

**CHALIMBANA UNIVERSITY**

**DIRECTORATE OF DISTANCE EDUCATION**

**BHS 311: OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT**

**FIRST EDITION 2020**

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**MODULE OVERVIEW**

**Introduction**

The human, social and economic costs of occupational accidents, injuries and diseases and major industrial disasters have long been cause for concern at all levels from the individual workplace to the national and international. Measures and strategies designed to prevent, control, reduce or eliminate occupational hazards and risks have been developed and applied continuously over the years to keep pace with technological and economic changes. Yet, despite continuous if slow improvements, occupational accidents and diseases are still too frequent and their cost in terms of human suffering and economic burden continues to be significant. An ILO report estimated that 2 million occupational fatalities occur across the world every year (ILO, 2003b), the highest proportions of these deaths being caused by work-related cancers, circulatory and cerebrovascular diseases, and some communicable diseases. The overall annual rate of occupational accidents, fatal and non-fatal, is estimated at 270 million (Hämäläinen, Takala and Saarela, 2006). Some 160 million workers suffer from work-related diseases and about two-thirds of those are away from work for four working days or longer as a result. After work-related cancers, circulatory diseases and certain communicable diseases, accidental occupational injuries are the fourth main cause of work related fatalities.

According to the European Statistics on Accidents at Work (ESAW), every year in the 15 Member States of the European Union (EU) before the enlargements of 2004 and 2007 about 5,000 workers were killed in accidents at work and about 5 million workers were victims of accidents at work leading to more than three days’ absence from work (EU, 2004).

1. In India and China, the rates of occupational fatalities and accidents are similar at, respectively, 10.4 and 10.5 per 100,000 for fatalities, 8,700 and 8,028 for accidents.
2. In sub-Saharan Africa, the fatality rate per 100,000 workers is 21 and the accident rate 16,000. This means that each year 54,000 workers die and 42 million work-related accidents take place that cause at least three days’ absence from work.
3. In Latin America and the Caribbean, about 30,000 fatalities occur each year and 22.6 million occupational accidents cause at least three days’ absence from work.

The economic costs of these injuries and deaths are colossal, at the enterprise, national and global levels. Taking into account compensation, lost working time, interruption of production, training and retraining, medical expenses, and so on, estimates of these losses are routinely put at roughly 4 per cent of global GNP every year, and possibly much more. Overall spending on compensation for a group of OECD countries was estimated at US$122 billion for 1997 alone, with 500 million working days lost as a result of accidents or health problems. If property losses from accidents, and more specifically major industrial accidents, are included, recent studies suggest that insured losses are in the vicinity of US$5 billion annually and are on the increase (Mitchell, 1996). Moreover, these figures are based mainly on acute and intensive events and do not include uninsured losses, delayed losses associated with acute events such as oil and other toxic chemical spills, or the environmental impact and losses caused by chronic industrial pollution. The total annual cost to the EU of work-related injuries and ill health in 2001 was estimated at between €185 billion and €270 billion, or between 2.6 per cent and 3.8 per cent, of the EU’s GNP. In comparison, the cost of occupational accidents in Viet Nam for 2006 was estimated at US$3 billion (Government of Viet Nam, 2006). Box 2 illustrates the costs of occupational safety and health in an industrialized country.

**Rationale**

This course will equip you with skills that will enable you manage occupational health and safety in the work place.

**Course Aim**

The aim of this course is to introduce students to occupational health and safety and equip them with basic requirements and expectation of management health and safety in organisations.

**Learning Outcomes**

By the end of the module, you are expected to:

* describe the nature and the legal framework governing occupation health and safety at national and international levels;
* explain the causes of accidents, identify existing, potential safety and health hazards and risks at work, and the mechanisms to prevent these hazards and risks.
* describe the effects of OHS hazards on the employees;
* enumerate the effects of occupational illnesses/accidents to the workers, workplace, community, and society;
* determine the appropriate control measures to prevent hazards and risks;
* conduct a simulated safety and health audit through a site/plant visit;
* describe the roles of the supervisor in promoting an OSH-friendly environment in his/her organization;
* describe the components and benefits of a health and safety programme;

**Summary**

Occupational and industrial accidents are all caused by preventable factors which could be eliminated by implementing already known and available measures and methods. This is demonstrated by continuously reduced accident rates in industrialized countries. The application of preventive strategies therefore offers significant human and economic benefits.

**Study skills**

As an adult learner, your approach to learning will be different to that of your school days you will choose when you want to study. You will have professional and/or personal motivation for doing so and you will most likely be fitting your activities around other professional or domestic responsibilities.

Essentially, you will be taking control of your learning environment. As a consequence, you will need to consider performance issues related to time management, goals setting, stress management, etc. perhaps you will also need to reacquaint yourself in areas such as essay planning, coping with examinations and using the internet as a learning source.

Your most significant considerations will be time and space i.e. the time you dedicate to your learning and the environment in which you engage in that learning. It is recommended that you take time now before starting your self-study to familiarise yourself with these issues. There are a number of excellent resources on the web. A few suggested links are: <http://www.how-to-study.com/> and <http://www.ucc.vt.edu/stdysk/stdyhlp.html>

**Time frame**

You are expected to spend at least three terms of your time to study this module. In addition, there shall be arranged contact sessions with lecturers from the University during residential possibly in April, August and December. You are requested to spend your time carefully so that you reap maximum benefits from the course. Listed below are the components of the course, what you have to do and suggestions as to how you should allocate your time to each unit in order that you may complete the course successfully and no time.

**Required resources**

Text books and module.

**Need help**

In case you have difficulties in studying this module don’t hesitate to get in touch with your lecturers. You can contact them during week days from 08:00 t0 17:00 hours. Mr Daniel Siakalima danielsiakalima@yahoo.co.uk. You are also free to utilise the services of the University Library which opens from 08:00 hours to 20:00 hours every working day.

**Assessment**

**Continuous Assessment 50%**

Three Assignments 30%

One Test 20%

**Final Examination 50%**

**Total 100**

**Prescribed Reading**

Barry S.L. and David H.Wegman (1988) Occupational Health. Recognizing and Preventing Work-Related Diseases.3rd edition. London.

Dedglaville, H., R.S.F Schillings and C.H. Wood, editors, Occupational Health, A manual for health Workers in developing countries, AMREF. 1987.

Hämäläinen, P.; Takala, J.; Saarela, K. L. 2006. “Global estimates of occupational accidents”, in *Safety Science*, Vol. 44, pp. 137–156.

Krause, T, and Hodson, S, (1998), “ A Close Look at Safety Incentives, “ Occupational Health and Safety



**Recommended Readings**

Introduction to Occupational Health and Safety, International Labour Organization, accessed on 25 January 2020[http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm)](http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm)

ILO. 1984. *Conclusions concerning future action in the field of working conditions and environment*, adopted by the 70th Session of the International Labour Conference, 26 June, section I, para. 2.

2001b. *ILO guidelines on occupational safety and health management systems* (ILO-OSH 2001) (Geneva).

Jeremy Stranks and Malcolm Dewis. RoSPA. Health and Safety practice.2nd edition. Great Britain .1986

Module 010: Occupational Health, Safety and Environment in Construction, National Council for Construction, accessed on 25 January 2020 <http://www.ncc.org.zm/.../010-Training-Manual-Occupational-Health-and-Safety>

WHO. Occupational Health program of WHO Headquarters, Geneva, Switzerland. The Global Occupational Health Network 2003

# **UNIT 1: OCCUPATIONAL HEALTH AND SAFETY AND LEGISLATIVE FRAMEWORK**

## 1.1 Introduction

In this unit, you will be introduced to the technical discussions that will follow in the next modules. You will also look at legal framework governing occupational health and safety in Zambia and at the global level.

## 1.2 Learning Outcomes

By the end of this unit, you should be able to:

* demonstrate the basic understanding of existing legislation governing occupation health and safety;
* identify work hazards and risks and recommend control measures to reduce or eliminate work-related accidents and illness;
* acquire basic knowledge and skills on OHS, such as safe work practices, that will enable you to plan/develop your company’s Health and Safety programme;
* identify the different unsafe and unhealthy acts and conditions in your workplace;
* differentiate unsafe and unhealthy acts from unsafe/unhealthy conditions.
  1. **Time Frame**

You need about six (2) hours per week to interact with this material.

**1.4 Content**

* Legislative Framework
* Related Occupational Health and Safety Laws
* Ratified ILO Conventions on OHS and OHS-Related Issues
* Occupational Accidents and Diseases
* Mechanisms for Periodic Review of the List of Occupational Diseases
* Data on Occupational Accidents and Diseases

**1.5Legislative Framework**

Occupational health and safety is a discipline with a broad scope involving three major fields – Occupational Safety, Occupational Health and Industrial Hygiene.

* **Occupational safety** deals withunderstanding the causes of accidents at work and ways to prevent unsafe act and unsafe conditions in any workplace. Safety at work discusses concepts on goodhousekeeping, proper materials handling and storage, machine safety, electrical safety, fire prevention and control, safety inspection, and accident investigation.
* **Occupational health** is a broad concept which explains how the different hazards and risks at work may cause an illness and emphasizes that health programs are essential in controlling work-related and/or occupational diseases.
* **Industrial hygiene** discusses the identification, evaluation, and control of physical, chemical, biological and ergonomic hazards.

