**SOUND MANAGEMENT OF CHEMICALS**

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1. **INTRODUCTION**

Chemicals are the most critical agent of Nigeria’s industrial revolution. They are useful in manufacturing and economic development and occupy a pivotal role in many industrial sectors. Chemicals are utilized virtually everywhere, every workplace has the potential to expose employees to certain chemicals, such as paints, cleaning products, adhesives, etc. through a variety of routes, such as inhalation, skin contact, and oral route.

Over $4 trillion worth of chemicals are produced globally each year, and almost every industry uses them in some way, chemical output is growing at a rate of 3–4% yearly, with an increasing amount of this manufacturing taking place in developing nations. Despite their wide range of properties and uses, chemicals vary greatly in their properties, the quantities manufactured, and their use.

Some chemicals are produced in large quantities and are widely used in the production of other chemicals and consumer products. Some other products, such as pesticides and pharmaceuticals, are manufactured in much smaller quantities and are used for very specialized purposes.

A chemical's physical, chemical, and toxic properties vary greatly - some are not hazardous but are extremely persistent in the environment, travel long distances, and can harm human health and the environment even in small amounts. Chemicals of international concern include persistent organic pollutants, ozone depleting substances, and heavy metals such as mercury, lead and cadmium.

Chemical misuse, handling, and practices can result in serious risks, such as chemical disasters. Many countries have developed regulations regarding proper usage, storage, transportation, classification and labelling of hazards of chemical products and communication of health and safety information through safety data sheets due to the serious effects of chemical exposure on human health and environmental health.

Source: UNDP, Chemicals and Waste Management for Sustainable Development, April 2015

**HAZARD ASSOCIATED WITH CHEMICALS**

Any substance, regardless of its form, that has the potential to endanger people's health and well-being or cause environmental harm is considered a chemical hazard. It can also be defined as the real danger posed by a particular chemical, such as the skin burns, long-term health effects, long-lasting environmental harm, fires, or even explosions.

The Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) states that it's critical for employees to be aware of the risks and hazards related to their regular jobs. Recognition of hazards also lessens the possibility of coming into contact with dangerous chemicals and the harm they might cause. Physical hazards, health and Environmental hazards are the main categories of risks associated with chemicals.

**Health Hazard.**

Chronic or acute health impacts from chemical exposure are possible. There are numerous other categories of dangerous chemicals, such as neurotoxins, immunological agents, dermatologic agents, carcinogens, reproductive toxins, systemic toxins, asthmagens, pneumoconiotic agents, and sensitizers. In general, unless a chemical enters the body, you cannot be exposed to a health risk. There are four main routes of entry which includes:

1. **Absorption** – the chemical contacts the skin or eyes and causes immediate damage or is absorbed into the bloodstream
2. **Inhalation** – the chemical is breathed and enters the bloodstream through the lungs
3. **Ingestion** – the chemical is swallowed and enters the bloodstream through the gastro-intestinal track
4. **Injection** – the chemical enters a break in the skin from a new or previous injury.

**TYPES OF CHEMICAL HAZARD IN A WORKPLACE**

1. **Asphyxiants:** Chemical asphyxiants deprive the body of oxygen; interrupting the transfer and use of oxygen by the bloodstream. Asphyxiant Chemical Examples: Carbon monoxide and cyanide.
2. **Corrosives:** Chemical corrosives, when in direct contact with a material, modify the composition of that material in a way that is observable and/or irreversible. These similarly have the potential to trigger a localized response in the body at the site of contact. However, when combined with other substances, corrosive chemicals have the potential to cause systemic chemical exposure away from the point of contact. Examples of corrosive chemicals include sodium hydroxide and sulphuric acid.
3. **Irritants:** The eyes, skin, or respiratory system of a person can be harmed by chemical risks that are categorized as irritants. Irritants can be very, somewhat, or only slightly water soluble. Redness, rashes, inflammation, coughing, and haemorrhaging are just a few of the risks that can appear. Although irritants typically cause severe short-term diseases, some persons may experience long-lasting adverse effects. Some of these chemical substances can also cause allergic reactions in people, which can have fatal or long-lasting health effects. Nickel chloride and chromic acid are two examples of irritant-causing chemicals.
4. **Sensitizers:** When people are repeatedly exposed to particular substances over time, sensitizers—also known as allergens—cause an allergic reaction in them. Acute or chronic reactions to substances that are considered sensitizers can differ from person to person. When exposed to chemicals, the airways may swell or serious conditions like lung disease may occur. Overexposure to chemicals causes several diseases, like contact dermatitis and asthma, to grow widespread among humans. Chlorine and alkalis are two examples of allergen-causing chemicals.
5. **Carcinogens:** Chemicals that cause cancer are known as carcinogens, and even a small amount of a carcinogen can have a serious negative impact on human health. Such chemical chemicals' risks won't become apparent for many years following exposure. More than 200 human carcinogens are known. Examples of chemical carcinogens include vinyl chloride, cadmium, formaldehyde, and benzene.
6. **Reactive Chemicals** are compounds that, when mixed or combined with other chemicals or non-chemicals like water or air, can result in a chemical danger like an explosion. Examples of reactive chemicals are silane, nitric acid, and benzoyl peroxide.

