

# Need for Risk Management and Regular Occupational Health Safety Assessment Among Workers of Developing Countries

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## Abstract

Occupational health is a sensitive area in many developing countries where occupational exposure needs attention due to lack of awareness among industrialists as well as workers. Industries such as iron, textile, leather, and paper use a vast number of toxic chemicals during different industrial processes. Workers of these industries come in direct contact with these chemicals including dyes, solvents, and finishers, which are known to be mutagenic and genotoxic. In the absence of risk assessment programs, these chemicals pose serious health risks. Risk management is one of the key factors in health safety of the workers. Agencies of central, state, and local levels need to work harder in the field of occupational health and safety. These agencies should develop relevant risk assessment programs to minimize the exposure health impacts. In the present article, various exposure risks to workers of different industries including iron, textile, leather, and paper industry along with levels of risk management system and the need for regular health assessment programs have been discussed to put them into real practice.

**Keywords:** Hazardous chemicals, health and safety, iron industry, occupational health, paper industry, risk management, textile industry

## INTRODUCTION

In developing countries, the empowerment of occupational health safety departments is the need of the hour. In many developing countries, more than half of the workers are employed in the informal sector with no social protection for seeking health care and lack of regulatory enforcement of occupational health and safety standards.<sup>[1]</sup> This is an indication that health and safety is lacking somewhere and needs to be given importance. Poor occupational setups may lead to severe health hazards among industrial workers. According to the WHO report, certain occupational risks, such as injuries, noise, carcinogenic agents, airborne particles, and ergonomic risks account for a substantial part of the burden of chronic diseases: 37% of all cases of back pain, 16% of hearing loss, 13% of chronic obstructive pulmonary disease, 11% of asthma, 8% of injuries, 9% of lung cancer, 2% of leukemia, and 8% of depression.<sup>[1]</sup> Thus, there is a dire need to formulate prevention and conservative steps that can be taken to improve worker's health and safety measures in day-to-day life.

One of the culprits of all this hustle is the lack of occupational safety and health infrastructure. Health risk management involves practical steps that protect workers from harm and

at the same time protect the future success and the growth of business. Health and safety management should be the first and foremost part of workplace management. Good practice in health and safety makes sound business sense. A poor working environment is still highly considered as the cause of significant death, disease, and disability among workers in developing countries like Malaysia, India, and Zimbabwe. In addition, the tremendous increase in the volume of industrial waste produced globally has pushed disease and death rates to a vast extent. In low- and middle-income countries, waste is often disposed in unregulated dumps or openly burned. These practices create serious health, safety, and environmental consequences.<sup>[2]</sup>

Central and state government agencies have a bigger role to play. These agencies should educate the workers about various health hazards posed by different toxic chemicals being used by industries. A series of regular health assessment programs should be organized to check the overall risk associated with

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the use of different hazardous chemicals. The present paper highlights various exposures to workers of the iron, textile, paper, and leather industries and emphasizes the need of continuous health checkup programs for the workers engaged in different industrial sectors in developing countries.

### WORKERS AND EXPOSURE

In developing countries, industrial workers are employed in various job categories. The iron industry is one of the highest employment generation sectors.<sup>[3]</sup> It employs thousands of workers generally as grinders, welders, cutters, and smelters.<sup>[4]</sup> These workers are continuously exposed to a low dose of harmful chemicals and metals, which they take in through different routes of daily exposure depending on the working conditions.<sup>[5]</sup> It has been seen that workers in developing countries are exposed to a high level of suspended air metals formed as a result of welding due to lack of proper protection equipment. Different hazards to the workers employed in the iron industries are shown in Figure 1. Workers who are operating blast furnaces, coke ovens, and smelting plants are continuously exposed to a great amount of heat, dust, and gases.<sup>[6]</sup>

