

Occupational Hazards in the Chemical Industry: Scoping the Relevance for Prevention of Health Hazards

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Abstract

Occupational illnesses and hazards are still mostly unexplored topics in global literature. A subcategory of occupational hazards called “chemical hazards” involves a range of chemicals. Chemical exposure at work can have negative short-term or long-term impacts on health. The majority of sites include a variety of chemical substances in gaseous, liquid, or solid form. These toxins can enter an unprotected body through being ingested, absorbed through the skin, inhaled, injected, or punctured. The primary duty of anyone managing a business or undertaking, according to the Work Health and Safety Act, is to ensure that work being done as part of managing the business or undertaking does not risk the health and safety of employees and other people. The exposure of workers to risks at work must be kept to a minimum to safeguard them. The hierarchy of controls can be used to decide which actions will best reduce exposures. The hierarchy of controls consists of five tiers of measures taken to reduce or eliminate risks. According to general effectiveness, elimination, substitution, engineering controls, administrative controls, and personal protective equipment are the chosen order of action. Reducing worker exposures and the risk of disease or injury can be accomplished using this hierarchy. We learned from our review that India has a significant occupational health concern. It has a direct and indirect impact on the workers’ physical, physiological, and mental wellbeing. In addition, there is an issue with industrial workers’ lack of awareness of occupational dangers and preventative actions.

Keywords: Occupational hazards, Chemical industry, Prevention, Health

INTRODUCTION

It is time to discuss workplace health and safety in various industries in developing nations. The environment is put at danger and health hazards increase as new sectors grow, current industries diversify, and new technology is used. History has proven that protecting the community and the environment at the same rate as industrial progress is rare. The International Labor Organization (ILO) estimates that, each year, there are roughly 200,000 work-related fatalities worldwide. In addition,

a lot of employees suffer from sickness and accidents at work. In light of this, it is essential to maintain ongoing vigilance through an occupational health program to offer a scientific foundation for decisions aimed at protecting human health from the negative effects of exposure in the workplace.^[1]

In emerging nations, there are more workplace illnesses and accidents. Over 120 million workplace accidents are thought to occur annually, with over 200,000 of those deaths occurring in developing nations. According to the World Health Organization (WHO), lower worker capability and poor occupational health can cost a nation between 10% and 20% of its GNP. Globally, it is estimated that occupational diseases, illnesses, and deaths cost the economy 4% of its total output. According to the ILO, approximately 2.3 million deaths occur annually as a result of work-related diseases, and 6300 people die every day as a result of occupational accidents.^[2]

One of the most affected industries by occupational hazards is chemical industry. As chemicals are now an essential

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component of daily life for humans, supporting activities and development, preventing and treating a wide range of ailments, and boosting agricultural productivity. Despite their advantages, chemicals have the potential to harm both the environment and human health, especially when employed improperly. The likelihood of negative impacts grows as drugs are used widely over the world. Both in developed and developing nations, the chemical industry, are expected to grow. In this context, it is acknowledged that one of the highest objectives in achieving the principles of sustainable development is the assessment and control of hazards from exposure to chemicals.^[3]

Along with the chemical hazards, there are other types of hazards present such as biological hazards (biohazards), psychosocial hazards, and physical hazards (Figure 1).^[4]

EXPOSURE OF CHEMICALS: ASPECTS REGARDING HEALTH EFFECTS

Exposure is something in contact. No matter how dangerous a substance or activity, without exposure, it cannot harm you. A “chemical exposure” is the measurement of both the amount of, and the frequency with which, a substance comes into contact with a person or the environment. The exposure of chemical and pollutants occurred through three ways such as inhaling (breathing in), absorption (skin and eye contact), and ingesting (eating or drinking).

While inhaling or breathe in contaminants and chemicals, we are exposed to them (breathe in). Over 20,000 breaths are taken daily by us. For infants and young children, this figure may be considerably higher. Lungs and blood stream may become exposed to the toxins and contaminants when breathe in. Sometimes, but not always, we can smell or taste

dangerous chemicals. Some substances, such as radon or carbon monoxide, have no smell, no taste, and are invisible.

