MEDIRES
Symbol of Quality Research

Journal of Microbes and Research
info@mediresonline.org

ISSN: 2836-2187 RESEARCH ARTICLE

Human Health and Exposure to Hazardous Substances

Dr. Ajeet Jaiswal[1*], Archana S[2]

[1]*Associate Professor, Department of Anthropology, Pondicherry University, Puducherry. ORCID: 0000-0003-0891-2672*
[2]*Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu*

***Corresponding Author**: Dr. Ajeet Jaiswal, *Associate Professor, Department of Anthropology, Pondicherry University, Puducherry. ORCID: 0000-0003-0891-2672*

Received Date: 02 March 2023; **Accepted Date:** 10 July 2023; **Published date:** 11 July 2023

Citation: Ajeet Jaiswal, Archana S. (2023). Human Health and Exposure to Hazardous Substances. Journal of Microbes and Research. 2(2); DOI: 10.58489/2836-2187/011

Abstract

Hazardous chemicals are called life-threatening particles because they have the ability and character to pose a threat and risk to human health and the environment. They have ignitability, toxicity, corrosivity, oxidative and ecotoxicity characteristics, which may be included in flammable liquids, gases, solids, explosive or blasting substances, and infectious or infectious radioactive agent elements. The route of exposure is either through ingestion, inhalation, absorption or injection by contact of people which hazardous chemicals containing water, soil, food and air. This causes many health hazards, including chronic and acute disorders of eyes, skin and other body organs and damages the functioning of specific organs. However, these substances' health surveillance and risk assessment exposure can be controlled.

Keywords: *health hazards, hazardous waste, hazardous chemical, human health, exposure.*

Introduction

Exposure to hazardous substances is a significant cause which affects environmental health. Mismanagement or misuse of an unsafe (hazardous) or dangerous substance, mainly chemicals, results in unacceptable risk to human health. Many environmental programs aim to protect human health and the environment from the harmful threat of hazardous substances.13 million deaths annually are preventable ecological causes, including about 19,000 deaths yearly due to unintentional poisoning and exposure to hazardous chemicals. Hazardous substances are chemicals known as "dangerous goods" and cause adverse health impacts such as allergic reactions, skin rashes, breathing problems, poisoning, cancer and other health effects from exposure if not handled safely. Hazardous substances include chemicals, products containing chemicals, fumes, dust, biological agents, gases and many other substances which seriously affect health. The standard way these chemicals enter humans is through the air, water, soil and food.

The primary group susceptible to hazardous substances are children and adolescents, which are affected more than adults. About 100 children die every hour from exposure to indoor smoking from solid fuels and air pollution. Children aged 1-6 years are susceptible as these chemicals alter cell development activities and impair many body organs. Workers are the leading group exposed to hazardous substances [3]. Control of Substances Hazardous to Health Regulation (COSHH) this law prevents and reduces workers' exposure to hazardous substances and access to safety information about the dangerous materials they handle potentially, which enables the workers to decrease or minimize workplace exposure through health risk assessment, ensuring workers follow the control measures provided by safety data sheets as a part of health surveillance. Proper training and information must be given in the case of emergencies or any other harm to health by risk assessment.

Environmental Protection Agency (EPA) developed and describes how people get exposed to chemicals and how their adverse effect causes health impact. Hazardous materials- A class of substances, their handling and uses, their storage and regulation is an integral part of EPA. Hazardous waste also has a significant impact on human health. Every activity that leaves behind some waste includes ordinary household garbage, exhaust gases emitted from cars, buses and trucks, and industrial and manufacturing units contributing solid and hazardous waste. People come in contact with this waste directly

or indirectly and get exposed to the chemicals from different sources by factories, landfill incinerators, drums or tanks, and from these sources, it moves through air, soil and water and causes severe and injurious effects to humans by causing many illnesses and may cause death [3].

Methodology

The present paper is based on secondary data. The data was taken from different sources, which have been duly acknowledged. The knowledge and information regarding chemical exposure and its health impact were also obtained from some websites.

Some of The Common Hazardous Substances

These hazardous substances which cause specific types of hazards are considered chemical hazards and are mainly caused by the mismanagement of chemical substances, also called dangerous chemicals. When they produce substances with hazardous properties, it interacts with air and water. Hazardous substances can have more than one unsafe/hazardous property. The major properties include

- **Explosive**: This one causes an explosion or explodes
- **Oxidising**: This will be in the state of gaseous, liquid or solids, which can cause fires and explosion
- **Flammable**: Ignites easily, and they quickly catch fire and burns
- **Corrosive**: This can cause severe eye damage and blindness and harmful skin burns
- **Toxic**: This can cause harmful effects when it enters the body by ingestion or inhalation. These have mild or life-threatening effects and have immediate or long-term effects
- **Ecotoxic**: These substances are toxic to the environment [5].

Class Of Hazardous Substances

Some essential properties of hazardous substances are based on their classification under certain classes.