*“In its broadest sense, OHS aims at:*

* *the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations;*
* *the prevention of adverse health effects of the working conditions;*
* *the placing and maintenance of workers in an occupational environment adapted to physical and mental needs;*
* *the adaptation of work to humans (and NOT the other way around).*

*In other words, occupational health and safety encompasses the social, mental and physical well-being of workers, that is, the “whole person”.*

*Successful occupational health and safety practice requires the collaboration and participation of both employers and workers in health and safety programs, and involves the consideration of issues relating to occupational medicine, industrial hygiene, toxicology, education, engineering safety, ergonomics, psychology, etc.*

*Occupational health issues are often given less attention than occupational safety issues because the former are generally more difficult to confront. However, when health is addressed, so is safety - a healthy workplace is by definition also a safe workplace. The reverse, though, may not be true - a so-called safe workplace is not necessarily also a healthy workplace. The important point is that both health and safety issues must be addressed in every workplace.”*

**INTRODUCTION TO OCCUPATIONAL HEALTH AND SAFETY, International Labour Organization, accessed 25 January 2020**[**http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm)**](http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm)

**1.6Constitutional Provisions for Occupational Safety and Health**

There is no express provision made in the Constitution of Zambia for the safety and health of workers. However, under Part 3 of the Constitution which addresses the “Protection of the Fundamental Rights and Freedoms of the Individual”, issues of public health and public safety have been alluded to in general terms. Further, Article 14 provides for the protection of individuals from forced labour.

The only provision in the Constitution that is closely related to occupational safety and health is clause (1) of Article 24 which states that “A young person shall not be employed and shall in no case be caused or permitted to engage in any occupation or employment which would prejudice his health or education or interfere with his physical, mental or moral development…”.

**1.7The Factories Act, Chapter 441**

This Act generally provides for the regulation of the conditions of employment in factories and other places as regards to the safety, health and welfare of persons employed therein. The Act specifically provides for: supervision of safety and health in factories; inspection of factories and certain plant and machinery by inspectors from the Occupational Safety and Health Services department; and reporting and investigation of occupational accidents and diseases. Further, there are regulations under the Act that cover safety and health in the construction sector, electrical installations and woodworking machinery among others. Employers and employees are assigned various duties in various sections of the Act.

The Act’s scope includes factories belonging to or in occupation of the Republic and building operations and works of engineering construction undertaken by or on behalf of the Republic. The mining sector and explosives manufacturing/assembling factories are excluded from its coverage because these sectors are covered by other Acts of Parliament. Because of the Act’s limited interpretation of a factory, a number of sectors such as the agricultural and service sectors are either partially covered or not covered at all.

**Table 1.1** Main Regulations under the Factories Act

|  |  |
| --- | --- |
| **Regulations** | **What Regulations Provide For** |
| The Construction (Safety and Health) Regulations | These regulations provide for the regulation of safety and health in building operations and works of engineering construction. |
| The Factories  (Electricity) Regulations | These regulations provide for the regulation of safety and health in the generation, transformation, distribution and use of electrical energy in any undertaking. |
| The Woodworking  Machinery Regulations | These regulations apply to the safe use of woodworking machines in any undertaking. |
| The Factories (Benzene) Regulations | These regulations provide for safety and health in the use of benzene. |
| The Factories (First-Aid) (Prescribed Standard of  Training) Regulations | These regulations provide for the standard of training in first-aid treatment for first-aiders. |
| The First-Aid Boxes Regulations | These regulations provide for the regulation of the contents of first-aid boxes or cases. |

**Source:** ILO (2012) - Zambia country profile on occupational safety and health 2012

**1.8The Mining Regulations**

These regulations provide for the supervision of safety and health in mines, inspection of mines by inspectors from Mines Safety department (MSD), reporting and investigation of occupational accidents, and the compilation and publication of statistics on accidents, occupational diseases and dangerous occurrences. These regulations also provide for the responsibilities, duties and conduct of mine owners/ employers and workers.

The principal act under which the Mining Regulations fall is the Mines and Minerals Act. The application -of the Mines and Minerals Act is specific to the mining sector, including quarrying.

#### **1.9The Occupational Health and Safety Act, 2010**

This Act provides for the following: establishment of the Occupational Health and Safety Institute and its functions; establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work; and related matters.

The Occupational Health and Safety (OHS) Act is divided into seven parts, namely:

1. *Part I – Preliminary;*
2. *Part II – The Occupational Health and Safety Institute;*
3. *Part III – Health and Safety Committees;*
4. *Part IV- Health and Safe Workplaces;*
5. *Part V – Enforcement Provisions;*
6. *Part VI – The Occupational Health and Safety Services; and*
7. *Part VII – General Provisions.*

In this Act, duties of employers, employees and other persons with a part in occupational safety and health have been spelt out in parts III and IV of the Act.

#### **1.10The Ionizing Radiation Act, Chapter 311**

The purpose of the Ionizing Radiation Act is to protect the public and workers from dangers arising from the use of devices or materials capable of producing ionising radiation. The Act stipulates the Occupational Exposure Limits (OELs) for various categories of workers. It also regulates the possession, sell, disposal, importation and exportation of radioactive materials. Furthermore, it regulates the installation, servicing and maintenance of radioactive devices and radiation premises. This Act also requires that those who venture into prospecting and/or mining of radioactive minerals apply for a license prior to commencement of operations.

To operationalise its provisions, the Act has provided for the appointment of a Board and Radiation Protection Officers under a Radiation Protection Authority (RPA).

**1.11****The Workers’ Compensation Act, Chapter 271 (Act No. 10 of 1999)**

This Act provides for the establishment and administration of a Fund for the compensation of workers who are disabled by accidents or diseases contracted by such workers in the course of their employment. It also provides for the payment of compensation to dependants of workers who die as a result of such accidents or diseases, and for the grant of pensions and allowances to certain dependants of workers who being in receipt of pensions for such disablement die from causes not connected with such accidents or diseases. The Act further provides for the payment of contributions to such a Fund by employers.

Regulations established under the Act include among other things, a schedule of occupational diseases and employers’ register of accidents to workers.

The Act excludes members of the public service and the Zambia defence and Security Forces/Services from its application.

**MODULE 010: OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT IN CONSTRUCTION, National Council for Construction, accessed 25 January 2020 http://www.ncc.org.zm/.../010-Training-Manual-Occupational-Health-and-Safety**

## 1.12The Explosives Act, Chapter 115

The purpose of this Act is to regulate the manufacture, use, possession, storage, importation, exportation, transportation and destruction of explosives. For the administration of the Act, provision has been made for appointment of Inspectors of Explosives who ought to be public officers. The Act further empowers the Inspectors of Mines and Inspectors of Machinery, from Mines Safety department, to carry out the duties of Inspectors of Explosives in explosives factories. Various parts of the Explosives Regulations, formulated under this Act, deal with various aspects of safety. Part 16 in particular deals entirely with the health, safety and welfare of persons employed in explosives factories. This part regulates, among other things, welding operations, provision of sanitary conveniences, provision of change house accommodation and personal protective equipment and clothing.

The Explosives Act’s application does not include the Zambia defense and Security Forces.

**1.13The Public Health Act, Chapter 295**

This Act provides for the prevention and suppression of diseases and generally regulates all matters connected with public health in Zambia. Some of the issues dealt with in the Act include the provision of sanitary conveniences in various workplaces. Further, some of the regulations under this Act deal with the control of habitation in factories, workshops and trade premises and their application extend to most of the Local Authorities in the country. Regulations dealing with the handling of meat products prescribe periodic medical examinations for those who work in this sector.

To enforce its provisions, the Act has provided for the appointment of Health Inspectors in the employment of the Government or any Local Authority. A Health Inspector also includes any person appointed by the director of Medical Services to act as such within the district of one or more Local Authorities.

#### **1.14 The Environmental Management Act, No. 12 of 2011**

The Environmental Management Act provides for the protection of the environment and the control of pollution. Among the key issues addressed in this Act are those to do with air pollution, waste management, pesticides and toxic substances, noise and ionizing radiation. Apart from being addressed in the main text of the Act, some of these issues have also been addressed in regulations specific to them. Some of the regulations, such as the ones on pesticides and toxic substances, address safety and health matters including use of personal protective equipment and clothing in some detail.

To administer its provisions, the Act has provided for the establishment of an inspectorate and the appointment of inspectors to man the inspectorate.

## 1.15Ratified ILO Conventions on OHS and OHS-Related Issues

Zambia has ratified 39 ILO Conventions and denounced another 4 conventions, Annex 1. Although it has not ratified the key ILO Conventions on occupational safety and health apart from the Safety and Health in Mines Convention (1995), seven of the 39 Conventions it has ratified are related to occupational safety and health. The OHS and OHS -related Conventions that have been ratified include:

#### **1.16 C12: Workmen’s Compensation (Agriculture) Convention, 1921**

This Convention covers agricultural wage-earners and it provides for the compensation of workers, in this sector, for personal injury by accident arising out of or in the course of their employment. The provisions of this Convention have been domesticated under the Workers’ Compensation Act, No.10 of 1999.

#### **1.17 C17: Workmen’s Compensation (Accidents) Convention, 1925**

This Convention undertakes to ensure that workers, who suffer personal injury due to an industrial accident, or their dependants, are compensated. This Convention’s provisions have been domesticated in the Workers’ Compensation Act, No. 10 of 1999. The specific area that gives effect to this Convention is Part 5 of the Act, Sections 41 -54, which deals with the right to compensation.

#### **1.18** **C18: Workmen’s Compensation (Occupational Diseases) Convention (1925)**

This Convention provides for the payment of compensation to workers incapacitated by occupational diseases, or, in case of death from such diseases, to their dependants.

The national legislation which has domesticated the provisions of this Act is the Workers’ Compensation Act, No. 10 of 1999. Sections 91 – 96 of Part 9 of the Act, which deals with occupational diseases, give effect to the Convention.

