propose practical preventive measures. These include technological upgrades, regular safety audits, improved worker education, and community

engagement. By identifying gaps and offering solutions, the study seeks to contribute toward a safer, more responsible, and sustainable industrial ecosystem.

#### **REVIEW OF LITERATURE:**

1. Health and well being at work<sup>576</sup> - In this article, Benach.J, Benavides F.G, Jarque.S said that the Industrial accident is a serious concern to look at in any organization, not only in organization but also outside. Millions of industrial accidents take place throughout the world. Some accidents involve time off work, some are serious and some are fatal. Many experts believe that the accidents are occurring due to improper functioning of prevention systems. Hence, the systems are needed to be developed to secure the society. This can be done by improving sources of information into the causes of industrial accidents and also developing safety measures.
2. Industrial Accidents-Types and Causes<sup>577</sup> - In this article, Smriti Chand has found that, every country has its own regulations and that are to be followed by every citizen of that particular country. The U.S. Occupational Safety and Health Administration (OSHA) supervise the safety of more than 130 million workers each year. Despite these regulations, the accidents are common and uncontrollable. Employers are needed to be trained in the organizations and defected equipment is needed to be replaced, equipment is to be maintained at the workplace with proper supervision.

3. How do workplace accidents affect employers<sup>578</sup> - This section mainly focuses on workplace accidents and impact on employers in an organization. Safety procedures and equipment are the first lines of defense at a job. Because of human error and unanticipated occurrences, workplace accidents are self-evident facts. Employers must know how to deal with eventuality, coordinate and help the employee and ensure smooth functionality in the organization. One of the factors that an employer has to deal with, is financial cost like salary cost, productivity losses, retraining, repairs, medical and travel expenses, additional supervision. Another factor that affects workplace accidents is an employer-employee relationship. The recovered employee will maintain the relationship with his/her coworkers. But studies have shown that it is difficult for an employee to maintain a relationship with his/her employer. The relationship between them becomes demarcate.

#### **INDUSTRIAL ACCIDENTS:**

An accident is a sudden and unexpected occurrence of an event or any mishap happening that interrupts the progress of work and can cause loss to human life. It occurs in various forms like dangerous procedures, infrastructure failures or certain human activities, which may cause loss of life or injury or damage to properties. Accidents can be neither anticipated nor designed to occur. Thus, an accident may be an uncontrolled event which causes injuries to human life or may destroy any object or substance which may lead to huge loss.

An industrial accident can be defined as an event that is unexpected and uncontrolled that occurs in an industry and can cause personal

<sup>576</sup> Name of authors: Benach.J, Benavides F.G, Jarque.S, Title: Health and well being at work, Published on: 27 April 1999

Source: <https://www.eurofound.europa.eu/publications/article/1999/the-impact-of-industrial-accidents>

<sup>577</sup> Name of author: Smriti Chand, Title: Industrial Accidents-Types and Causes. Source: <http://dramamathgiri.blogspot.com/2016/09/industrial-accidents-types-and-causes.html>

<sup>578</sup> Name of author: Brent George, Title: How do workplace accidents affect employers, Published on: 28 April 2014 Source: <https://www.brentgeorgelaw.com/how-do-workplace-accidents-affect-employers/>

injury to the employees, which arises in the course of the employment. Accidents occur due to faulty equipment or negligence or conflicts among the employees that can lead to minor accidents. Accidents can be prevented if the organizations take proper precautions. Proper training and knowledge should be provided about the consequences of accidents.

#### **TYPES OF ACCIDENTS:**

Accidents can be of various types that are based on the asperity and degree of injury. An accident that can cause disability or death is called a major accident. A small injury that doesn't cause any disability to an employee is known as a minor accident. When an employee gets injured showing external signs like fractured bone then it is an external injury. On the other hand, if the employee gets injured without showing any external signs then it is an internal injury. When an injury lasts for a shorter period, say, a day or a week then it is a temporary injury. In contrary, if the injury makes the person disable for a lifetime then it is a permanent injury. The type of disability that is caused by an accident may be partial or total, fatal or non-fatal.

- I. **Minor Accidents** – The accidents that last for a shorter period of time and don't cause any disability are minor accidents. These are less harmful to the worker. They prevent the employee from performing work for less than 48 hours from the time of the accident. Sometimes these accidents cannot be controlled and are needed to report to the higher management. The manager is responsible for reporting to higher authority so that the work will not be affected.
- II. **Fatal Injury** – Fatal accident means the injury that is resulted from a personal injury that results in the death of the person. Insurances are also provided by the organizations for the victims when met with an accident or serious injuries.

- III. **Non-Fatal Injury** – The injuries that do not result in or capable of causing death are non-fatal injuries. For example, back injuries are the leading cause of non-fatal injury.