Class 1: Explosives and Blasting Agents

An explosive is a compound or mixture with a high rate of reaction, high-pressure development and production of faster waves in which it has a rapid generation of heat and gases. This has been used in military ordinance, blasting and mining. Primary explosive includes nitro-glycerine; secondary explosive includes trinitrotoluene, gunpowder, azides and peroxides.

Class 2: Flammable Gases

These are also called fuel gases mixed with an oxidant and provide ignition sources. Compressed gases include liquefied gases, non-liquefied gases and dissolved gases

- **Liquefied Gases**: Anhydrous Ammonia, Chlorine, Propane, Nitrous Oxides, and Carbon Dioxide
- **Non-Liquefied Gases**: Oxygen, Nitrogen, Helium, and Argon
- **Dissolved Gases**: Acetylene

Class 3: Flammable Liquid

They mainly include ethyl ether, isopentane, propylene oxides, acetone benzene, ethyl alcohol, gasoline isopropyl alcohol, naphtha, xylene, ethylene glycol, and glycerine. Cryogenics and refrigerated liquids include oxygen, nitrogen, liquid methane and CO.

Class 4: Flammable Solids

Solids quickly catching fire through friction are readily combustible, including metallic hydrides, sodium and potassium, processed metals, and nitrocellulose products.

Class 5: Oxidising Substances and Organic Peroxides

Oxidising substances and organic peroxides readily produce oxygen, including potassium permanganate, sodium nitrite, hydrogen peroxides, ammonium nitrate fertilizers, and oxygen generators.

Class 6: Toxic and Infectious Substances

These are usually chemicals which are classified as acute toxicity. They include cyanides, lead compounds, phenols, cresols, pesticides and herbicides, which contain the categories of fertilizers, biological agents such as fungi, bacteria and infectious agents, biological samples and clinical waste [6].

Class 7: Radioactive Materials

This is according to the radioactivity, which includes uranium, radioactive ores and isotopes and some of the medical equipment that emits radiation [5].

Class 8: Corrosive Substances

Corrosive substances that cause damage to living tissues, especially eye and skin damage, occur due to strong acids such as sulphuric acids, sodium hydroxide, batteries and their fluids.

Class 9: Substances Which Is Toxic to the Environment

These environmentally hazardous substances

include zinc oxides, lithium-ion, genetically modified organisms, motor engines and airbag modules.

Besides this, many other paints, adhesives, cleansing agents, welding fumes and mists, wood dust, asbestos, petrol, cosmetics, detergents and degreases [7].

- **Pesticides:** Pesticides are chemicals used to reduce or remove pests. This kills the target and non-target organisms as it risks human health and agricultural crop.
- **Environmental Tobacco Smoke:** It is a harmful hazard where millions of people use it; risk includes lung cancer and heart disease. This is also a pollutant which actively or passively affects human health.
- **Lead:** Lead is a naturally occurring element used to manufacture industrial and domestic products. Overexposure to lead leads to lower IQ levels, anaemia, congenital disability, kidney disorders and specific other neurological damage. Children are in risk groups where the lead enters their blood from eating lead-containing substances such as paint and gasoline.
- **Radon:** Radon is a colourless gas that is the second leading cause of lung cancer, mainly in indoor air.
- **Indoor air pollutants** are the primary cause of asthma, allergic reactions, chemical poisoning, and many types of cancer [3].

Exposure To Hazardous Substances

Exposure is the contact between an agent and a target on the exposure surface over an exposure period. An etiological diagnosis of occupational diseases and health surveillance of workers can do an exposure assessment. Those exposed for a long time are at more risk than those exposed for short times. Adverse effects of exposure depend on the factors such as the type of chemicals, the amount or dose to which the person is exposed, the duration that is how long and the frequency, and how many times the person has been revealed. They come in contact with these chemicals through several processes in the workplace, such as processing [1].

Route Of Entry or Exposure Pathway

The exposure pathway is how the person comes in contact with a hazardous chemical. They mainly

- **Inhalation**: If we can smell it, we can inhale it. Inhalation is the primary entry route of hazardous chemicals; all airborne particles can be inhaled. This is mainly in the process of breathing.
- **Ingestion**: The toxic materials enter the gastrointestinal tract through eating, drinking or smoking. This causes harmful chemical ingestion.
- **Absorption**: This is mainly through the absorption of harmful substances. Absorption is the common exposure site for liquids and airborne particles where absorption occurs rapidly.
- **Injection**: The sharp puncture on the skin allows infectious agents to enter the body [4].

Exposure can occur through the water. When people drink contaminated groundwater or surface water by swimming or showering—exposure to the soil and dust when they ingest or breathe them. Children are more susceptible due to activities and hand-mouth contact. Exposure through food people who consume food containing hazardous substances [3].