#### **1.19 C19: Equality of Treatment (Accident Compensation) Convention (1925)**

Convention 19 undertakes to grant to the nationals of any other Member, which shall have ratified the Convention, who suffer personal injury due to industrial accidents happening in another Member’s territory the same treatment in respect of workers’ compensation as it grants to its own nationals. The Convention guarantees this equality of treatment to foreign workers and their dependants without any condition as to residence.

The provisions of this Convention have been domesticated in the Workers’ Compensation Act, No. 10 of 1999. An example is the Workers’ Compensation Reciprocal Arrangements (Zimbabwe) Rules.

**1.20C124: Medical Examination of young Persons (underground Work) convention,** **1965**

This Convention stipulates that thorough medical examinations and periodic re-examinations at intervals of not more than one year, for fitness for employment, shall be required for the employment or work underground in mines, of persons under 21 years of age. This Convention has been domesticated by way of adoption as a Schedule under the Mines and Minerals Act, Chapter 213 of the Laws of Zambia.

#### **1.21 C136: Benzene Convention, 1971**

The purpose of the Benzene Convention is to protect workers against hazards arising from benzene. It applies to all activities involving exposure of workers to benzene and products the benzene content of which exceeds 1 per cent by volume. This Convention has been given effect by means of the Benzene Regulations that were formulated under the Factories Act.

**1.22C148: Working Environment (Air Pollution, Noise and Vibration) Convention,** **1977**

The Working Environment Convention requires national laws or regulations to prescribe measures to be taken for the prevention and control of, and protection against, occupational hazards in the working environment due to air pollution, noise and vibration.

The Mines and Minerals (Environmental) Regulations have given adequate effect to the Convention with regards to the prevention and control of air pollution, noise and vibration in the mining sector. The Factories Act, on the other hand has not given adequate effect to the Convention. Consequently, the sectors covered by the Factories Act do not have adequate, up-to-date legislation dealing with issues of air pollution, noise and vibration within the working environment.

#### **1.23 C176: Health and Safety in Mines Convention, 1995**

This Convention stipulates that Members shall formulate, carry out and periodically review a coherent policy on safety and health in mines, particularly with regard to the measures to give effect to the provisions of the Convention. The contents of this Convention have been domesticated in regulations that fall under the Mines and Minerals Act, particularly the Mining Regulations and the Mines and Minerals (Environmental) Regulations. Other aspects of the Convention have also been domesticated under the Explosives Act, Chapter 115 of the Laws of Zambia.

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**1.24 Occupational Accidents and Diseases**

The International Labour Organization estimates that over 300 million occupational injuries and at least 320,000 fatal occupational injuries occur each year. A further 2 million cases of fatal work-related dis- eases are reported annually. Considering fatal occupational injuries and work-related diseases together, the global estimate of work-related deaths amounts to 2.3 million annually.

In Zambia, approximately 1,200 occupational accidents and diseases are reported from all industries annually while many others go unreported.

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## 1.25 Notification and Recording of Occupational Accidents and Diseases

There are three key institutions responsible for the collection and compilation of data on occupational accidents and diseases. These are the Occupational Health and Safety Services department, the Mines Safety department and the Workers Compensation Fund Control Board.

## 1.26 Occupational Health and Safety Services Department (OHSSD)

Occupational Health and Safety Services department’s sources are accident reports submitted by all industries covered by the Factories Act. In workplaces that fall under the Factories Act, employers are required, by law, to record all accidents, dangerous occurrences and occupational diseases that occur in their workplaces in a prescribed manner.

Though employers are required to record all accidents that occur in their workplaces, it is not all accidents that they are supposed to report to the OHSSd. Reportable accidents are those that either cause loss of life to a person employed in a workplace or disable any such person for more than three days from performing the work for which he/she was employed. Other incidents that may not necessarily lead to death or disablement but cause damage to plant and/or property as outlined in the first schedule of the Act are considered reportable.

## 1.27 Mines Safety Department (MSD)

MSd’s sources are mainly accident reports submitted by the mining industry. Under the Mining Regulations the Mine Manager is required to give notice of any accident specified in the regulations, on a form prescribed, and inform an inspector immediately, by the quickest means available, of any such accident. In addition to the specified accidents, those accidents in which any person injured is incapacitated from performing his/her usual work for more than three days, excluding the day of the accident but including weekends or official holidays, are also to be reported to the department. Whether personal injury is caused or not, certain incidents that are outlined in the regulations are required to be reported to the department within 24 hours of their occurrence.

In the case of an occupational fatality, the manager is required to immediately notify the Police by the quickest means possible and to also inform the nearest magistrate in writing.

## 1.28 Workers Compensation Fund Control Board

WCFCB’s sources include data based on workers’ accident compensation insurance benefits. This data includes accidents that are reportable to both OHSSd and MSd. The Workers’ Compensation Act (Number 10 of 1999), administered by WCFCB, requires that as soon as an employer gains knowledge of the occurrence of an accident or incidence of a disease, he/she reports the same, in a prescribed form, to the Commissioner within three days. Upon receipt of the written report, the Claims Manager forwards the report to the Manager Health and Safety. The Manager Health and Safety then extracts some information from the report and records it in an accident register for statistical purposes. The accident register maintained by the Manager Health and Safety includes details such as sex and age of victim, time and day of accident, nature of injury etc.

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# **1.29 Schedule of Occupational Diseases**

Both the Factories Act and the Workers’ Compensation Act (Number 10, of 1999) contain schedules of occupational diseases.

## 1.30 Schedule of Occupational Diseases under the Factories Act

The list of occupational diseases under the Factories Act appears under Schedule 2 of the Principal Act. The total number of diseases considered occupational is 15 and most of them are attributed to chemical poisoning. Provisions of the Factories Act regarding notification of accidents also apply to occupational diseases. However, the prescribed form for reporting of occupational diseases is separate from that of occupational accidents.

Section 78 (1) of the Factories Act obligates “Every medical practitioner who attends any patient whom he believes to be suffering from any disease specified in the Second Schedule contracted as a result of his employment in a factory…” to forthwith report the matter to an inspector. However, few, if any, medical practitioners are aware of this provision and the schedule of occupational diseases. Further, there is a critical shortage of medical personnel trained in occupational medicine thus making the identification and subsequent notification of occupational diseases very difficult.

**1.31Mechanisms for Periodic Review of List of Occupational Diseases**

###### **1.31.1 Mechanisms for Periodic Review under the Factories Act**

With regards to the list of diseases under the Factories Act, the only provision that appears close to a review mechanism for occupational diseases is what is provided for in Section 79 (a) of the Act. This section empowers the Minister to extend legal provisions regarding the scheduled diseases to any disease that may not have been specified in the schedule by way of regulations.

###### **1.31.2 Mechanisms for Periodic Review under the Workers’ Compensation Act**

As far as the schedule of occupational diseases under the Workers’ Compensation Act is concerned, the review mechanism is not clearly outlined. However, the generally accepted approach is to review and update the schedule whenever the ILO amends its “List of Occupational diseases” under Recommendation 194. Once reviewed, the list is expected to be issued as a Statutory Instrument (SI) by the Minister of Labour and Social Security. Currently, however, the two schedules of occupational diseases have not been reviewed in line with the ILO’s reviewed Recommendation 94.

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**1.32 Data on Occupational Accidents and Diseases**

###### **1.32.1 Accident Classification by Type of Industry and Degree of Disablement**

According to WCFCB’s annual reports for the period 2003 – 2007, a total of 5,758 occupational accidents and diseases were recorded in all industries. The eight industries that registered the highest number of occupational accidents were: Mining and Quarrying (1,492); Agriculture and Forestry (730); Building Construction (487); Iron and Steel Industry (461); Textile Industry (385); Personal Services, Hotels etc (374); Chemical Industry (360); Food, drink and Tobacco Industry (327).

**Table 1.2**: Accident Classification by Type of Industry and degree of disablement, 20032007

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INDUSTRY TYPE | DEGREE OF DISABLEMENT | | | |
| FATAL | PERMANENT | TEMPORARY | TOTAL |
| Agriculture & Forestry | 52 | 394 | 284 | 730 |
| Banking Finance & Insurance | 3 | 16 | 20 | 39 |
| Building Construction | 58 | 281 | 148 | 487 |
| Charities, Religious, Political | 6 | 47 | 30 | 83 |
| Chemical Industry | 59 | 171 | 130 | 360 |
| Educational Services | 5 | 25 | 21 | 51 |
| Food, drink & Tobacco | 35 | 194 | 108 | 327 |
| Glass, Brick Site & Asbestos | 0 | 26 | 26 | 52 |
| Iron, Steel Industries, etc | 39 | 234 | 188 | 461 |
| Leather Industries, etc | 3 | 5 | 1 | 9 |
| Local Authorities | 10 | 47 | 32 | 89 |
| Medical Services | 1 | 6 | 1 | 8 |
| Mining, Quarrying Industries | 96 | 954 | 442 | 1,492 |
| Personal Services, Hotels, etc | 35 | 154 | 185 | 374 |
| Professional Services, etc | 1 | 25 | 28 | 54 |
| Publishing, Printing, Paper | 1 | 14 | 16 | 31 |
| Textile Industries | 9 | 170 | 206 | 385 |
| Trade & Commerce, etc | 31 | 104 | 56 | 191 |
| Transport, etc | 41 | 146 | 74 | 261 |
| Entertainment | 0 | 2 | 4 | 6 |
| Wood, Furniture Industries | 10 | 92 | 40 | 142 |
| Unregistered | 17 | 77 | 32 | 126 |
| **TOTAL** | **512** | **3,174** | **2,072** | **5,758** |