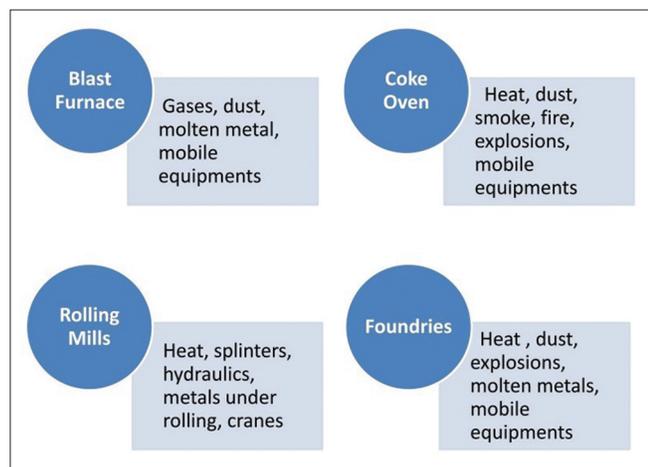
Similarly, in textile industries, the workers are exposed to number of dyes, solvents, finishing chemicals, and fiber dusts. Many reports have pointed out occupational hazards to workers under different job categories in textile industries.<sup>[7]</sup> Workers in the dyeing sector are using a variety of dyes including direct, disperse, sulfur, mordant, vat, azo, aniline, and anthraquinone dyes. Dyes differ in their affinity for different types of fibers and are available in different forms including powders, pastes, liquids, and granules. Various chemicals are also used to stabilize the dyes on to the fabric. Solvent dyes have low polarity and do not undergo ionization and thus are insoluble in water. For these dyes, the textile industry also uses different solvents of different nature. Solvents can be chlorinated hydrocarbons of aliphatic series, which have specific advantages including

high wettability, fast dyeing, better dye yield, and less dyeing time. Thus, workers are exposed to a set of mixed dyes and solvents and are at a high risk to develop different health problems.<sup>[8,9]</sup>

The paper industry is also using a variety of chemicals of varied nature. Chlorine and chlorine dioxide are mainly used as bleaching agents in the paper industry.<sup>[10]</sup> Chlorine is known to be highly toxic.<sup>[11,12]</sup> It is also responsible for irritation of the mucous membranes of nose, throat, and lungs. High exposures may also lead to pneumonia.<sup>[13,14]</sup> Table 1 lists the different chemicals used in the paper industry. Exposure to epichlorohydrin, an organochlorine compound, in the paper industry may cause irritation to the eyes and skin of workers. Long duration of exposure to these chemicals may result in severe health problems. Similarly, workers in the leather industry are exposed to different types of acids and bases, sulfides, solvents, and finishing chemicals [Table 1]. The most hazardous exposure is to chromium in the tanning process. Chromium has been linked to increased rates of asthma,<sup>[15,16]</sup> bronchitis, pharyngitis, and enlargement of lymph nodes.<sup>[17]</sup> Likewise, there are a number of industries including the mining industry, coal sector, ore extraction sector, pesticide factories, chemical industries, construction sector, agriculture, pharmaceuticals, petroleum, tobacco, automotive industry, etc., where the workers need to be regularly checked for exposures and health.

### THE LACUNA: LACK IN THE IMPLEMENTATION OF POLICIES

In fast and rapidly developing countries like India, diseases related to mining workers have been reported.<sup>[18]</sup> In the mining sector, the notified diseases include silicosis, pneumoconiosis, manganese poisoning, asbestosis, mesotheliomas, hearing loss, contact dermatitis, and pathological manifestations due to radioactive substance exposure.<sup>[18]</sup> India is also one of the founding members of the International Labour Organization, which has so far adopted various recommendations on occupational safety and health of the workers. But in the same report, it was pointedly mentioned that the Internal Safety Organization, a critical link between the corporate level and operators' level, has failed to live up to the expectations.