#### **CAUSES OF ACCIDENTS:**

Accidents do not just occur but there are always certain causes. If accidents are needed to be reduced in an organization then the causes should be known in detail.

The various causes can be as follows-

- a) Physical Causes
- b) Physiological Causes
- c) Psychological Causes

**Physical Causes** – Physical causes are related to plant and machinery, say, noisy or unbalanced machine parts, damaged tools and slippery floors, long working hours resulting in tiredness.

**Physiological Causes** – Physiological causes of accidents are related to the physical body of the employee e.g. a weak eye sighted person cannot find it difficult to perform the job. An old person cannot do heavy work. It also includes poor listening power, weak health, defective body parts, fatigue, fitness and high blood pressure.

**Psychological Causes** – Psychological causes are related to the individual employee mental disturbance at the workplace. If an employee works with a disturbed mind, it can lead to minor accidents and the employee will be regarded as a victim. To avoid such accidents an employee must follow the rules and regulations, avoid frustration, carelessness, nervousness, and depression.

#### **NOTABLE INDUSTRIAL ACCIDENTS IN INDIA:**

1. **Bhopal Gas Tragedy (1984)** – The Bhopal Gas Tragedy is considered one of the world's worst industrial disasters. It occurred on the night of December 2–3, 1984, at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh. A highly toxic gas called methyl isocyanate (MIC) leaked from the plant

due to poor maintenance, a failed safety system, and insufficient emergency preparedness. Over 5,000 people were officially reported dead, but unofficial estimates put the death toll at over 15,000, with hundreds of thousands more suffering from long-term health issues such as respiratory problems, birth defects, and blindness.

The tragedy highlighted the catastrophic consequences of industrial negligence, lack of accountability, and weak safety regulations. The absence of proper training, inadequate warning systems, and disregard for standard operating procedures led to mass casualties. It also exposed the failure of regulatory oversight and the urgent need for strict industrial safety laws in India. The incident led to the introduction of the Environment Protection Act, 1986, and improved safety and disaster management protocols nationwide.

- 2. Vizag Gas Leak (2020)** – The Vizag Gas Leak, also known as the LG Polymers gas leak, took place on May 7, 2020, at a chemical plant in Visakhapatnam, Andhra Pradesh. A storage tank containing styrene gas leaked due to the improper storage of the chemical during the COVID-19 lockdown period. The leak occurred in the early morning hours, affecting nearby residential areas. The toxic fumes caused 11 deaths and affected over 1,000 people, many of whom suffered from nausea, dizziness, skin irritation, and respiratory issues. Investigations revealed that the plant lacked adequate monitoring systems, and the company had delayed upgrading its safety infrastructure despite previous recommendations. The incident raised serious concerns about the safety practices in chemical industries, especially in aging plants. It also pointed to gaps in local authorities' preparedness for industrial emergencies.

Following the leak, the National Green Tribunal (NGT) imposed a fine on LG Polymers and stressed the importance of regular audits and strict compliance with safety norms in hazardous industries.

- 3. Neyveli Lignite Corporation (NLC) Boiler Explosion (2020)** – On July 1, 2020, a boiler explosion occurred at the Neyveli Lignite Corporation (NLC) power plant in Tamil Nadu. The explosion took place in the thermal power station's sixth unit during a routine operation, resulting in the deaths of 13 workers and injuries to several others. This incident came just weeks after a similar explosion had taken place at the same facility, indicating a pattern of safety lapses and inadequate corrective action.

The tragedy at NLC underlined the dangers of poor equipment maintenance, inadequate safety inspections, and negligence in operational protocols. Workers had reportedly raised concerns about the condition of the boilers before the incident. The explosion revealed serious lapses in internal safety audits and called into question the company's risk management approach. It brought renewed focus on the need for continuous monitoring of high-risk installations and transparent investigation processes following such accidents.

#### **CONCEPT OF SAFETY:**

Safety is beneficial in every aspect. The greatest desire in human life is security. Safety has become a prominent aspect for every human. Safety is the state in which risks or harm due to accidents to property or a person can be reduced or maintained. In order to reduce accidents at workplace safety is essential. Every organization has at least minimum safety for the well being of the employees.

Many organizations provide different training programs for the employees so that the

employees get the awareness on the impact of the accidents at the workplace and can learn to handle the accident if occurs and use required precautionary measures that are provided by the organization. The employees should be more safety conscious to prevent accidents in the organization. Safety consciousness can be increased by displaying safety posters in the organization, welcome all safety suggestions, organizing safety competition; employees should identify the accident-prone areas.

In an organization, safety committees play a crucial role by making the employees to assume responsibilities. Employees, supervisors should be selected from different departments to be the members of the committees. Educational films related to safety can be shown to the employees by the committees. The main objective of a safety committee is to make the employee's safety conscious and to ensure that all the precautions are adopted properly.