**Source:** Compilation based on Annual Reports of Workers’ Compensation Fund Control Board from 2003-2007 (ILO, 2012)

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###### **1.32.2 Accident Classification by Cause and Degree of Disablement**

WCFCB’s annual reports for 2003 – 2007 show that the largest number of recorded accidents during this period was due to unspecified causes at 2,141. Apart from unspecified causes, the major causes of accidents were:

* *Struck by Falling Objects (857);*
* *Vehicles, Excel Hand Trucks (703);*
* *Caught on or between (648);*
* *Falling (462);*
* *Explosions (182);*
* *Use of Hands (163);*
* *Machines (125).*

**Table 1.3**: Accident Classification by Cause and Degree of Disablement, 2003-2007

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **INDUSTRY TYPE** | **DEGREE OF DISABLEMENT** | | |  |
| **FATAL** | **PERMANENT** | **TEMPORARY** | **TOTAL** |
| Prime Movers (Steam, Gas & Other Engines) | 0 | 14 | 12 | 26 |
| Lifting Machinery | 2 | 31 | 36 | 69 |
| Use of Hands | 4 | 91 | 68 | 163 |
| Struck by Falling Object | 49 | 367 | 441 | 857 |
| Falling | 13 | 249 | 200 | 462 |
| Caught on or Between | 11 | 397 | 240 | 648 |
| Stepping on or Struck Against | 8 | 45 | 46 | 99 |
| Trans - Shafting | 0 | 7 | 2 | 9 |
| Machines - Bolts, Ropes, Pulleys & Gearing | 1 | 74 | 50 | 125 |
| Metal-milling Machinery | 1 | 7 | 14 | 22 |
| Power Press | 1 | 22 | 4 | 27 |
| Circular Saws - All Types | 0 | 8 | 3 | 11 |
| Wood-planning Machinery | 0 | 6 | 6 | 12 |
| Machinery - Vertical Spindle Moulding | 1 | 26 | 15 | 42 |
| Railways (Locomotives & Rolling Stock) | 5 | 7 | 3 | 15 |
| Vehicle (Exel Hand Trucks) | 126 | 271 | 306 | 703 |
| Electricity | 12 | 17 | 37 | 66 |
| Explosions | 73 | 95 | 14 | 182 |
| Fire | 2 | 17 | 38 | 57 |
| Gassing | 1 | 6 | 15 | 22 |
| Other | 220 | 1441 | 480 | 2,141 |
| TOTAL | 530 | 3,198 | 2,030 | 5,758 |

**Source:** Compilation based on Annual Reports of Workers’ Compensation Fund Control Board from 2003-2007 (ILO, 2012)

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###### **1.32.3 Accident Classification by Injury Description and Degree of Disablement**

The largest number of injuries due to occupational accidents fell in the unclassified category at 1,901. Of the injuries that were classified, the largest numbers were recorded in the following categories:

* *Contusions, Abrasions (1,646);*
* *Fracture (914);*
* *Amputation (754);* • *Burns (247).*

This accident data is in accordance with WCFCB’s annual reports for 2003 – 2007.

**Table 1.4:** Accident Classification by Injury Description and Degree of Disablement, 20032007 (ILO, 2012)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **INDUSTRY TYPE** | **DEGREE OF DISABLEMENT** | | | |
| **FATAL** | **PERMANENT** | **TEMPORARY** | **TOTAL** |
| Amputation | 1 | 666 | 87 | 754 |
| Burns | 9 | 85 | 153 | 247 |
| Contusions, Abrasions, Cuts | 44 | 495 | 1,107 | 1,646 |
| dislocation | 3 | 72 | 66 | 141 |
| Fracture | 12 | 731 | 171 | 914 |
| Internal Injuries | 12 | 19 | 12 | 43 |
| Sprain | 0 | 14 | 57 | 71 |
| Concussion | 1 | 6 | 6 | 13 |
| Asphyxiation | 0 | 0 | 0 | 0 |
| Hernia | 2 | 4 | 11 | 17 |
| Electric Shock | 3 | 2 | 6 | 11 |
| Unclassified | 442 | 1,105 | 354 | 1,901 |
| TOTAL | 529 | 3,199 | 2,030 | 5,758 |

**Source:** Compilation based on Annual Reports of Workers’ Compensation Fund Control Board from 2003-2007 (ILO, 2012)

###### **1.32.4 Accident Classification by Age Group and Degree of Disablement**

WCFCB’s annual reports for 2005– 2007 showed that the highest number of accidents by age were recorded in the following age groups: 30 – 34 (698); 25 – 29 (612); 35 -39 (603); 45 – 49 (449); 40 – 44 (440)

**Table 1.5:** Accident Classification by Age Group and degree of disablement, 2005-2007

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **AGE GROUP** | **DEGREE OF DISABLEMENT** | | | |
| **FATAL** | **PERMANENT** | **TEMPORARY** | **TOTAL** |
| 19 & Below | 1 | 1 | 0 | 2 |
| 20 -24 | 10 | 45 | 36 | 91 |
| 25 -29 | 61 | 301 | 250 | 612 |
| 30 -34 | 55 | 344 | 299 | 698 |
| 35 -39 | 56 | 290 | 257 | 603 |
| 40 - 44 | 35 | 234 | 171 | 440 |
| 45 -49 | 43 | 291 | 115 | 449 |
| 50 -54 | 18 | 172 | 85 | 275 |
| 55 -59 | 23 | 182 | 58 | 263 |
| 60 & Above | 14 | 126 | 55 | 195 |
| **TOTAL** | **316** | **1,986** | **1,326** | **3,628** |

Source: Compilation based on Annual Reports of Workers’ Compensation Fund Control Board from 2005-2007 (ILO, 2012)

**1.32.5 Estimate of underreporting of Accidents**

Underreporting of accidents to both Occupational Safety and Health Services department (OSHSd) and Mines Safety department (MSd) appears high in comparison to the number of accident reports often sent to Workers’ Compensation Fund Control Board (WCFCB). Accident reports sent to both OSHSD and MSD are fewer than the actual occurrences due to perceptions, on the part of most employers, that such reports may subject those to punitive measures from the enforcement authorities. On the other hand, a lot of employers report accident occurrences in their workplaces to WCFCB because of the motivation for compensation.

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# **1.32.6: Unsafe and Unhealthy Acts and Conditions**

What are unsafe/unhealthy acts and conditions?

To be able to define this, let us first go back to the work system composed of various elements: workers, raw materials, tools and equipment and the work environment. The interplay of these elements results in the performance of specific tasks like production of goods. But when an accident happens, the task/s will not be accomplished or will be delayed.

**Accidents**

An **accident** is an unexpected, unforeseen, unplanned and unwanted occurrence or event that causes damage or loss of materials or properties, injury or death.

**Common types of accidents:**

* fall from height and fall from the same level (slips and trips)
* struck against rigid structure, sharp or rough objects
* struck by falling objects
* caught in, on or in between objects
* electrocution
* fire

**Costs of accidents**

Corollary to accidents are costs that companies have to bear whether directly or indirectly. The cost of accidents can be best explained by the Iceberg Theory. Once an accident happens, money has to be spent for medical expenses of the injured worker/workers, insurance premiums and, in some cases, for penalty and litigation expenses. Companies also spend huge amounts to replace damaged equipment and wasted raw materials. These are what we consider as the direct costs of accidents. But these are just the tip of the iceberg.

The larger and more dangerous part of the iceberg however is the part that lies beneath the water. This represents the **indirect costs** of an accident which have a more damaging impact to the worker, their families, the company and the community in general. Indirect costs include:

1. Lost or lesser productivity of the injured – workers lose their efficiency and income due to work interruption on the day of the injury.
2. Loss of productivity among other employees due to work stoppage when assisting the injured worker, inspection or merely out of curiosity. The psychological impact of the accident reduces the workers’ productivity.
3. Loss of productivity among supervisors because instead of focusing on managing people and the work flow, they spend their time assisting the injured, investigating the accident and preparing inspection reports.
4. Hiring and training replacement workers.
5. Downtime due to equipment damage

Apart from these are humane aspects of accidents such as sorrow due to loss, hardships and inconveniences, physical pain and discomfort and psychological problems.

**Accident causation**

After knowing what accidents are and the costs that will be incurred when these happen, we will now look at the primary causes of accidents. Understanding this topic will help you identify appropriate measures to prevent accidents from happening. There are three basic causes of workplace accidents: chance occurrences, unsafe conditions and unsafe acts on the part of employees. Chance occurrences (such as walking past a plate – glass window just as someone hits a ball through it) are more or less beyond management’s control. We will therefore focus on unsafe conditions and unsafe acts.

**Unsafe/unhealthy Act:** the American National Standards Institute (ANSI) defines this as “any human action that violates a commonly accepted safe work procedure or standard operating procedure.” This is an act done by a worker that does not conform or departs from an established standard, rules or policy. These often happen when a worker has **improper attitudes**, **physical limitations** or **lacks knowledge or skills.**

Examples of unsafe acts include:horse playing, smoking in non-smoking areas, using substandard/defective tools, non - wearing of goggles/gloves, driving without license, reporting to work under the influence of liquor or drugs, and improper storage of paints and hazardous chemicals among others.

**Unsafe/unhealthy Condition:** ANSI defines this as the physical or chemical property of a material, machine or the environment which could possibly cause injury to people, damage to property, disrupt operations in a plant or office or other forms of losses. These conditions could be guarded or prevented.

