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# Occupational Injury Characteristics and Safety Issues in the Chemical Industry

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**ABSTRACT:** The provision of a secure atmosphere, safe tools, and safe processes in the workplace to protect the health and protection of workers is referred to as worker safety. While companies have a moral duty to guarantee the safety of their workers. The goal of this survey is to define the characteristics of occupational injury among chemical production workers and to improve security issues. Injury data was gathered and analyzed based on a variety of factors, including age, gender, skill level, hazard type, and so on. According to the study, 55 percent of injured workers were more than 40 years, maximum numbers of injury occury in first shift and minimum numbers of injury occurred in third shift, 62% of injury occur in hand, feet, arm, eye and face and 38% of injury occur in knee shoulder, throat and head. As a future point of view this study will help to identify reasons of worker safety in chemical industry.

**Keywords:** Chemical, Occupational Injury, Safety, Vehicles, Workers.

## 1. INTODUCTION

The chemical business is classified as a "high-technology, knowledge-intensive enterprise." As a consequence, traditional variables such as raw material availability, low labor costs, and market infrastructure are insufficient to propel this business forward[1]. For this form of industrial growth, technical improvement and knowledge acquisition are essential. Only nations with a strong economic foundation and significant levels of industrial development have been able to establish large chemical facilities, according to research [2] . The substantial financial expenditure required to set up the chemical sector is a disadvantage for emerging countries. Another problem that prevents the construction of chemical facilities is the ownership of 'patents' by multinational corporations. The fact that these corporations have exclusive rights to design and procedures is one of the main causes for industry concentration in a few nations [3]. The bulky and weight-losing raw materials utilized in chemical manufacturing are bulky and weight-losing. As a result, some of the plants grow in the raw material source[4]. However, since the products are typically expensive and needed in other sectors, the market plays a crucial influence in the plant's location[5]. The most common cause of workplace injuries is chemical industrial accidents. An accident was defined by a WHO panel in 1956 as "an unplanned incident resulting in recognized harm." As a outcome, a competent health-care system should be in place to regulate and prevent industrial accidents among employees while they are on the job. As a result, in creating an effective health-care system[6].

*1.1 Method of stay safe in chemical industry:*

- *Everything should be clearly labeled:*

You may possibly prevent a lives by accurately recognizing all hazardous bottles. Even to a chemist, compounds may seem to be identical. Check the module's labelling; the toxins should be visible on the exterior of the jar to everybody[7]. With correctly labelled bottles, mishaps induced by inappropriately mixing substances or improper disposal may be prevented [8].

- *Safety Examine your emergency supplies:*

The Industrial Security and Hygiene Organization required rescue gear to be available and operable in businesses that store or handle chemicals [9]. An urgent eyewash may help employees who receive toxins in their eyes [10]. Minor

fires may be prevented by using a smoke extinguishers that is in excellent working condition and has recently been inspected. On-site firemen may need fighting gear such as water supply and hoses [11].

- *Keep your safety gear visible:*

Workers should use protective gear when in the location to prevent toxic contact. Ascertain that everyone knows where sunglasses, respiratory protection, and mittens may be located. Encourage staff to use the gear every time they arrive to work [12]. Chemicals may be released if protective gear is not worn. Workers would be more likely to use protective devices if it is more easily available [13].

- *Make a chain of accountability:*

Have a properly established chain of authority in existence in the event of an emergency. Employees at all degrees of authority should work each shift. Teach each worker who they would notify if an accident occurs [14] . This demands planning in order to avoid a situation like the one shown in Figure 1 when the correct supervisor fail to make up for duty [15].

- *Set aside a spot for food and drink:*

Restrict eating near the working zone to safeguard staff from mistakenly absorbing chemicals. Make a separate location apart from the chemical storage and workplace for dining, sipping, and taking breaks[1]. Allow personnel at this area free accessibility to sinks and soap so they may wash their fingers prior eating or consuming. This helps to minimize accidental ingestion by removing any contaminant from the hands. The easiest way to prevent contaminating of both the pesticides and the meals is to restrict the consumption of any foods or beverage near the work area [15].


**Figure 1: Illustrating the Method of stay safe in chemical industry**

This study discusses synthetic sector personnel are more likely to be injured on the job. Security of employee's mentions to the providing of a healthy workplace, safe gear and safe Working operations must safeguard the wellness and protection of employees. While corporations clearly have a moral commitment to guarantee the safety of employees, a dangerous workplace may also have substantial legal and financial ramifications for employers [16]. This research paper consists of 5 sections out of which section 1 discusses the overview of chemical industry, The review of literature is discussed in section 2, the methodology part which will furthered divided by 4 parts which includes research design, Instrument and sampling, data collection and data analysis, section 4 discusses the result and discussion part and section 5 consists the conclusion of the study.