Another way of exposure is absorption (skin and eye contact). Chemicals and pollutants can enter your body through your skin and eyes, by exposing them. As eye and skin may respond more quickly than the rest of body to toxins and are more chemically sensitive. One more way of exposure is ingesting. When we eat and drink, we are exposed to toxins and contaminants. Both the food we eat and the water we drink include chemicals and contaminants.^[5]

HAZARDOUS CHEMICALS: ASPECT OF PREVENTION, HEALTH, AND SAFETY MANAGEMENT

According to the WHS (Work Health and Safety) act, it is the primary responsibility of anyone running a business or undertaking to make sure that work being done as part of running the business or undertaking does not endanger the health and safety of workers and other people. This includes making sure that substances are used, handled, and stored safely. A person running a business or enterprise has special responsibilities under the WHS rules for managing the health and safety risks related to using, handling, producing, and storing hazardous substances at a workplace. The duties include correct labeling of containers, pipework, using warning placards and outer warning placards, and displaying of safety signs.

Hazardous chemicals may be created as waste or a by-product of some activities. When created at work, these dangers, such diesel exhaust fume from truck engines or hydrogen sulfide in a sewer, may be difficult to detect. A safety data sheets might provide information on by-products, but not usually. Off-gassing of solvent vapors from glues used to create timber products such as medium density fiber, dusts released from machining timbers, and the usage of welding rods may emit toxic fumes and vapors. Grinding metals may also release toxic metal dust or fumes.^[6]

Preventive measures for health and safety management of hazardous chemicals are as follows:

- Solvents used in chemical analysis, purification of synthetic product, and extraction should be handled carefully.
- Explosive and flammable substances need to be maintained at a safe distance.
- Toxic chemical tolerance standards established by federal regulation must be obeyed.
- Appropriate labeling of the substances for safe handling.
- Personal protective cloth.
- Cream application before to starting work.
- Putting on safety glasses.

HAZARDOUS CHEMICAL: ASPECT OF SAFETY MEASURES

Following safety measures should be followed before handling of hazardous chemicals;

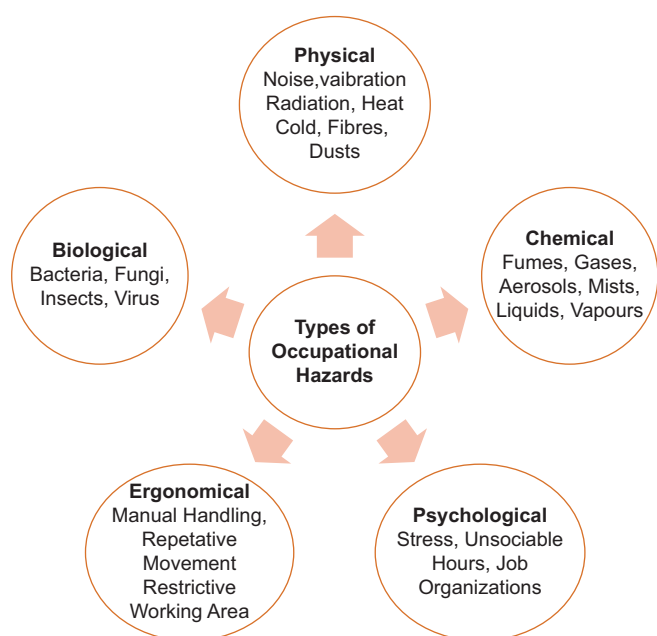


Figure 1: Various types of hazards

- A “chemical hazard pocket guide” should be consulted before beginning work with a chemical to obtain the necessary knowledge about the chemical. The type of reaction the chemical may have, its flammability, carcinogenicity, preventative, treatment options, etc., will all be provided.
- Avoid consuming food, beverages, or tobacco near chemical facilities.
- Protective garments should be worn to cover exposed skin.
- Clothes should be taken off as soon as they become damp or chemically polluted.
- After an accident, wipe eyes or skin thoroughly with water.
- Gases or poisonous dust may warrant the usage of a face mask.
- Employees who handle products containing antibiotics need to be changed frequently to prevent prolonged exposure to a particular drug.
- When a worker develops a dust allergy or respiratory condition, they should be taken out of the office and given the appropriate medical attention very away.
- In the event of a solvent or flammable gas leak, exhaust fans should be turned on and all fire sources should be put out.^[7]

To protect workers, it is crucial to limit their exposure to risks at work. For limiting exposure, hierarchy of controls is suitable for finding out best way to control exposure. Five tiers of activities to lessen or eliminate dangers make up the hierarchy of controls. The preferred order of action based on general effectiveness is elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE). Using this hierarchy can lower worker exposures and reduce risk of illness or injury (Figure 2).