Examples of unsafe conditions include: slippery and wet floors, dusty work area, congested plant lay-out, octopus wiring, scattered objects on the floor/work area, poor storage system, protruding nails and sharp objects, unguarded rotating machines/equipment, etc.

In identifying unsafe/unhealthy acts and conditions, you should be as specific as possible. The term “poor housekeeping” is a very general and vague term that does not tell you the real condition/situation of the workplace that needs to be addressed. You should avoid using general terms when citing for unsafe/unhealthy acts and conditions. Rather, you must state specifically what you are referring to, like: dusty workplace and improper storage of paints. The term “Non-wearing of Personal Protective Equipment (PPE)” is another generalized statement of an unsafe act. To be more specific, you must cite the kind of PPE that is not used or improperly worn by the worker. In this case, your observation should be: not wearing gloves and mask while mixing chemicals, not wearing goggles while welding, or not wearing safety shoes while walking on slippery surface.

It is very important to state the specific unsafe/unhealthy acts and conditions since these become the basis for recommendations to the management. A general statement of the problem will only mean a general recommendation or solution, not an accurate one. If you state that the problem is “poor housekeeping”, logically your recommended solution would be “good housekeeping”. Although this is very basic, being definite and specific in identifying unsafe/unhealthy acts and conditions is critical in convincing the management that safety and health issues in the workplace are worth their attention and commitment.

The basic remedy here is to identify and eliminate the unsafe conditions. OHS standards address these mechanical and physical accidents causing conditions. HR and the firm’s top managers should play a central role in and accept responsibility for identifying unsafe conditions. However, as the employer’s front-line managers, supervisors play a crucial role in this process too, as the “When you are on your own” feature explains.

While accidents can happen anywhere, there are some special danger zones. About one third of industrial accidents occur around forklift trucks, wheelbarrows and other handling and lifting areas. The most serious accidents usually occur near mental and woodworking machines and saws, or around transmission machinery like gears, pulleys and flywheels. Falls on stairs, ladders, walkways and scaffolds are the third most common cause of industrial accidents. Hand tools (like chisels and screwdrivers) and electrical equipment (extension cords, electric droplights and so on) are other major causes of accidents. In addition to unsafe conditions, three other work-related factors contribute to accidents: the job itself, the work schedule, and the psychological climate of the workplace.

Certain jobs are inherently more dangerous. For example, the job of crane operator results in about three times more accident related hospital visits than does the job of supervisor.

Work schedules and fatigue also effect accident rates. Accident rates usually don’t increase too noticeably during the first five or six hours of the workday. But after that, the accident rate increases faster than the increase in the number of hours worked. This is due partly to fatigue and partly to the fact that accidents occur more often during night shifts.

Unfortunately, some of the most important working condition related causes of accidents are not as obvious, because they involve workplace psychology. For example, one researcher reviewed the official hearings regarding fatal accidents suffered by offshore oil workers in the British sector of the North Sea. A strong pressure within the organization to complete the work as quickly as possible, employees who are under a great deal of stress, and a poor safety climate for instance, supervisors who never mention safety were a few of the psychological conditions leading to accidents. Similarly, accidents occur more frequently in plants with a high seasonal layoff rate and where there is hostility among employees, many garnished wages and blighted living conditions.

**Can accidents be prevented?**

**Herbert William Heinrich,** an[American](http://en.wikipedia.org/wiki/United_States)industrial safety pioneer who worked as an Assistant Superintendent of the Engineering and Inspection Division of Travelers Insurance Company, did a study on the insurance claims. After reviewing thousands of accident reports completed by supervisors, who generally blamed workers for causing accidents without conducting detailed investigations into the root causes, Heinrich found out that 98% of workplace accidents are preventable and only 2% are non-preventable. Of the 98% preventable accidents, 88% is due to unsafe/unhealthy acts or “man failure” and 10% is due to unsafe/unhealthy conditions. This study explains the rationale for focusing interventions on changing the behaviors and attitudes of workers and management towards safety and health.

**How do you prevent yourself from performing unsafe/unhealthy acts that will cause unsafe/unhealthy conditions at work?**

It is important to raise everybody’s consciousness to such a degree that we all begin to realize that our actions affect other people in the workplace, even if these appear to have nothing to do with them. If you agree that we are part of the problem, then, probably we can be part of the solution, too.

**1.33 Terminologies**

* **Occupational safety** deals withunderstanding the causes of accidents at work and ways to prevent unsafe act and unsafe conditions in any workplace. Safety at work discusses concepts on goodhousekeeping, proper materials handling and storage, machine safety, electrical safety, fire prevention and control, safety inspection, and accident investigation.
* **Occupational health** is a broad concept which explains how the different hazards and risks at work may cause an illness and emphasizes that health programs are essential in controlling work-related and/or occupational diseases.
* **Industrial hygiene** discusses the identification, evaluation, and control of physical, chemical, biological and ergonomic hazards.
* **Hazard** – a source or situation with a potential to cause harm in terms of injury, ill health, damage to property, damage to the environment or a combination of these.
* **Risk** – a combination of the likelihood of an occurrence of a hazardous event with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.

**1.34 Activities**

1. Analyse the legislative frame work governing occupational health and safety in Zambia and at the global level.
2. Explain the work hazards and risks and recommend control measures to reduce or eliminate work-related accidents and illness.
   1. **Reflection**

What do you think is the difference between unsafe and unhealthy acts at the work place?

* 1. **Summary**

In this unit, you have learnt about the laws governing occupational health and safety in Zambia and at the global level. You have also learnt how to identify work hazards and risks and the control measures to reduce or eliminate work-related accidents and illnesses. In the next unit, you will learn about the importance of house keeping.

**UNIT 2: HOUSE KEEPING**

**2.1 Introduction**

This unit aims to introduce you to the importance of good housekeeping in preventing most common accidents in the workplace.

The 5S, a Japanese concept that aims to optimize time for production, is a very practical, simple and proven approach to improving housekeeping in the workplace. Housekeeping is important because it lessens accidents and related injuries and illnesses. It therefore improves productivity and minimizes direct/indirect costs of accidents/illnesses. Housekeeping means putting everything in its proper place. It is everybody’s business to observe it in the workplace.

## 2.2 Learning Outcomes

By the end of this unit, you should be able to:

* explain the value of practicing good housekeeping;
* explain the role of management, supervisor and employees in good housekeeping activities;
* discuss good housekeeping practices.

**2.3 Time Frame**

You need about six (2) hours per week to interact with this material.

**2.4 Content**

* House Keeping at Work
* Why pay attention to House Keeping at Work
* Purpose of House Keeping
* Benefits of Good House Keeping
* House Keeping Programme
* Elements of an effective House Keeping Programme

**2.5Defining Housekeeping**

I want to begin by explaining to you what housekeeping is not: It is shown when your surroundings have:

1. cluttered and poorly arranged areas
2. untidy piling of materials
3. improperly piled-on materials that results to damaging other materials
4. items no longer needed
5. blocked aisles and passageways
6. materials stuffed in corners and out-of-the-way places
7. materials getting rusty and dirty from non-use
8. excessive quantities of items
9. overcrowded storage areas and shelves
10. overflowing bins and containers
11. broken containers and damaged materials

Do you agree with this? Housekeeping is avoiding all of the above and many more. Now instead of just being crabby and complaining about poor housekeeping, why don’t we see how we can instill and implement good housekeeping in our workplace? Look at the two pictures below. Do you know about with these seven wastes and how we can eliminate them? You got it! Through good housekeeping!

**2.6 Why should we pay attention to housekeeping at work?**

Effective housekeeping can eliminate some workplace hazards and help get a job done safely and properly. Poor housekeeping can frequently contribute to accidents by hiding hazards that cause injuries. If the sight of paper, debris, clutter and spills is accepted as normal, then other more serious health and safety hazards may be taken for granted.

Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing accidents.

**2.7Purpose of workplace housekeeping**

Poor housekeeping can be a cause of accidents, such as:

1. tripping over loose objects on floors, stairs and platforms
2. being hit by falling objects
3. slipping on greasy, wet or dirty surfaces
4. striking against projecting, poorly stacked items or misplaced material
5. cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

To avoid these hazards, a workplace must "maintain" order throughout a workday. Although this effort requires a great deal of management and planning, the benefits are many.

**2.8Benefits of good housekeeping practices**

Effective housekeeping results in:

1. reduced handling to ease the flow of materials
2. fewer tripping and slipping accidents in clutter-free and spill-free work areas
3. decreased fire hazards
4. lower worker exposures to hazardous substances (e.g. dusts, vapours)
5. better control of tools and materials, including inventory and supplies
6. more efficient equipment cleanup and maintenance
7. better hygienic conditions leading to improved health
8. more effective use of space
9. reduced property damage by improving preventive maintenance
10. less janitorial work
11. improved morale
12. improved productivity (tools and materials will be easy to find)

**2.9Housekeeping programme**

A good housekeeping programme plans and manages the orderly storage and movement of materials from point of entry to exit. It includes a material flow plan to ensure minimal handling. The plan also ensures that work areas are not used as storage areas by having workers move materials to and from work areas as needed. Part of the plan could include investing in extra bins and more frequent disposal.

The costs of this investment could be offset by the elimination of repeated handling of the same material and more effective use of the workers' time. Often, ineffective or insufficient storage planning results in materials being handled and stored in hazardous ways. Knowing the plant layout and the movement of materials throughout the workplace can help plan work procedures.