## 2. LITERATURE REVIEW

K. Alomari et al. [13] stated that Building Information Modeling (BIM) allows for the production of a digital representation of a planned building that includes information regarding project parameters, performance standards, and the construction process. One of the advantages of utilizing BIM tools, according to users, is the aptitude to view the last project as well as the building process. Both safety experts and designers benefit from understanding the building procedure in connection to a facility's design when preparing worker security precautions for a project. The extent to

that project workers are acquainted with BIM technologies and how well they can be used to identify and mitigate safety risks issues are both important factors in adopting BIM to improve safety. The authors studied the link between BIM and safety in a separate, continuing research to describe the potential, challenges, and repercussions. Based on an online poll of projects architects who operate for construction companies and a complete literature analysis, those that use BIM feel it assists in transmission of projects data and program execution, both of whom have been proven to have beneficial benefits on building place protection. Further comprehend the features, use a multivariate linear regression econometric methodology that drive safety experts to believe that BIM improves workplace safety. Furthermore, a substantial number of engineers that use BIM believe that it eventually helps to remove safety dangers and increase worker protection, according to the study results. The results of the research imply that growing usage of BIM in the building sector may be contributing to improvements in safety performance.

K. Logasakthi and K. Rajagopal [18] mentions the measures of enhancing labor efficiency are health, safety, and welfare in the workplace. The dissimilar wellbeing measures supplied by the company would have an instant influence on the worker's health, physical and mental alertness, morale, and general effectiveness, resulting in increased production. Appropriate cafeteria facilities, lodging Arrangements, entertainment services, healthcare amenities, and transportation are all available to you are around of the amenities and facilities that come within the scope of labor welfare. As a consequence, people in this field not only enjoy the pleasure of their employment, but also the many benefits provided by their employers. The workers provide their full support to the company's development. The personal department is in charge of the company's complete human resources. The administration gives all health, safety, and welfare benefits to the workers, allowing them to perform better at work and in the workplace.

M. N. Vinodkumar and M. Bhasi [15] stated that in a densely populated nation like India, chemical safety is a serious concern. The author conducted research to investigate the chemical industry's safety climate parameters in Kerala, India. A study of 2536 workers in eight major accident-prone chemical manufacturing plants in Kerala was done using a questionnaire. The study comprised employees and 1st managers at the highest level of leadership. Using the SPSS application, with variance rotations, 75% of the informations were subjected to principal components element testing. This found eight variables that accounted for 52.15 percent of the total variation. Internal consistency was determined to be satisfactory across items in each of the eight components, as well as the overall scale. By utilizing the AMOS 4.0 structural equation modeling tool to do confirmatory factor analysis on the remaining data, the model was found to give a satisfactory match. There was a strong unfavorable association between the estimated safety environment ratings and identity incident occurrences, indicating that they had good predictive validity. The findings of a one-way ANOVA demonstrate that the mean safety climate scores of firms vary substantially from one another, demonstrating that organizations have various degrees of safety climate. Tests were also done to determine the impact of respondents' qualifications, age, job type, and knowledge on their views and arrogances toward security.

After analyzing few related studies regarding to Occupational Injury Characteristics and Safety Issues in the Chemical Industry, it was reported that workers over the age of 40 were found to be more vulnerable to damage, with the most affected bodily parts are the fingers, legs, elbows, eyeballs, face, and head that were working in the chemical industry.

*Research Questions:*

- How to improve workers safety in chemical industry?

## 3. METHODOLOGY

### *3.1 Research design:*

This investigation was accepted out in India on employees and certain management staff of Step-by-step guide to Natural Gas Fertilizer Manufacturers. Age, gender, skill, and worker job category, accident timing, damage in different body areas, and accident agent are all variables to consider, and kind of danger, among others, were considered in this research. Several members of management as well as employees of various categories were asked to provide relevant details on occupational harm and danger.

### *3.2. Sampling:*

In this research samples are taken from Natural Gas Fertilizer Companies of 100 respondents out of which 60% are males and 40% are female out of which 20 respondents are 15–25 year-old, 26 respondents are 25-40 year old, 35 respondents are from 40-60 year old and 19 respondents are more than 60 year old as shown in Table 1.

**Table 1: Illustrating the Number of Respondents Based on the Age**

| Number of respondents | Age of respondents |
|---|---|
| 20 | 15-25 |

| | |
|---|---|
| 26 | 25-40 |
| 35 | 40-60 |
| 19 | More than 60 |

*3.3. Instrument:*

Statistical tools would be utilized by the researchers throughout the research process, depending on the accessibility of information and the study's requirements. Mean, %, association, chi-square test, and t-test are a few examples. The study's findings will be represented using graphs, charts, and tables. There are different questions have been asked that will help to explain the study and map the graph. The list of questions are shown in Table 2:

- Does company have sufficient PPE kit for all workers?
- Does injured workers age less than 60 year?
- Does injured workers are qualified?
- Does workers injured by agent of accidents?
- Does workers injured by types of hazards?