The controls that result in the elimination of the dangerous chemical are the most trustworthy and effective ones. The next control of preference is the substitution of a dangerous chemical for a less dangerous one, but care must be made to ensure that the substituted chemical does not introduce new risks. In addition, substitution might entail applying the

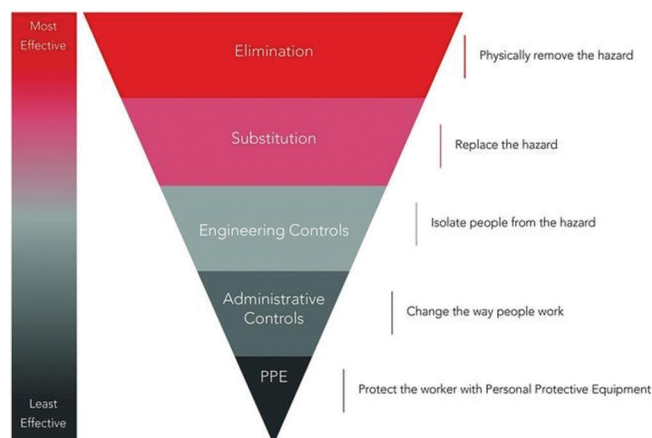


Figure 2: Hierarchy of control for preventing occupational hazards

substance through a less dangerous procedure or form (e.g., use of the chemical in a pellet form rather than a dust). Controlling a chemical by isolating it from those who might be exposed in time or space can be useful (e.g., locating people in a protected control room, installing a buffer area around a chemical reactor, using the material when people are not in the vicinity). Usually, engineering measures decrease exposure at the source (e.g., by enclosing the process in vessels or pipes, or by local exhaust ventilation). It is crucial to prevent uncontrolled releases; this can be done by employing tactics such as quantity reduction and segregation. Administrative controls are typically necessary to support higher-level controls. Maintenance of the equipment and instruction in its use for employees and their managers are two examples of administrative controls. To avoid uncontrolled emissions, preventative maintenance is essential. To ensure that engineering controls operate as intended, work procedures, including any safe-handling guidelines and particular storage instructions, may need to be devised.^[8]

Workers may be required to wear PPE to reduce exposure to chemicals by inhalation, skin or eye contact, or any residual danger. It could be necessary to have specialized expertise to choose the right PPE for a given chemical. It is necessary to consult chemical resistance charts or databases while choosing gloves for chemical protection, as well as to take into account the possibility of chemical permeation, penetration, and PPE degradation. Chemically resistant safety footwear may be necessary in specific circumstances. Chemical exposure can result from improperly used or poorly maintained PPE (e.g., contaminated gloves can be a source of ongoing exposure through persistent permeation or occlusion of the chemical inside the gloves). Even though it would be reasonable to assume that technical controls such as enclosures or other measures would limit the risk associated with jobs like decanting chemicals, some chemical handling tasks might still necessitate the use of eye protection. This could be full facial protection or safety goggles, depending on the task. There are numerous types of PPE available for respiratory protection. Although Australian standards offer guidance on the proper selection of respirators, its interpretation and the choice of the best respiratory protection necessitate specialized knowledge. Fitting, upkeep, and user education are crucial for all types of PPE, but respiratory protection in particular.^[9]

OCCUPATIONAL HAZARDS: ASPECT OF INDUSTRIAL SAFETY SYSTEM MEASURES

Any hazardous plants, including nuclear power plants and oil and gas production facilities, must have an industrial safety system as a preventative measure. In the event that the process exceeds the control margins, they are employed to protect people, plants, and the environment. Process control systems, safety shutdown systems, and fire and gas systems are three examples of safety systems.

These systems do not actually regulate any processes; rather, they only come into action when conventional methods of

process control are ineffective. They are primarily implemented as a safety precaution, but they are increasingly becoming necessary in every workplace. They are set up to monitor the manufacturing environment and electronically manage the manufacturing process. For the purpose of detecting liquid or gas in the surroundings, a laser diode is employed. If the gas or liquid is found, its specific frequency signature is translated into a digital signal, in which the CPU then uses to identify the signal. Because they immediately shutdown a system to a safe state once they detect a hazard, these systems are very useful in an emergency situation. To create a more secure working environment, they can be connected to the fire and gas systems. These systems are extremely perceptive and clever. They detect the spill of an ignitable gas, substance, or liquid early on. In addition, they identify threats through the detection of fire in the workplace and by providing auditory and visual indications. These systems can be turned on manually or automatically. There are other systems that are commonly utilized in the industrial business, such as pressure safety valves and emergency shutdown systems.^[10]