Types Of Hazards

Types of hazards include physical hazards and several health hazards

Physical Hazards: This means the chemicals which are classified as the hazardous property such as oxidizers, flammable, explosive, corrosive to metal and high-pressure systems and are represented by pictograms for safety purposes such as flame over circles, flames exploding bombs, corrosion, gas cylinder [5].

Health Hazards: Some chemicals are categorised as having different hazardous properties. Several pictograms are used for safety purposes and precaution for the people. They are classified and the other health hazards such as

- Acute And Chronic Toxicity
- Skin Corrosion or Irritation
- Aspiration Hazards
- Serious Eye Damage
- Respiratory And Skin Problems
- Germ Cell Mutagenicity
- Carcinogenicity
- Reproductive Toxicity
- Specific Target Organ Toxicity [5].

Controlling The Risk of Physical Hazards and Health Hazards in the Workplace

Controlling the exposures is primarily done by protecting and guiding the workers by the Hierarchy of Controls method. These are the following steps

1. **Elimination and Substitution:** These are most effective in decreasing hazards, and this process is simple and inexpensive. This is physically removing the threats/ hazards and replacing them, for these specific tools and equipment are being used.

2. **Engineering Controls**: It is the changes in the process to minimize contact with hazardous materials. That is to isolate or enclose the process, use the wet method to reduce dust generation, ventilation etc.
3. **Administrative Control**: This is to adjust the work schedule so workers are less exposed to the chemical. This is to rotate the work time and schedule, ensure safer work practices and training of employees, and make them aware of the hazards.
4. **Personal Protective Equipment** (PPE): This ensures the employees use individual protective measures, such as gloves, chemical protective clothing, and respiratory and eye protection substances for their safety [5].

Discussion

As per the environmental protection agency (EPA) research, the chemicals that enter our bodies make us sick and cause many adverse health problems. The toxicity depends on exposure amount, age, gender, genetics, health condition, etc. Children's Health Protection (CHP) dramatically impacts children's health due to higher susceptibility and their activities in the environment. It affects their developmental stage by decreasing or hindering cell growth [3].

Society now experiences increased health problems, mainly in cancer, autoimmune disorders, male and female fertility, diabetes and obesity. This is all because of lifestyle changes and people's exposure to certain chemicals, which makes them life-threatening. It is mainly due to many man-made and naturally occurring chemicals, air pollution, e-waste, furniture waste, food additives, and packing materials.

According to the UNEP "Global Chemical Outlook" report from September 2012, poisonings from industry and agricultural chemicals contribute to more than one million deaths yearly worldwide [2].

Humans can tolerate some amount of the chemicals to an extent and excrete them through normal body function. After exposure, chemicals enter the body, the bloodstream, and finally, the Liver. The Liver can detoxify the chemicals and drugs to a limit, which are eliminated through sweat, urine, faeces, and exhalation. The remaining amount of chemicals that couldn't be detoxified affects the health, causing adverse effects and risks to human health [3].

Work is vital for the economic growth of a country, but due to these hazards, it decreases economic growth. The primary reason behind workplace exposure is poor housekeeping, the poor extraction process, poor work practices, spillage and contamination, lack of awareness and training, and exposure to sunlight. These can all be resolved by proper care, maintenance and health surveillance of the workers. Minimizing the vulnerability can be done by the management of workplace risk assessment by using the following instruction such as standard data sheets, hazardous chemical register, managing incompatible goods, storage and handling system, health monitoring, chemical security concern and emergency planning [8].

Conclusion

This environmental health impact directly or indirectly affects the industrial disruption and loss of adequate food and housing. This destroys the global system on which the health system depends; whether it is the environment or workplace, the source of hazards and impact are almost the same. To control these impacts on health, adequate measures in the setting, the system and proper maintenance. To reduce the health risk due to chemical hazards, we can produce low-toxic chemicals by using modern technologies and eliminate or mitigate chemicals that cause health risks to the general population and the workers who are directly exposed to the chemicals.

References

1. Better Health, (2017). Workplace Safety - Hazardous Substance, November 2020(Accessed Year).
2. CHEMSEC, (2018). Effect of Hazardous Chemicals, November 2020
3. Missouri Dept of Health and Senior Service, (2020). Health Effect of Chemical Exposure, November 2020.
4. Health Scotland, (2019). Healthy Working Live, November 2020.
5. Occupational Safety and Health Administration (OSHA), (2017). Outreach Training for General Workplace, November 2020.
6. Sarazin, P., Burstyn, I., Kincl, L., Friesen, M. C., & Lavoué, J. (2018). Characterization of the selective recording of workplace exposure measurements into OSHA's IMIS Databank. Annals of Work Exposures and Health, 62(3), 269-280.
7. Rout, B. K., & Sikdar, B. K. (2017). Hazard identification, risk assessment, and control measures as an effective tool of occupational health assessment of hazardous process in an iron ore pelletizing industry. Indian journal of occupational and environmental medicine, 21(2),

56.

8. Workplace Health and Safety Queensland, (2020). Managing Hazchem, November, 2020.