**Table 2: Illustrating the list of question asked during research**

| Questions asked | Yes | No | In the developing stage |
|---|---|---|---|
| Does company have sufficient PPE kit for all workers? | 30% | 50% | 20% |
| Does injured workers age less than 60 year? | 35% | 47% | 18% |
| Does injured workers are qualified? | 50% | 40% | 10% |
| Does workers injure by agent of accidents? | 60% | 35% | 5% |
| Does workers injure by types of hazards? | 40% | 55% | 5% |

*3.4. Data collection:*

During the research, 100 respondents were surveyed. 60% were males and 40 % were females (Most of the interviewers were male because it was easier to get responses from the male than the female). About 20 % of respondents was amongst the ages of 15 and 25, 26 % was amongst the ages of 25 and 40, 35% percent was amongst the ages of 40 and 60 and 19% of respondents was more than age of 60 as shown in Figure 2.

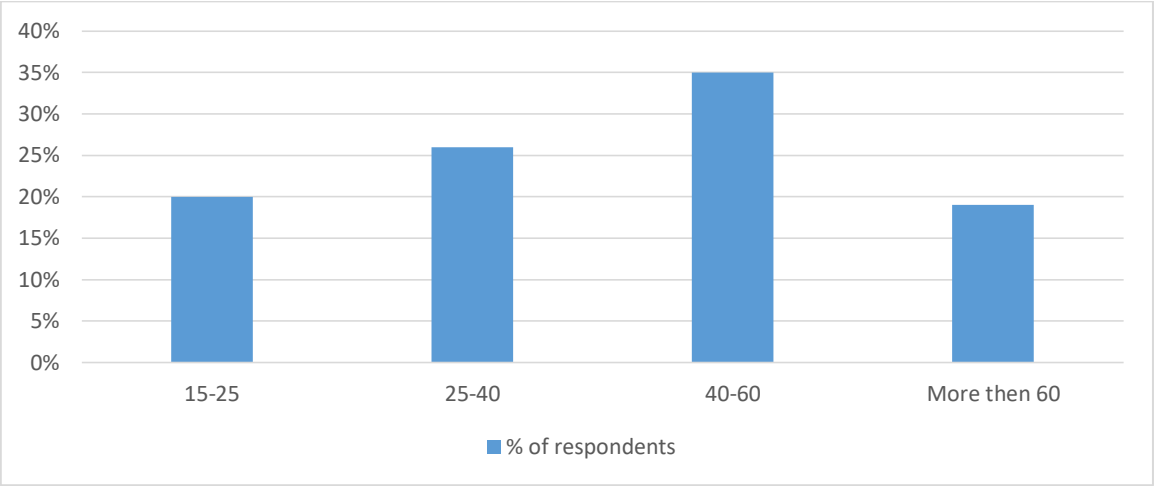


**Figure 2: Illustrating the Age Group of Respondents Participated in this Research**

Table 3 show that 12% workers have injured between age group 15 -25, 33% of workers were injured between the age group 25-40, 16% of workers were injured between the age group 25-60 and 39% workers have injured between more than 60 years.

**Table 3: Illustrating the Employees Who Have Been Hurt are Distributed According to Their Age Groups.**

| Age group | Injured people | Percentage |
|---|---|---|
| 15- 25 | 12 | 12% |
| 25-40 | 33 | 33% |
| 40-60 | 16 | 16% |
| More than 60 | 39 | 39% |

*3.5. Data analysis:*

Figure 3 show that 17% of workers have injury in their hands, 7 % in their feet, 10% in their arm, 8% in their eye, 20% in their face, 5% in their knee, 7% in their shoulder, 8% in their throat and 18% in their head.


**Figure 3: Illustrating the distribution of injured workers with body parts.**

## 4. RESULTS AND DISCUSSION

Table 4 shows that the first and third shifts had the maximum (52%) and minimum (13%) injuries workers respectively, while the second shift had the rest (35%) of injured workers.