OCCUPATIONAL HAZARDS: ASPECT OF CURRENT SCENARIO IN INDIA

According to study held in India regarding state of occupational health its challenges and possibilities for the future over viewed that there are a huge variety and number of employment available in India. As a result, OHS does not require a formalized policy structure. In addition, there is no formal regulating body, competency-based training, or specialized registration. In both the public and private sectors, occupational safety is often ignored, with a few notable exceptions. Occupational research is still underutilized in spite of rising demands for items like child labor, a significant informal sector, industrial hygiene, and OH surveillance. Increasing OSH awareness through strategic partnerships is essential. The need for best OHS practices, integrated research, and efficient resource allocation should be addressed through activism and lobbying. It is critically necessary to establish a national task force and a central regulatory body.^[11]

An additional investigation into the occupational health characteristics of Indian industrial workers asserts that there are an estimated 115 million individuals employed in the industrial sector, even though the Labor Bureau only counts the one-tenth of persons who work in factories that are formally registered with the government. Reports often do not mention the human capital used, their standard of living, or the occupational health-care provided. Occupational hazards such as high blood pressure, stress, cancer, diabetes, liver disease, TB, and eye/hearing problems have reportedly been reported. No research on the manufacture of glass, tobacco, computers, or associated products could be found. Although the number of accidents is decreasing, more people are dying in accidents. Occupational health is governed by a number of laws, but the bulk of them are out of date and have not been appropriately

updated to reflect the realities of today. There is a lack of personnel as well as occupational health statistics for dealing with surveillance, prevention, and regulation in this industry. There is an urgent need for a modern occupational health law and a robust enforcement mechanism, ideally through intersectoral collaboration between the Employees' State Insurance Corporation, corporations, and state governments. Occupational health should be a part of general healthcare.^[12]

To determine prevalence and trends of industrial injuries, researcher conducted a study on welders in the coastal south of India in 2014. The bulk of participants (160, 76.6%) was between the ages of 20 and 40 and had merely completed the 10th grade (181, 86.6%); therefore, they were able to find results. 10.74 injuries per 100,000 people were reported in the prior year (SD: 5.74). Every single one of them had more than two wounds, and 42% (or 92) of them had more than ten. More than three-quarters of them also had lacerations, contusions, flash burns, and foreign objects in their eyes. In addition to having cuts, they all had other injuries. Multiple logistic regression analysis found that characteristics such as age under 30 (OR = 5.19), tobacco use (OR = 2.56), alcohol use (OR = 3.96), and institutional training (OR = 0.10) were associated with more than ten injuries among welders. In this area, welder injuries are a serious health concern. By putting policies into place to enhance institutional training for younger age groups, it might be able to reduce the burden of injuries.^[13]

From above reviews, we came to know that occupational health problem in India is quite high. It directly indirectly affects on physical, physiological, and psychological health of workers.

OCCUPATIONAL HAZARDS: ASPECT OF RISK OVERVIEW

According to study held in Sri Lanka regarding Workplace dangers in medium- and large-scale industries for creating lesson for developing countries. States that physical risks found in the workspaces of the 69 units in the 25 factories included: excessive noise (78.3%), insufficient lighting (58%), increased temperature (65.2%), and poor ventilation (68.1%). About 33% of medium-sized machinery and more than 50% of large machinery lacked sufficient guards. Nearly 41% of the machinery was challenging to operate, and of that, 36.2% had controls that were challenging to reach. Only 34.8% of the safety measures adopted had adequate area demarcation, and 28.9% had safety signs displayed. <40% of households lacked secure storage for raw materials and finished goods, while 59.4% had poor housekeeping.^[14]