#### **PREVENTIVE MEASURES:**

The concept of safety in industrial environments revolves around the protection of human life, property, and the environment from hazards associated with industrial activities. It involves a systematic approach to identifying risks, implementing control measures, training workers, and preparing for emergencies. A safe workplace not only prevents injuries and fatalities but also enhances productivity and morale. Safety is considered a shared responsibility among employers, employees, and regulatory authorities.

To ensure industrial safety, various preventive measures are implemented, including regular inspection of machinery, mandatory use of personal protective equipment (PPE), fire safety protocols, and proper handling of hazardous materials. Worker training, safety audits, risk assessments, and emergency preparedness drills are also essential components. Industries are encouraged to adopt global safety standards like ISO 45001 to maintain a structured safety management system.

Preventive strategies aim to reduce accidents at the source rather than simply reacting after incidents occur.

Promoting a culture of safety through education, technology integration, and public-private partnerships can significantly improve compliance. Use of real-time monitoring systems, automation in hazardous operations, and mobile apps for reporting unsafe conditions are examples of how technology can enhance industrial safety. Encouraging worker participation in safety committees and recognizing industries that maintain high safety standards can also foster accountability and long-term improvement. Ultimately, a combination of legal compliance, preventive action, and a proactive safety mindset is a key to building safer industries in India.

#### **LEGAL FRAMEWORKS:**

India has a comprehensive legal framework to ensure safety and health in industrial establishments. The cornerstone of this framework is The Factories Act, 1948, which lays down provisions related to the health, safety, and welfare of workers employed in factories. It mandates employers to provide safe working conditions, maintain machinery, ensure cleanliness, prevent overcrowding, and install adequate lighting and ventilation. The Act also requires fencing of machinery, appointment of safety officers in large factories, and the establishment of health and safety committees in certain cases.

In addition to the Factories Act, several other laws target specific safety concerns. The Environment (Protection) Act, 1986 empowers the central government to take measures for the protection and improvement of the environment and to prevent industrial pollution, including from hazardous substances. The Boilers Act, 1923 ensures the safe design, operation, and maintenance of boilers used in industries. The Indian Electricity Act, 2003, along with the rules framed under it, provides regulations for electrical safety in industrial premises. The Explosives Act, 1884 and Gas

Cylinders Rules regulate the manufacture, transport, storage, and use of explosive materials and gases, helping to prevent fire and explosion-related accidents.

Regulatory authorities such as the Directorate General Factory Advice Service & Labour Institutes (DGFASLI) and the Chief Inspector of Factories in each state are responsible for enforcing these laws. These bodies conduct inspections, issue safety guidelines, and take legal action in case of violations. Additionally, the National Policy on Safety, Health, and Environment at Workplace (2009) aims to strengthen compliance, promote awareness, and encourage continuous improvement in workplace safety. Together, these legal frameworks form a crucial foundation for promoting industrial safety and protecting workers' rights across the country.

#### **CHALLENGES IN ENFORCEMENT AND COMPLIANCE:**

1. **Gaps in Regulations** - One of the primary challenges in enforcing industrial safety is the presence of outdated or insufficient regulations. Although the Factories Act, 1948, and other related laws have been instrumental in establishing safety standards, many of them have not kept pace with rapid industrial modernization and technological changes. Some sectors—like construction, warehousing, and small-scale industries—often fall outside the strict purview of these laws, creating regulatory blind spots where safety is compromised. Additionally, there is often ambiguity in overlapping jurisdictions of different laws and regulatory bodies. For instance, environmental hazards may fall under both labor and environmental ministries, leading to a lack of coordinated enforcement. Without regular updates and clear guidelines, it becomes difficult for industries to fully understand or meet all compliance requirements, resulting in

inconsistent safety standards across the country.

2. **Issues in Implementation** - Even when regulations are in place, poor implementation remains a major hurdle. Many state-level factory inspectorates face a shortage of staff, outdated inspection tools, and lack of digital monitoring systems. As a result, routine safety audits and inspections are often delayed or skipped entirely. In some areas, inspections are symbolic rather than meaningful, with limited follow-up on safety violations or corrective actions. Corruption and lack of accountability also affect the enforcement process. In some cases, industries may bypass safety norms due to weak or non-transparent enforcement mechanisms. Smaller units, particularly in unorganized sectors, may not be inspected at all. The absence of a centralized, real-time system to track safety incidents and compliance data further hampers effective implementation.
3. **Safety in Small and Medium Enterprises (SMEs)** - Small and Medium Enterprises (SMEs) make up a large portion of India's industrial base, but they often struggle to comply with safety norms due to limited resources and awareness. Many SMEs operate with old machinery, minimal training, and no dedicated safety officers. Because they lack technical and financial capacity, safety measures are often seen as an added cost rather than a priority. Moreover, SMEs frequently operate in informal setups where regulatory oversight is weak or absent. Without pressure from regulators or incentives to improve, many such units continue to operate with poor safety standards. Promoting safety in SMEs requires not just regulation but also support systems like financial incentives, training

programs, and access to affordable safety equipment.