**Table 4: Illustrating the distribution of injured workers by time occurrence**

| Shifts | Shift Unit | Injured workers | Percentage of injured workers |
|---|---|---|---|
| 1 shift | 1st | 5 | 5% |
| | 2nd | 15 | 15% |
| | 3rd | 25 | 25% |
| | 4th | 7 | 7% |
| 2 shift | 1st | 6 | 6% |
| | 2nd | 17 | 17% |
| | 3rd | 7 | 7% |
| | 4th | 5 | 5% |

| | | | |
|---|---|---|---|
| 3 shift | 1st | 3 | 3% |
| | 2nd | 3 | 3% |
| | 3rd | 2 | 2% |
| | 4th | 5 | 5% |

**Table 5: Illustrating the harmed workers' redistribution with qualification**

| Skills | Injured workers | Percentage |
|---|---|---|
| Master technician | 19 | 19% |
| Highly skilled | 14 | 14% |
| Skilled | 18 | 18% |
| Semi-skilled | 23 | 23% |
| Unskilled | 26 | 26% |

Table 5 show that 74 % of injured workers are skilled among 19% are master technician, 14% are highly skilled, 18% are skilled and 23% are semi-skilled. The remaining 26% of injured workers are unskilled**.** Table 6 show that 20 % of workers have injured due to pump agents of accidents, 13% of workers have injured due to lifting and carrying agent of accidents, 10% of workers have injured due to vehicles agent of accidents, 9% of workers have injured due to pipelines agent of accidents, 8% of workers have injured due to valve agent of accidents, 6% of workers have injured due to grinding agent of accidents, 6% injured workers have injured due to handling chemical agent of accidents, 5% of workers have injured due to welding agent of accidents, 4% of workers have injured due to slipping agent of accidents, 7% of workers have injured due to conveyor agent of accidents, 5% of workers have injured due to blower agent of accidents and 7% of workers have injured due to other types of gents of accidents.

**Table 6: Illustrating the Workers who have been wounded are distributed with the help of an accident consultant**

| Agents of accidents | Injured workers | Percentage |
|---|---|---|
| Pump | 20 | 20% |
| lifting and Carrying | 13 | 13% |
| Vehicles | 10 | 10% |
| Pipelines | 9 | 9% |
| Valve | 8 | 8% |
| Other | 7 | 7% |
| Grinding | 6 | 6% |
| Handling chemical | 6 | 6% |
| Welding | 5 | 5% |
| Slipping | 4 | 4% |
| Conveyor | 7 | 7% |
| Blower | 5 | 5% |

Table 7 shows that mechanical and chemical dangers accounted for 70% and 26% of total injuries, respectively, whereas electrical hazards accounted for just 4% of total injuries.

**Table 7: Illustrating the delivery of injured employees by types of hazards**

| Hazards | Injured workers | Percentage |
|---|---|---|
| Mechanical | 70 | 70% |

| | | |
|---|---|---|
| Chemical | 26 | 26% |
| Electrical | 4 | 4% |

Table 8 show that 28 workers have injury in their feet due to different types of agent of accident, 30 workers have injury in their hand due to different types of agent of accidents, 13 workers have injury in their eye due to different types of agents of accidents, 11 workers have injury in their arm due to different types of agent of accidents, 10 workers have injury in their head due to different types of agents of accidents and 5 workers have injury in their face due to different types of agent of accidents.

**Table 8: Illustrating the delivery of injured employees by agents of accidents and injured body pars**

| Agent of accident | Feet | Hand | Eye | Arm | Head | Face |
|---|---|---|---|---|---|---|
| Pump | 6 | 10 | 2 | 3 | - | 1 |
| Carrying and lifting | 5 | 5 | 3 | 1 | - | - |
| Vehicles | 3 | 4 | - | 4 | 2 | - |
| Pipelines | 2 | - | 4 | 1 | 3 | 1 |
| Valve | 3 | - | 2 | 1 | - | 3 |
| Grinding | 2 | 5 | - | - | - | - |
| Handling chemical | 2 | 4 | - | - | - | - |
| Welding | - | - | 2 | - | 2 | - |
| Slipping | - | - | - | - | 3 | - |
| Conveyor | 3 | - | - | - | | - |
| Blower | 2 | 2 | - | - | - | - |
| Other | - | 3 | - | 1 | - | - |

## 4. CONCLUSION

This research was carried out by taking into account several factors to provide a comprehensive image of occupational injury among employees and to improve the chemical industry's protection standards. Workers over the age of 40 were found to be more vulnerable to damage. The bulk of harm occurred in the 1st and 2nd shift units of each shift, indicating a strong link among the intensity of the collisions and the time they happened; the bulk of the wounded folks was master techs, strongly skillful and unskilled employees; the bulk of the incidents was caused by pumps, Carrying and lifting, vehicles, pipelines, valve, and grinding. It's also worth noting that a lack of personal protective equipment (PPE), improperly maintained PPE, pain while wearing PPE, and overconfidence was shown to be the leading causes of harm. However, preventative activities indicated should be executed and managed carefully and genuinely to keep employees protective and sound bodily and economically, as well as to avoid loss of making time resulting in losses to workers.

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