Worker training is an essential part of any good housekeeping programme. Workers need to know how to work safely with the products they use. They also need to know how to protect other workers such as by posting signs (e.g., "Wet - Slippery Floor") and reporting any unusual conditions.

Housekeeping order is "maintained" not "achieved." Cleaning and organization must be done regularly, not just at the end of the shift. Integrating housekeeping into jobs can help ensure this is done. A good housekeeping programme identifies and assigns responsibilities for the following:

1. clean up during the shift
2. day-to-day cleanup
3. waste disposal
4. removal of unused materials
5. inspection to ensure cleanup is complete

Do not forget out-of-the-way places such as shelves, basements, sheds, and boiler rooms that would otherwise be overlooked. The orderly arrangement of operations, tools, equipment and supplies is an important part of a good housekeeping program. The final addition to any housekeeping program is inspection. It is the only way to check for deficiencies in the programme so that changes can be made. The documents on workplace inspection checklists provide a general guide and examples of checklists for inspecting offices and [manufacturing facilities.](http://www.ccohs.ca/oshanswers/hsprograms/list_mft.html)

**2.10 Elements of an effective housekeeping programme:**

**Dust and Dirt Removal**

In some jobs, enclosures and exhaust ventilation systems may fail to collect dust, dirt and chips adequately. Vacuum cleaners are suitable for removing light dust and dirt. Industrial models have special fittings for cleaning walls, ceilings, ledges, machinery, and other hard-to-reach places where dust and dirt may accumulate. Special-purpose vacuums are useful for removing hazardous substances. For example, vacuum cleaners fitted with HEPA (high efficiency particulate air) filters may be used to capture fine particles of asbestos or fiberglass.

Dampening (wetting) floors or using sweeping compounds before sweeping reduces the amount of airborne dust. The dust and grime that collect in places like shelves, piping, conduits, light fixtures, reflectors, windows, cupboards and lockers may require manual cleaning.[Compressed air](http://www.ccohs.ca/oshanswers/safety_haz/compressed_air.html)should not be used for removing dust, dirt or chips from equipment or work surfaces.

**Employee Facilities**

Employee facilities need to be adequate, clean and well maintained. Lockers are necessary for storing employees' personal belongings. Washroom facilities require cleaning once or more each shift. They also need to have a good supply of soap, towels plus disinfectants, if needed. If workers are using hazardous materials, employee facilities should provide special precautions such as showers, washing facilities and change rooms. Some facilities may require two locker rooms with showers between. Using such double locker rooms allows workers to shower off workplace contaminants and prevents them from contaminating their "street clothes" by keeping their work clothes separated from the clothing that they wear home.

Smoking, eating or drinking in the work area should be prohibited where toxic materials are handled. The eating area should be separate from the work area and should be cleaned properly each shift.

**Surfaces**

Floors: Poor floor conditions are a leading cause of accidents, so cleaning up spilled oil and other liquids at once is important. Allowing chips, shavings and dust to accumulate can also cause accidents. Trapping chips, shavings and dust before they reach the floor or cleaning them up regularly can prevent their accumulation. Areas that cannot be cleaned continuously, such as entrance ways, should have anti-slip flooring. Keeping floors in good order also means replacing any worn, ripped, or damaged flooring that poses a tripping hazard.

Walls: Light-coloured walls reflect light while dirty or dark-coloured walls absorb light. Contrasting colours warn of physical hazards and mark obstructions such as pillars. Paint can highlight railings, guards and other safety equipment, but should never be used as a substitute for guarding. The program should outline the regulations and standards for colours.

**Maintain Light Fixtures**

Dirty light fixtures reduce essential light levels. Clean light fixtures can improve lighting efficiency significantly.

**Aisles and Stairways**

Aisles should be wide enough to accommodate people and vehicles comfortably and safely. Aisle space allows for the movement of people, products and materials. Warning signs and mirrors can improve sight-lines in blind corners. Arranging aisles properly encourages people to use them so that they do not take shortcuts through hazardous areas.

Keeping aisles and stairways clear is important. They should not be used for temporary "overflow" or "bottleneck" storage. Stairways and aisles also require adequate lighting.

**Spill Control**

The best way to control spills is to stop them before they happen. Regularly cleaning and maintaining machines and equipment is one way. Another is to use drip pans and guards where possible spills might occur. When spills do occur, it is important to clean them up immediately. Absorbent materials are useful for wiping up greasy, oily or other liquid spills. Used absorbents must be disposed of properly and safely.

**Tools and Equipment**

Tool housekeeping is very important, whether in the tool room, on the rack, in the yard, or on the bench. Tools require suitable fixtures with marked locations to provide orderly arrangement, both in the tool room and near the work bench. Returning them promptly after use reduces the chance of being misplaced or lost. Workers should regularly inspect, clean and repair all tools and take any damaged or worn tools out of service.

**Maintenance**

The maintenance of buildings and equipment may be the most important element of good housekeeping. Maintenance involves keeping buildings, equipment and machinery in safe, efficient working order and in good repair. This includes maintaining sanitary facilities and regularly painting and cleaning walls. Broken windows, damaged doors, defective plumbing and broken floor surfaces can make a workplace look neglected; these conditions can cause accidents and affect work practices. So it is important to replace or fix broken or damaged items as quickly as possible. A good maintenance programme provides for the inspection, maintenance, upkeep and repair of tools, equipment, machines and processes.

**Waste Disposal**

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities. Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. All waste receptacles should be clearly labelled (e.g., recyclable glass, plastic, scrap metal, etc.).

**Storage**

Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere with work but they should still be readily available when required. Stored materials should allow at least one meter (or about three feet) of clear space under sprinkler heads. Stacking cartons and drums on a firm foundation and cross tying them, where necessary, reduces the chance of their movement. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations. All storage areas should be clearly marked.

Flammable, combustible, toxic and other hazardous materials should be stored in approved containers in designated areas that are appropriate for the different hazards that they pose. Storage of materials should meet all requirements specified in the fire codes and the regulations of environmental and occupational health and safety agencies in your jurisdiction.

[***http://www.ccohs.ca/oshanswers/hsprograms/house.html***](http://www.ccohs.ca/oshanswers/hsprograms/house.html)

**Example of a workplace housekeeping checklist for construction sites?**

DO:

* Gather up and remove debris to keep the work site orderly.
* Plan for the adequate disposal of scrap, waste and surplus materials.
* Keep the work area and all equipment tidy.
* Designate areas for waste materials and provide containers.
* Keep stairways, passageways, ladders, scaffold and gangways free of material, supplies and obstructions.
* Secure loose or light material that is stored on roofs or on open floors.
* Keep materials at least 2m (5 ft.) from openings, roof edges, excavations or trenches.
* Remove or bend over nails protruding from lumber.
* Keep hoses, power cords, welding leads, etc. from lying in heavily travelled walkways or areas.
* Ensure structural openings are covered/protected adequately (e.g. sumps, shafts, floor openings, etc.)

DO NOT:

* Do not permit rubbish to fall freely from any level of the project. Use chutes or other approved devices to materials.
* Do not throw tools or other materials.
* Do not raise or lower any tool or equipment by its own cable or supply hose.

**Flammable/Explosive Materials**

* Store flammable or explosive materials such as gasoline, oil and cleaning agents apart from other materials.
* Keep flammable and explosive materials in proper containers with contents clearly marked.
* Dispose of greasy, oily rags and other flammable materials in approved containers.
* Store full barrels in an upright position.
* Keep gasoline and oil barrels on a barrel rack.
* Store empty barrels separately.
* Post signs prohibiting smoking, open flames and other ignition sources in areas where flammable and explosive materials are stored or used.
* Store and chain all compressed gas cylinders in an upright position.
* Mark empty cylinders with the letters "mt," and store them separately from full or partially full cylinders.
* Ventilate all storage areas properly.
* Ensure that all electric fixtures and switches are explosion-proof where flammable materials are stored.
* Use grounding straps equipped with clamps on containers to prevent static electricity buildup.
* Provide the appropriate fire extinguishers for the materials found on-site.
* Keep fire extinguisher stations clear and accessible.

**Housekeeping Inspection Checklist**

Use the following checklist as a general workplace guide:

**Floors and Other Areas**

* Are floors clean and clear of waste?
* Are signs posted to warn of wet floors?
* Are floors in good condition?
* Are there holes, worn or loose planks or carpet sticking up?
* Is anti-slip flooring used where spills, moisture or grease are likely?
* Are there protruding objects such as nails, sharp corners, open cabinet drawers, trailing electrical wires?
* Are personal items, such as clothing and lunch boxes, in assigned lockers or storage areas?
* Is the work area congested?
* Are floors well-drained?

**Aisles and Stairways**

* Are aisles unobstructed and clearly marked?
* Are mirrors installed at blind corners?
* Are aisles wide enough to accommodate workers and equipment comfortably?
* Are safe loading practices used with hand and power trucks, skids, or pallets?
* Is the workplace lighting adequate? Are stairs well lit?
* Are stairs covered with an anti-slip tread? Are faulty stair treads repaired?

**Spill Control**

* Are all spills wiped up quickly?
* Are procedures followed as indicated on the material safety data sheet?
* Are spill absorbents used for greasy, oily, flammable or toxic materials?
* Are used rags and absorbents disposed of promptly and safely?
* Is a spill area surrounded by a barrier to prevent a spill from spreading?

**Equipment and Machinery Maintenance**

* Is equipment in good working order, with all necessary guards or safety features operational or in place?
* Is equipment damaged or outdated?
* Are tools and machinery inspected regularly for wear or leaks?
* Is equipment repaired promptly?
* Are drip pans or absorbent materials used if leaks cannot be stopped at the source?
* Is a machine that splashes oil fitted with a screen or splash guard?
* Are machines and tools cleaned regularly?