**Figure 1:** Exposures and hazards to workers employed in different job categories in iron industries

**Table 1:** List of the major chemicals used in the paper and leather industry

Paper industry	Leather industry
Dyes	Chromium
Epichlorohydrin	Formaldehyde
Urea formaldehyde	Coal-tar derivatives
Titanium dioxide	Finishing chemicals
Optical brighteners	Dyes
Alkyl ketene dimers	Solvents
Chlorine	Acids and bases
Chlorine dioxide	Sulfides

There is a strong need for implementing the policies already framed by different occupational safety agencies for different occupations. In light of the above facts, workers in different industries exposed to a number of hazardous chemicals and physical factors are at a high risk of health hazards. Workers have to come in contact with particular chemicals, knowingly or unknowingly, during different industrial processes. Thus, regular health assessments are an important method to assess the health risk posed by different chemical exposures. If any risk is found, workers should be educated about it or the working method should be improved. Theoretically, the introduction of a hazard identification, risk assessment, and risk control program has increasingly become a fundamental practice not only among governments and health professionals but also among many organizations and the public, aiming to raise awareness of health promotion issues related to waste management. The following discussions shall focus mainly on the hierarchy of risk control and how it has been actively approached as a preventive measure to encourage safer work practices.

The representation of the hierarchy has six levels of control measures consisting of elimination, substitution, isolation, engineering, administration, and personal protective equipment (PPE). Figure 2 allocates the level of these controls in the form of hierarchy pyramid or hierarchy of control.<sup>[19]</sup>

Ideally, the most effective measure is always at the top of the hierarchy pyramid (elimination) and the least effective measure is always at the bottom (PPE).<sup>[20]</sup> Thus, many individuals, organizations, and governments will tend to strictly follow the structure to create an inherently safer working environment where the risks of injuries and accidents are substantially reduced.<sup>[21]</sup>

## PROCESS OF IMPLEMENTING GOOD MEASURES IN MANAGING RISK FOR INDUSTRIAL MANAGEMENT

### Elimination

Elimination simply means to get rid of the hazard completely. Hazard elimination is certainly the most effective measure of removing hazards among all the controls in the hierarchy pyramid because the risk value reaches zero.<sup>[22]</sup> The elimination method works in many ways. One of the simplest elimination

control methods is to remove the machine with a substantial risk magnitude. A consistent inspection on machines to prevent malfunctioning and damage to workers should be done. If the repair and maintenance turns out to be very costly over a long-term period, then eliminating the machine is recommended.<sup>[23]</sup>

However, Nix<sup>[22]</sup> pointed out that the elimination method could not possibly solve every issue occurring 100% effectively due to several setbacks that might reintroduce the hazards. In other words, it has failure modes and the outcome might not be as expected. For instance, the method can be difficult to implement and can be time-consuming, thus it may not work smoothly. Hence, if this method seems unreliable and tedious, the employers can proceed to the next alternatives available.

### Substitution

The substitution method refers to performing the same task in a less hazardous way. Using the substitution method, hazards can be restricted to a certain limit by replacing hazardous material or process with a safer material or process while achieving the same result. Substitution also includes replacing the hazardous chemical with a less hazardous chemical. For instance, solid waste workers may be exposed to cleaning solutions that contain toxic chemicals, which can cause nausea and allergic reactions.<sup>[24]</sup> Therefore, it can be minimized by substituting with a less toxic chemical, like replacing harmful pesticides with a more natural pesticide like pyrethrins.<sup>[25]</sup>

However, industries should be aware that the substitution method possesses similar consequences as the elimination method or even worse. If there is a threat that the substitution of materials or substances could lead to a reintroduction of hazards that can affect others beside the workers, including the society, a conscientious consideration must be made by the management before using this method to avoid negative outcomes.<sup>[22]</sup>

### Isolation

Isolation involves separating the hazard or hazardous work practice from employees and their work areas. Isolation can be done through putting up barriers or by relocating either the hazardous work practice or the employees and their work practices altogether.<sup>[24]</sup> One example of isolation is to provide a contaminant-free insulated room around the equipment or around the employee workstations.<sup>[25]</sup> The workplace must also be equipped with extra protections for workers while on duty, for instance, providing the room with proper ventilation, right amount of light bulbs, ceiling fans to keep the room temperature in control, and even water pipes to clean the room. Another example is to reduce the risk of excessive noise emanating from machinery by enclosing it in an isolated place, thus creating an isolating barrier between the noise and the workers.<sup>[24]</sup> This type of preventive measure, such as barriers and isolation of hazards, will have no effect unless they are implemented correctly from the beginning and are consistently supervised. If supervised correctly, the isolation method could become a reliable and effective risk-control method.