The following are examples of Toxic chemicals and their negative health impacts

1. Mercury: Mercury has a number of negative consequences, including organ damage and neurotoxicity, including neurotoxicity during development. When cars with mercury-containing switches are smashed or shredded, mercury can leak out. Methylmercury, a bio-accumulative form of mercury, can be created from elemental mercury.
2. Polycyclic Aromatic Hydrocarbon (PAHs): These naturally occurring carcinogens are employed to make rubber polymer easier to deal with and ensure soft tread. Rubber materials that contain PAHs can eventually wear off and release the PAHs into the environment. These chemicals are carcinogenic in nature, they are used to make rubber polymer easier to work and make sure they tread soft. Rubber materials containing PAHs can wear off over time dispersing PAH into the environment.
3. The disposal or recycling of electronic trash results in the emission of heavy metals and brominated flame retardants.
4. Lead: Lead is primarily used in lead acid batteries, which are a common source of lead exposure for both humans and the environment in many countries. Major use of lead globally is in lead acid batteries, in many countries recycling of batteries/ car batteries is a common source of human and environmental exposure to lead.

**Physical Hazard**

Physical hazard is based on the chemical's inherent properties. Chemicals that could be explosive, shock-sensitive, oxidizers, or react severely with water or air are a few examples of physical risks. These are then classified into various groups based on the level of danger, and to identify each category, unique hazard statements are assigned.

Examples of Environmental Disasters caused by improper management of chemicals include:

1. January 28, 2021, a chicken plant accident occurred in Gainesville, Georgia, in the United States. A liquid nitrogen leak at a Foundation Food Group-owned poultry processing facility resulted in the asphyxiation deaths of six employees.
2. 2020 explosion at the Dahej chemical plant on June 3. There were five fatalities and over fifty injuries.
3. August 4, 2020: Explosions in Beirut; Much of the Port of Beirut was destroyed in a big explosion caused by a large stash of ammonium nitrate, and several structures all across the city were also affected, nearly 7,000 people were injured, and over 200 individuals were killed.
4. 6 January 2022: Surat gas leak: At least six people died and 22 people became sick following gas leak from a tanker in an industrial area in India.
5. 4 June 2022: 2022 Sitakunda fire. A fire and subsequent explosions at a container storage facility in Bangladesh's Chittagong District killed at least 33 people and injured more than 450 others.
6. 27 June 2022: 2022 Aqaba toxic gas leak, at least 10 dead and more than 251 injured by ruptured tank containing 25 tons on chlorine in Port of Aqaba, Jordan

**SOUND MANAGEMENT OF CHEMICALS**

Sound Chemical management refers to a procedure that tracks chemical products from procurement to final disposal. It also entails taking all necessary precautions to guarantee that chemicals are handled in a way that protects human health and the environment from potential negative impacts of chemical use.

It is no secret that chemicals influence many aspects of development, and they also affect drinking water, air, and food quality. In general, sound management is essential to the health of people, the environment, and ecosystems. Sound chemical management attempts to prevent exposure to toxic and hazardous compounds as well as chemicals suspected of having such features, and in cases where this is not possible, to reduce or minimize the possibility for such exposure.

Hazards that arise over the whole life cycle of the chemical, including during manufacture, storage, transport, use, and disposal, as well as risks from chemicals contained in products and other items can be prevented, reduced, remedied, minimized, and eliminated. It entails applying the best management practices to chemicals, which calls for enhanced methods and technology at every stage of the life cycle as well as strengthened governance.

**OBJECTIVES OF SOUND MANAGEMENT OF CHEMICALS**

1. To implement a sound chemical management system that will ensure that chemicals are manufactured handled, stored and utilized in a way that has the minimum possible harmful effects on the environment and human health.
2. Raise the importance that companies have to put on chemical management

**NEED FOR SOUND CHEMICAL MANAGEMENT**

Chemical management is not only a requirement that must be adhered to because of pressure from regulatory authorities, worry about hefty fines, and concern for brand reputation. It is significant because it is our responsibility to safeguard our planet's resources from both short-term and long-term adverse chemical consequences. The chemical management is important for:

1. Regulatory compliance: It's critical to manage and control hazards linked with chemicals, regardless of how risky or safe they are to use. Organizations that deal with the use, storage, and disposal of chemicals must ensure regulatory compliance. Example of such regulations include Montreal Protocol, Rotterdam Convection, Chemical Convection 1990, SAICM, Stockholm Convention, etc.
2. Improved Health and Safety: Chemical misuse has a serious negative influence on workers' health. The severity is increased and there is a risk of fire or explosions as well. Effective chemical management promotes responsible chemical use and reduces occurrences and accidents related to chemical handling.
3. Reduced environmental impact: Chemical management places a strong emphasis on identifying the environmental risks linked to the chemical and assures correct handling and disposal, hence reducing its influence on the environment.
4. Improved Brand reputation: Consumers are becoming more aware of the effects that products have on the environment and their health today. Utilizing safer ingredients in a product gives an advantage over rival producers and boosts the reputation and image of the business.