**Waste Disposal**

* Are there adequate numbers of containers?
* Are there separate and approved containers for toxic and flammable waste?
* Are waste containers located where the waste is produced?
* Are waste containers emptied regularly?
* Are toxic and flammable waste chemicals handled properly?

**Storage**

* Are storage areas safe and accessible?
* Is material stacked securely, blocked or interlocked if possible?
* Are materials stored in areas that do not obstruct stairs, fire escapes, exits or firefighting equipment?
* Are materials stored in areas that do not interfere with workers or the flow of materials?
* Are bins or racks provided where material cannot be piled?
* Are all storage areas clearly marked?
* Do workers understand material storage and handling procedures?

**Fire Prevention**

* Are combustible and flammable materials present only in the quantities needed for the job at hand?
* Are combustible and flammable materials kept in safety cans during use?
* Are hazardous materials stored in approved containers and away from ignition sources?
* Are sprinkler heads clear of stored material?
* Are fire extinguishers inspected and located along commonly travelled routes, and close to possible ignition sources?
* Are oily or greasy rags placed in metal containers and disposed of regularly?

**Example of a workplace housekeeping checklist for stockpiling**

**Lumber**

* Lay lumber before stacking on a solid level sill.
* Use cross-piling or cross-stripping whenever the pile exceeds 1.2 meters (4 ft.) in height.
* Exercise care when cutting bands used to bundle lumber. Avoid being trapped by falling materials.

**Reinforcing steel**

* Use wooden spacers to separate piles of reinforcing steel.
* Unload reinforcing steel by mechanical means whenever possible.
* Check all bundles for broken or weak tie wires before attempting to unload.

**Pipe**

* Stack pipe on solid, level sills only. Block pipes to prevent them from rolling.
* Place lagging between layers to reduce the pressure and prevent the pile from spreading.
* Remove pipe from ends of the pile.
* Do not stack pipe higher than 1.5 meters (5 ft.).

**Structural steel**

* Pile structural steel to prevent tipping and slipping.
* Give special attention when loading structural steel from trucks.
* Place slings on steel before releasing binder chains.

**Bagged and stacked material**

* Maintain stability.
* Do not allow piles to exceed ten bags in height unless the face of the piles are supported by the walls of a storage bin or enclosure.
* Cross-pile bagged materials on skids and pile only to a convenient height. The height depends on the nature and ability of the mechanical aids used and the weight of the bagged materials.

**Bricks, Blocks, Tiles**

* Pile bricks, blocks or tiles on a solid, level surface only.
* Use extreme caution when removing metal bands.
* Do not stockpile material on a scaffold beyond the safe loading capacity.

**Example of a Workplace Housekeeping Checklist**

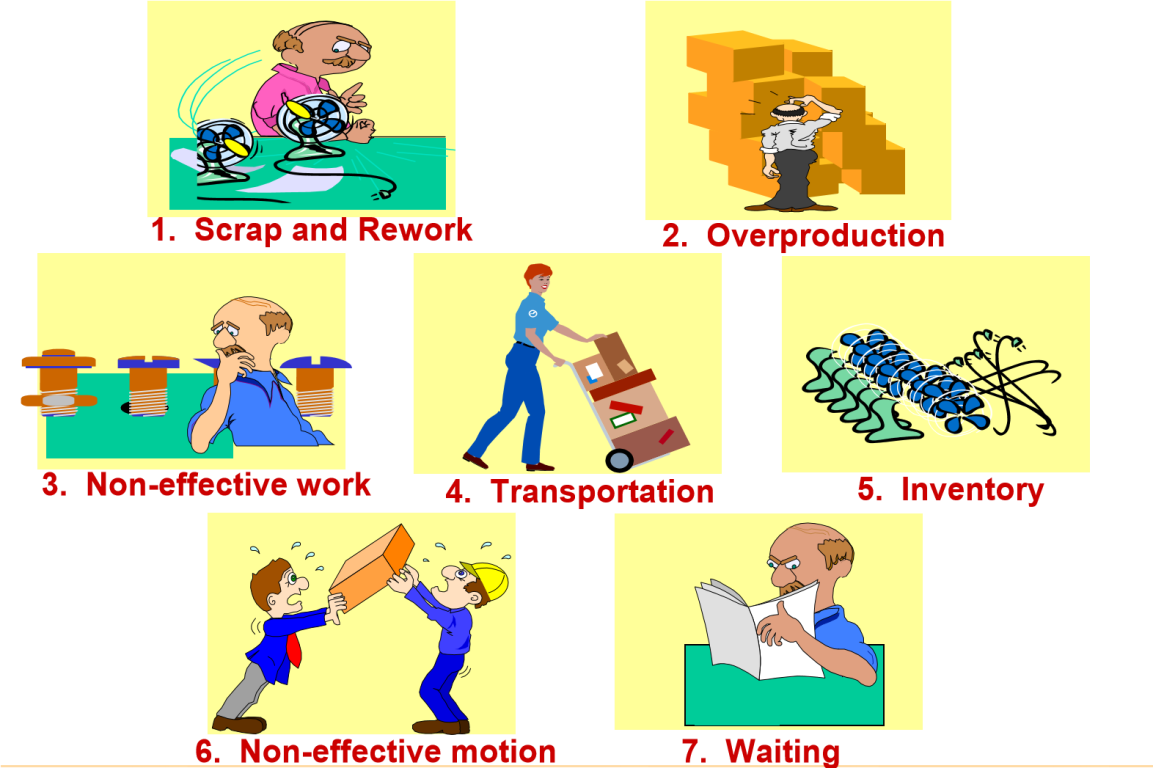
DO:

* Minimize fire hazards by keeping workplace free of accumulated combustible materials and waste.
* Ensure that exits and aisles are clear of obstructions to allow easy evacuation of the building.
* Place all trash and scrap in proper containers.
* Keep oily rags in covered metal containers.
* Dispose of hazardous materials in approved marked containers.
* Store equipment and materials in their assigned location.
* Clean air vents and filters to maintain ventilation efficiency.
* Ensure that boxes, drums, and piles are located on a firm foundation and properly stacked.
* Clean up tools and unused materials after finishing a job or before leaving the job site.
* Clean up spills promptly according to procedures, using personal protective equipment (PPE) where necessary.
* Report hazards such as uneven boards, cracks, burnt-out lights. Fix immediately.
* Bundle hoses and cables when not in use.
* Place empty containers and pallets in designated locations.
* Dump small containers into larger ones.
* Keep only enough combustible materials at job site for job at hand.

DO NOT:

* Do not pile material around fire extinguishers, sprinklers, or emergency exits.
* Do not leave clean-up to last few minutes of shift or day.
* Do not clean equipment without "locking out."
* Do not reach into waste containers. Dump contents or remove bag.
* Do not blow off dust with compressed air. Use a vacuum or brush.
* Do not collect broken glass and metal straps in plastic bags.
* Do not use bare hands when collecting waste. Wear gloves to avoid cuts and splinters.
* Do not place materials on stairs.
* Do not use kegs or boxes as chairs or ladders.

### SEVEN (7) WASTES



Source: [***http://www.ccohs.ca/oshanswers/hsprograms/cklstcon.html***](http://www.ccohs.ca/oshanswers/hsprograms/cklstcon.html)

What is 5S?

5S is a systematized approach to:

* organizing work areas
* keeping rules and standards
* maintaining discipline

5S utilizes:

* workplace organization
* work simplification techniques

5S practice…

* develops positive attitude among workers
* cultivates an environment of efficiency, effectiveness and economy

5S Philosophy

* Productivity comes from the elimination of waste
* It is necessary to attack the root cause of a problem, not just symptoms
* Participation of everybody is required
* To acknowledge that the human being is not infallible

**5S Terms:**

1. **Sort** – is the first S which means sorting out unnecessary items and discarding them.
   * Make the work easy by eliminating obstacles
   * Eliminate the need to take care of unnecessary items
   * Provide no chance of being disturbed with unnecessary items
   * Prevent faulty operation caused by unnecessary items.
2. **Systematise** – is the second S which means we need to organize things

**How to SYSTEMATISE Your Workplace**

**Items**

**Necessary**

**SORT**

**Stratification**

**Required**

**Action**

**Items frequently**

**used**

**Must be placed**

**near the point**

**of use**

**Items sometimes**

**used**

**Can be placed**

**farther away**

**Items not**

**used at all**

**must be kept**

**Must be stored**

**separately with**

**clear**

**identification**

**SYSTEMATISE**

Source: [***http://www.ccohs.ca/oshanswers/hsprograms/cklstcon.html***](http://www.ccohs.ca/oshanswers/hsprograms/cklstcon.html)

7 Systematise Principles:

* + - * Follow the first-in-first-out (FIFO) method for storing items
      * Assign each item a dedicated location.
      * All items and their locations should be indicated by a systematic labelling
    - Place items so that they are visible to minimize search time
    - Place items so they can be reached or handled easily.
    - Separate exclusive tools from common ones.
    - Place frequently used tools near the user.

1. **Sweep** – is the third S which means we have to sanitize or clean our workplace.
   * + Keep environmental condition as clean as the level necessary for the products
     + Prevent deterioration of machinery and equipment and make checking of abnormalities easy
     + Keep workplace safe and work easy
2. **Standardize** – is the fourth S which means we have to standardize what we are doing.
3. **Self- Discipline** – is the fifth and last S which means we have to do this process without prodding.