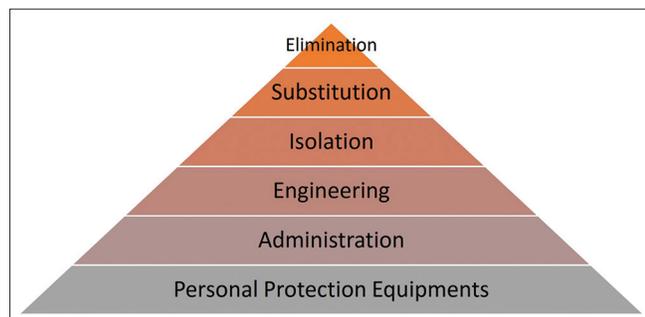


Figure 2: Hierarchy of control. Adapted from.<sup>[19]</sup>

## Engineering

Engineering control refers to designing and/or adding physical safety features to the plant, equipment, and even the process itself to minimize the hazard. Engineering control can take up numerous forms. One precise example is to change how a job activity is performed to reduce the hazard, that is, to introduce a safer process. This includes equipping the workers with automated equipment like better and more advanced machinery to handle the material, hence minimizing the risk of injuries and hazard exposure to the workers. In addition, waste management services can consider investing in an improved version of mechanical transportation to maximize workloads with minimum effort.<sup>[25]</sup> In this way, workers are motivated to perform their tasks more efficiently and effectively, which will eventually result in a more productive workplace with lower risks. Another part of engineering control is the provision of awareness devices, which are often classified as information for use. They serve as warnings for workers to take precautions while performing their work, for instance, warning lights, horns, or even warnings through signboards or posters.<sup>[22]</sup>

Engineering controls possess both advantages and setbacks. Normally, they are more favored over the other measures such as administrative and PPE controls because they are designed to remove the hazard immediately before it comes to contact with the workers. Well-designed engineering controls can be very costly to implement at the initial stage, but over a longer period of time, this measure can save operating costs to an extraordinary level, and in some instances, it can substantially lead to cost savings in other areas of the process as well.<sup>[21]</sup> On the other hand, if this measure is wrongly applied and if workers are not properly trained to adapt to this method, then the workers' exposure level to the hazard can remain the same or increase.<sup>[22]</sup> Thus, employers have to consider all the factors involved carefully before deciding to use this method so that unnecessary failure modes can be avoided or at least controlled.

## Administration

Administrative control systems are generally established mainly to restrict the workers' exposures to occupational hazards by scheduling shorter and more effective or reliable work times in contaminated areas or by introducing safer working procedures. One example of a safe working procedure is to strictly follow standardized operating practices, such as different welding and foundry procedures, to perform mandatory regular inspections of the machines before use, and to make an immediate report to the authority if there are any technical problems found during inspections to reduce risk of accidents.<sup>[22]</sup> The development and implementation of safe work practices are extremely crucial and is the employer's responsibility. Employers should establish frequent checking of the workers to ensure that they obey these practices.<sup>[26]</sup> Likewise, employers can also attempt to redesign a new job process for the workers. For example, creating a new schedule or task delegation for workers to improve overall work safety is an integral part of good administrative control.

Employers can also attempt to enhance health education among workers through the provision of training regarding how to perform various industry-related processes and adopt safety measures. Specific recommendations and guidance can also be given to educate them on how to carry the procedures correctly.<sup>[27]</sup> Organizing talks and seminars relating to personal hygiene issues can be very helpful for workers as well. For example, workers can now be better informed on the importance of proper hygiene practices such as washing their hands with soap and clean water after exposure to dyes, solvents, and metals and before eating, drinking, or smoking. Rest areas must be separated from work areas to avoid overexposure of hazards to workers.<sup>[25]</sup> The frequency of workers' exposure to hazards can also be limited by introducing job rotations.<sup>[24]</sup> For instance, after proper guidance, employers can arrange working shifts under different job categories such as grinding, welding, and smelting so that each worker will not have to deal with the hazard frequently.