### **REPORTS RELATED TO INJURIES:**

Injuries contribute significantly to the global burden of morbidity and mortality. The worldwide rate of unintentional injuries has been estimated to be 61 per 1,000 populations with 90% occurring in low and middle-income countries (WDR, 1993). More than 4 million people die from injuries, whereas 138 million Disability Adjusted Life Years (DALYs) are lost every year (ibid). The younger population is more prone to fatal and non-fatal injuries and DALYs. In India too, injuries are emerging as a major public health problem. National Crime Records Bureau (NCRB) has reported 413,457 deaths due to unintentional injuries in India in 2015, an increase of 40.5% compared to 2005 (NCRB, 2015)<sup>579</sup>. Sample Registration Survey (SRS) informs that injuries contributed 10.7% to total deaths in India in 2010–2013 (SRS 2010–13, 2014)<sup>580</sup>. Age stratification of injuries reveals that people in 15–29 years age group are affected the most with 44.6% deaths due to injuries followed by the 30–44 year's cohort with 25.7% deaths (SRS 2010–13, 2014). Gender segregation of SRS data informs that injuries are the cause of 12.4% deaths in male and 8.4% deaths in females.

After road traffic collisions, workplace accidents are the next major cause of injuries in India (CGHR, 2015)<sup>581</sup>. The International Labour Organization (ILO) has estimated that there were 47,000 fatal and 44.1 million non-fatal work-related accidents in India in 2003 (ILO, 2008)<sup>582</sup>. ILO has also informed that workplace injuries are vastly under-reported in India (Takala, 2005)<sup>583</sup>. Industrial accidents are important contributors to workplace injuries and preventable death and disability. There were

361,994 registered factories in India in 2014, which had employed 200,34,859 workers (OHS Profile India, 2017)<sup>584</sup>. In the same year, 1,141 fatal and 25,173 non-fatal injuries were reported in these factories (DGFASLI, Standard note, 2014)<sup>585</sup>.

### **CONCLUSION:**

Industrial accidents in India remain a significant concern, especially as the country continues to grow as a global manufacturing and industrial hub. Incidents like the Bhopal Gas Tragedy, Vizag Gas Leak, and the Neyveli Boiler Explosion have shown the devastating impact of negligence, poor safety infrastructure, and inadequate legal compliance. These accidents have resulted in tragic loss of life, long-term health issues, environmental damage, and shaken public trust in industrial operations. They serve as powerful reminders of the need for industries to place safety at the core of their functioning.

Despite having several legal frameworks such as The Factories Act, 1948, and The Environment Protection Act, 1986, the real challenge lies in consistent and effective enforcement. Shortcomings in regulatory oversight, manpower, inspection mechanisms, and lack of awareness—especially in small and medium enterprises (SMEs)—have left gaps in implementation. Many industries either ignore safety norms or treat them as a formality, often due to financial constraints, lack of training, or poor risk perception. A culture of safety must be developed from top management to workers on the floor, with continuous training, awareness, and accountability.

To move forward, a combination of stronger legal enforcement, technological integration, and community involvement is needed. Regular safety audits, digital monitoring, emergency preparedness, and stricter penalties for non-compliance can significantly reduce industrial

<sup>579</sup> NCRB. Accidental Deaths and Suicides in India 2015. Delhi: National Crime Records Bureau, Ministry of Home Affairs, Government of India; 2015.

<sup>580</sup> Causes of Death in India 2010-13. New Delhi: Registrar General of India; 2014. SRS 2010-13.

<sup>581</sup> CGHR. Causes of Death Statistics 2010-13. A Joint Report of the Registrar General of India and the Centre for Global Health Research. 2015

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<sup>583</sup> Takala J. Introductory Report: Decent Work – Safe Work. 2005.

<sup>584</sup> Occupational Health and Safety Profile - India 2017. ICMR-National Institute of Occupational Health (Indian Council of Medical Research) Department of Health Research. Ministry of Health and Family Welfare. Ahmedabad. India

<sup>585</sup> DGFASLI Standard note. Standard Reference Note-2014. Directorate General Factory Advice Service & Labour Institutes. Ministry of Labour & Employment, Government of India. 2014.

hazards. Encouraging industries to adopt international safety standards, supporting SMEs with financial and technical aid, and involving workers in safety planning are critical steps. By prioritizing human lives and environmental protection, India can not only prevent future tragedies but also build a more responsible and sustainable industrial sector.

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