**THE BARRIER OF CHEMICAL MANAGEMENT**

In terms of chemical management, a company may have the following difficulties:

1. Profound efforts to manage change in the understanding and application of regulatory compliance
2. A lack of qualified personnel to undertake chemical evaluations.
3. Difficulty in handling a large number of chemical data, processes, and measures using IT systems.
4. Lack of validation tools/processes for monitoring changes in geography/regional compliance criteria.
5. Lack of a centralized information system on the usage, properties, and dangers of chemicals in the workplace.
6. Time-consuming, non-auditable chemical data collection procedures.
7. An inconsistent document management system that makes it impossible to track the most recent SDS, SOP, etc. versions.
8. A lack of funding and a lack of interest on the part of senior management in chemical management

**COMPONENT OF AN EFFECTIVE CHEMICAL MANAGEMENT**

Any chemical management system that aims to achieve highly competent chemical management at the workplace and to ensure that various risks are carefully evaluated and appropriately controlled with the goal of zero release of harmful chemicals throughout the product's life cycle should include the following essential components.

|  |  |  |
| --- | --- | --- |
| **S/N** | **CMS COMPONENT** | **REQUIREMENT**  |
| 1 | Chemical Management Plan | * Higher Management vision and approach towards chemical management
* Policy for monitoring and controlling use of restricted hazardous chemicals at workplace
 |
| 2 | Organization Structure | * Details of key people responsible for managing chemical management strategies
 |
| 3 | Accurate Chemical Inventory Management | * Up to date database of all the chemicals used/placed in the facility
* Creation of flow diagrams to detect the general flow of chemicals through different processes and equipment at workplace
 |
| 4 | Chemical Risk Assessment  | * Assessment of Hazards/ risks related with chemicals placed in the chemical inventory
* Job safety analysis
 |
| 5 | Chemical procurement Management  | * Chemical purchasing policy
* Assessment of chemical inventory before any chemical procurement
* Disposal cost consideration at the time of procurement (some chemicals deteriorate with time)
* Chemical supplier approval/ removal
 |
| 6 | Environment Impact Management | * Identification and management of potential environmental impacts from the use of chemical inventory
* Hazardous waste management program
* Reduce chemical waste/ releases
 |
| 7 | Alternatives Assessment | * Assess alternatives for chemicals that are found to significant physical, health and environmental hazards
 |
| 8 | Health surveillance  | * Periodic health surveillance is recommended for workers who are dealing with hazardous chemicals
* Implementation of good industrial hygiene and safety practices
 |
| 9 | Labelling and Packaging Management  | * Standard labelling and packaging of all the chemicals used or placed at the workplace as per regulatory requirement
 |
| 10 | Chemical Transport Management | * Proper transport of chemicals when transferred from one place to another
 |
| 11 | Regulatory Obedience  | * Ensure compliance with the statutory obligations under relevant HSE regulations
 |
| 12 | Folder Management | * Accessibility of SDS/SOPs, H&S documents
 |
| 13 | Skill Management  | * Track proficiencies/ workforce skills
* Technical and functional trainings for employees, contractors and visitors
* Ongoing Assessment
 |
| 14 | Crisis Retort Plan | * Crisis reaction plan if anything goes wrong
* Distress System
* Smart devices/ indicators
 |
| 15 | Analytics  | * Reporting tools
* Collaborative dashboards for faster decision making
 |
| 16 | Inspection Drives  | * Inspection plans to check the success of executed chemical management system
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**BENEFIT OF CHEMICAL MANAGEMENT**

1. Accurate information on chemicals used at work is provided by a chemical management system.
2. It prevents chemical overstocking and overbuying.
3. Improve operational effectiveness
4. Minimize exposure to chemical risks generally and their effects on the environment.
5. Lower costs associated with addressing accidents and incidents;
6. Competitive advantage over similar market participants

 **CONCLUSION**

The sound management of chemicals provides many tangible benefits for the general public and supports the protection of the environment. There is no one-size-fits-all approach to chemical management, so it is important to take the above described fundamental component into account when selecting a chemical management choice. Chemical management is a responsibility, not because we must comply with regulatory authorities' demands or out of concern for hefty fines, but rather because it is our responsibility to preserve the environment from the short- and long-term effects of improper chemical management.

**REFRENCE**

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