Nevertheless, administrative control measures can prove to be less effective as this type of control has little effect on the removal of hazards. It can only diminish the risks to a certain extent. Furthermore, administrative controls may be inexpensive to establish, but in the long term, it can be very costly to sustain. In conclusion, this method of protecting workers requires a significant effort, teamwork, and monitoring by all the affected parties if failures are to be avoided.<sup>[21]</sup>

## Personal protective equipment

This type of control involves supplying the workers with protective items, equipment, and even clothing such as gloves, face masks, goggles, work boots, respirators, iridescent vests, and bump caps or hard hats. PPE is regarded as an effective control measure and should be practiced because it directly reduces the hazard contact with the workers. It is also important for the employers to select the right type of PPE for workers to wear under different job categories and circumstances and provide training so that workers are well-informed on the proper usage of PPE. As PPE clearly acts as a supplementary protection and has limitations, extra care must be taken to ensure that the PPE is working properly so that it does not excessively endanger the workers' health.<sup>[26]</sup>

## SUMMARY

Based on the above discussion, the following suggestions can be implemented so as to improve the overall working structure of different industries.

### Switch to alternate nontoxic materials

The use of highly toxic chemicals needs to be checked in different industrial setups. Safer and environmental-friendly alternates should be formulated and used wherever possible.

### Use proper protection equipment

The workers should be provided and trained about the importance and use of protection equipment to reduce the

exposure of hazardous chemicals in different industrial processes.

### Conduct educational programs among workers

General education among the workers about their health and safety should be imparted by government agencies. These programs should include the ways and means against various health hazards faced by the workers in different industries.

### Collaborate with government agencies

The occupational agencies should work in collaboration with the different government agencies to ensure the safety and health of workers employed under various job categories in different industries. Industries on their own should follow proper safety and security programs for minimizing the exposure of workers to different sets of chemicals in their respective jobs.

### Improve working microenvironments

Working space should be improved to have proper light, area, and ventilation, keeping in mind the ergonomics. Postures of the workers should be checked for any physical anomaly. Overall noise levels in the working environment should be minimized.

### Refine working methods

Working methods under different job categories should be improved to minimize the physical and chemical burden on the workers.

### Maintain working equipment

Working equipment should be maintained at regular intervals. Oiling and greasing should be a regular feature for mobile equipment.

### Replace unsafe machinery

Old and worn-out machines should be replaced by modern safer and user-friendly machines. Regular machinery inspections should be done and defective parts should be replaced.

### Take appropriate emergency measures

Various emergency conditions such as fires and injuries should be handled with care. All industries should be provided with proper emergency equipment and training for their use.

### Awareness among industrialists

Industry owners should be educated and made aware about the health hazards associated with the chemicals being used in their industries. Safety and welfare of the workers engaged by them should be a high priority.

## CONCLUSION

In developing countries, occupational health safety is an area where different agencies have to work hard to minimize the risk posed to the workers engaged in different industries. Workers engaged in iron, textile, paper, leather, and mining industries are exposed to a variety of chemicals that are known to have deleterious effect on human health. Still, the workers are exposed to those chemicals due to either ignorance or

improper working conditions in their respective industrial setups. Workers should be educated about the health hazards posed by toxic chemicals they may be exposed to, and a series of regular health assessment programs should be organized annually by government agencies to check the overall risk associated with exposure to different hazardous chemicals. One recommended strategy for the government is to utilize the mass media, and even organize campaigns to promote health and safety awareness for industrial workers. Another strategy is for the industrial sector, both government-owned and private, to collaborate with other agencies to educate the workers, such as the insurance firms and hospitals. Organizing more voluntary programs by need to define NGO, such as free health screenings, physical examinations, vaccinations, and free medicine for the workers, is strongly suggested as well to enhance the overall workers' physical and mental state.

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### Conflicts of interest

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