A case study of workers in a refinery was used to evaluate the occupational health risks faced by 85 employees in oil sector. states that The majority of responders were between the ages of 31 and 40, and about 31% worked shift duty. Males made up the majority of respondents (82.4%), followed by married people (64.7%) and those who had finished tertiary education (81.2%). The majority of survey participants were able to name the following health risks: Physical health risk (74.2%), chemical health risk (70.9%), and mechanical/ergonomics

health risk (78.8%), but knowledge of psychosocial health risk (48.3%) and biological health risk (9.6%) was low, especially for the latter. Most respondents (78.1%) who participated in the evaluation of occupational health practices believed that management is dedicated to the health and welfare of its employees. The first three health hazards mentioned above as well as the biological health hazard were shown to be common in the refinery through environmental monitoring. However, there are many factors that affect a worker's vulnerability to work-related illnesses, and it typically takes some time before symptoms of these illnesses and diseases manifest on the individual worker. To help the management of an oil and gas refinery safeguard, advance, and restore the health and wellbeing of their employees, the Health Effect Management Process, one of the components of the Occupational Health and Safety Management System (OHS-MS), is advised.^[15]

Research held on occupational health in India. India, a developing country, struggles with common public health issues such communicable diseases, malnutrition, inadequate sanitization of the environment, and inadequate medical care. However, in the recent years, challenges relating to occupational health have emerged as a result of globalization and rapid industrial growth. About 58% of people in India are employed in agriculture, which is the country's primary industry. In India, silicosis, musculoskeletal injuries, coal miners' pneumoconiosis, chronic obstructive pulmonary illnesses, asbestosis, byssinosis, pesticide poisoning, and noise-induced hearing loss are the main occupational diseases/morbidity of concern. Researchable issues like asbestos and diseases associated with it, pesticide poisoning, diseases associated with silica other than silicosis, and musculoskeletal disorders are being worked on by a number of organizations, including the National Institute of Occupational Health, the Industrial Toxicology Research Center, and the Central Labor Institute. There is still more work to be done to advance the field of occupational health research. It is necessary to take actions such as building cutting-edge research facilities, developing human resources, establishing environmental and occupational health cells, and developing database and information systems.^[16]

From all the above reviews, it is clear that there is high health related risk in industrial workers.

OCCUPATIONAL HAZARDS: ASPECT OF SAFETY AWARENESS MEASURES

Study held on Workers in Italian research laboratories for to determine the aware of, perceive, and practice chemical risk and safety. Result stated that 237 participants were enrolled, yielding an 81.7% response rate. In the laboratories surveyed, more than 90 dangerous chemical compounds were present. Younger researchers, those handling a greater number of hazardous chemicals, and those with more years of training in the observed laboratory had considerably higher odds of having accurate understanding of hazardous chemicals;

54.4% of the employees reported feeling extremely exposed to chemical risk. Researchers who agreed with the statement that colleagues handle chemicals according to safety procedures and who perceived to have received adequate training in the management of accidents and first aid had significantly higher odds of using correct practices in the laboratories than researchers who perceived to have a low exposure to chemicals but a high exposure to biological risk. Our findings demonstrated serious knowledge gaps and a lack of readiness in the use of safety procedures to prevent and limit dangers associated with the use of hazardous substances in research laboratories.^[17]

According to study held in Ethiopia regarding welders' awareness of workplace dangers and use of safety precautions. states that he majority of study subjects used PPE, and nearly half of respondents were aware of occupational hazards. The common element to promote knowledge and personal protective usage practicing behaviors was safety and health training. Employers and other accountable parties should support training, and regular supervision should be made with an emphasis on the security and wellbeing of employees.^[18]

The chemical risks and safety oversight in the pharmaceutical sector study discusses industrial chemicals, how their toxicity is determined, and how such determinations are used to inform regulatory decisions. It begins with general points about the availability of toxicological data and hazard identification, then moves on to risk assessment and occupational exposure limits, and finally looks briefly at three specific toxicological issues, asthma, chronic toxic encephalopathy, and "low toxicity" dust effects on the lung, where the science is far from resolved. At hazardous waste sites, preventing exposure to dangerous substances is of utmost importance. In their solid, liquid, or gaseous forms, a range of chemical compounds can be found at most sites. These compounds have the potential to enter an unprotected body by eating, skin absorption, inhalation, or puncture wounds (injection). The significance of collaborating with a variety of OHS specialists is emphasized to ensure that a variety of talents are directed at preventing mortality, damage, disease, and poor health resulting from this intricate area of OHS.^[19]

All the above reviews show that there is a lack of knowledge as well as awareness regarding safety measures for occupational hazards in industrial workers.

CONCLUSION

Chemical exposure can have physical, physiological, or psychological consequences on health. We came to the conclusion that industrial workers do not comprehend chemical hazards and how to avoid them based on the studies cited above. To solve this issue, industries might put in place occupational training programs that instruct staff workers on all safety measures that may be implemented to avoid hazards.

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