Good housekeeping is needed for quality improvement. By this we lessen rejects/losses. If the workplace is in order, it is easy to do the job. An easier job, having no defects, continuous production and an orderly workplace is akin to work improvement. It is important to note that ISO Certification is a must and as such, the impression of a company to the community is very important. A company that follows good housekeeping principles will surely be recognized as a provider of quality service and products.

**Steps in implementing 5S**

**Step 1: Preparations**

1. Understanding 5S concepts and benefits by the CEO
2. CEO’s visit to the 5S model companies
3. CEO’s commitment to 5S implementation
4. Organize 5S working Committee
5. 5S facilitators
6. Train facilitators and practitioners

**Step 2: Management’s official announcement**

1. CEO officially announces implementation of 5S programme
2. CEO explains the objectives of 5S to all colleagues
3. Publicize 5S organizational chart and lay-out
4. Work out various promotional tools

**Management’s Role**

* + Providing adequate equipment
  + Including housekeeping in the planning of all operations
  + Including maintenance of good housekeeping as part of individual’s job responsibility
  + Providing clean-up schedule and personnel
  + Maintaining executive supervisory and interest

**Supervisor’s Role**

* + Maintaining constant check on housekeeping conditions
  + Seeing that employees maintain good housekeeping
  + Having unusual situations corrected or cleaned up immediately
  + Planning for orderliness in all operations
  + Issuing definite instructions to employees
  + Insisting on clean-up after every job

**Worker’s Role**

* + Follow housekeeping procedures
  + Maintain an orderly workplace
  + Report to supervisors any unsafe condition

**Step 3: Big clean-up day**

1. Organize a big clean-up day after 5S implementation announcement by CEO
2. Divide company premises into small areas and assign a small group of people for each area
3. Provide enough cleaning tools and materials
4. This big cleaning must include public areas such as gardens, canteen and car park
5. Everybody must participate in this big cleaning day

**Step 4: Initial sort**

1. Establish disposal standards for unnecessary items
2. Apply “Disposal Notices” to all questionable items
3. Carefully examine responses to disposal notices
4. Dispose unnecessary items according to disposal standards
5. A company-wide sort should be planned and practiced annually

**Daily Sweep and Systematise activities**

* 1. Identify areas for improvement and work out a priority listing by colleagues
  2. Select untidy, inconvenient and unsafe areas
  3. Set each activity for 3-6 months
  4. Organize presentations by small groups
  5. Standardize good 5S practices visibly
  6. Motivate colleagues for creative improvements

**Hard 5S – refers to all facets of the work environment**

* 1. Furniture – tables, shelves, drawers
  2. Equipment – computers, projector, fax, copier
  3. Lay-out of desk and equipment

**Soft 5S**

* 1. Office policies and procedures
  2. Dress code
  3. Sharing of responsibilities, telephone etiquette

**5S Office guidelines**

Desks

* Do not place anything under your desk
* Dispose of unnecessary items in your drawers
* Arrange items in your desk drawers neatly for easy retrieval
* Do not pile up documents on your desk top
* Wipe your desktop every morning
* Do not leave unnecessary things on your desk top when you go home

Office machines

* Clean office machines and equipment regularly
* Set electric cables neatly for safety and good appearance
* inspect machines regularly and take action for required servicing

Toilets

* Flush after use
* Wash hands after using the toilet
* Clean up toilet and wash basin everyday
* Replenish toilet paper, soaps and paper towels
* All users should always try to keep toilets clean and tidy
* Check exhaust fans regularly for effective function

Canteen

* Do not leave unnecessary things on the dining table
* Tuck chairs properly after use
* Return chairs and tables to their original location when used for meetings or functions
* Put away all cups and plates after each meal
* Clean up tables immediately after each meal

Hallways

* Do not smoke while walking in the hallways
* Do not place anything in the hallways without permission
* Pick-up and dispose any waste in the hallway
* Avoid talking loudly along hallways

Notice Boards

* Ensure that outdates notices are removed
* Ensure that all information are updated regularly
* Items should be neatly aligned and properly secured
* Pins must be readily available
* Check that the location of notice boards are appropriate

**Visual Control** - a technique that enables people to make the rules easy to follow, differentiate normal and abnormal situations and act accordingly, with the use of visual aids.

**Pointers in making visual control**

* 1. Should be easy to see from a distance
  2. Should be properly and strategically located
  3. Should be easy to follow
  4. Should facilitate distinction of what is right and what is wrong

**Step 5: Periodic 5S audits**

1. Establish 5S evaluation and incentive plan
2. Conduct 5S evaluation and inspection regularly
3. Organize 5S inter-department competition
4. Periodically award groups and individuals
5. Organize study tours to other companies
6. Organize 5S inter-company competition

**Purpose of 5S audit**

1. Turn PDCA Cycle (Plan-Do-Check-Act)
2. Analyze the results of actual implementation in the workplace
3. Give support and guidance to the members of each unit
4. Dissemination of good practices
5. Regular audit sustains the program

**Key points in the implementation of 5S**

1. Start small, easy and proceed slowly but steadily
2. Start with the most suitable “S”
3. Only one or two “S” are enough for the initial practice
4. Set simple, easily achievable and step by step targets
5. Everyone’s participation is important
6. Management should take leadership of 5S movement
7. Record improvements for comparison
8. Devise schemes to stimulate awareness and stimulate enthusiasm

**5S Evaluation procedure**

* 1. Walking rally – by to and middle management
  2. Fixed point photograph – visual comparison of “before” and “after”
  3. Achieved level of evaluation – for predetermined targets which are upgraded step-by-step after each evaluation
  4. Competition – among departments /workplaces
  5. Combination of the above

**5S Evaluation Form**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ITEM** | **FOCUS** |  | **SCORE** | | |  |
| Desks / tables / chairs | Are they tidy and conveniently organized? | 10 | 8 | 6 | 4 | 2 |
| Cabinets/shelves | Are they clean and labelled for the easy retrieval of things needed? | 10 | 8 | 6 | 4 | 2 |
| Documents/files | Are they clean and systematically organized? | 10 | 8 | 6 | 4 | 2 |
| Forms/office supplies | Are they tidy and conveniently stored for retrieval? | 10 | 8 | 6 | 4 | 2 |
| Telephones | Are they clean and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Facsi-miles | Are they clean and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Typewriters/wordprocessors | Are they clean and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Computers/monitors | Are they clean and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Printers | Are they clean and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Copying machines | Are they clean and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Electric wiring | Is it tidy, safe and conveniently laid out for operation? | 10 | 8 | 6 | 4 | 2 |
| Lighting/ventilation | Are they adequate for efficient operation? | 10 | 8 | 6 | 4 | 2 |
| Floors/walls/windows/ceiling | Are they dust-free and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Fire extinguishers | Are they adequate and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Emergency exits | Are they adequate and clear of  obstacles in case of emergencies? | 10 | 8 | 6 | 4 | 2 |
| Safety devices | Are they adequate and wellmaintained? | 10 | 8 | 6 | 4 | 2 |
| Working clothes/shoes | Are they clean and do they present a good image? | 10 | 8 | 6 | 4 | 2 |
| Waste baskets | Are clean and well-maintained? | 10 | 8 | 6 | 4 | 2 |
| Others |  | 10 | 8 | 6 | 4 | 2 |

Source:[***http://www.ccohs.ca/oshanswers/hsprograms/house.html***](http://www.ccohs.ca/oshanswers/hsprograms/house.html)

**Factors leading to the success of 5S**

1. Strong sponsorship and leadership of CEO
2. Active promoter/5S committee
3. Good launching activity
4. Regular audits
5. Good documentation
6. Visits by external consultants
7. Competition

**Factors that hinder the success of 5S**

1. Project sponsor is not the decision maker
2. Organizational policies
3. Lack of experience in undertaking cross-functional activities
4. Lack of top management support
5. Implementation carried out through orders from the management
6. Implementation done by task forces
7. 5S treated as a project
8. Emphasis on immediate results
   1. **Terminology**

Housekeeping means ensuring that the work environment is kept tidy and that no objects or substances are improperly stored or kept which may have the potential of causing occupation accidents or illnesses.

**2.12 Activity**

Discuss the role of management, supervisor and employees in good housekeeping activities.

**2.13 Reflection**

What do you think is the value of practicing good housekeeping?

**2.14 Summary**

In this unit, you have learnt about how you can make your work area more pleasant and conducive to working, thus creating and improving work efficiency, safety and quality of work and products. You have also learnt that 5S is an integrated approach for production, quality, lower costs, on time delivery, safety, and morale. In the next unit, you will learn about materials handling and storage.

**UNIT 3: MATERIALS HANDLING AND STORAGE**

**3.1 Introduction**

This unit introduces you to materials handling and storage is a technique which includes the art of lifting, placing, storing or movement of materials through the use of one’s physical strength or appropriate handling equipment. Materials handling has two general classifications: manual materials handling and mechanical materials handling.

**3.2 Learning Outcomes**

By the end of this unit, you should be able to:

* demonstrate methods of safe manual handling;
* discuss safe procedures in mechanical handling; and
* explain standard requirements on materials storage.

**3.3 Time Frame**

You need about six (2) hours per week to interact with this material.

* 1. **Content**
* Manual Materials Handling
* Types of Protective Clothing
* Lifting Guidelines
* Mechanical Materials Handling
* Workspace Layout
* Materials Storage
* Solving Materials Handling

### **3.5Manual Materials Handling**

Manual materials handling (MMH) means moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining using one’s physical strength. MMH is also the most common cause of occupational fatigue, low back pain and lower back injuries. It is riskier than one might think as it could lead to strains, sprains, wounds, fractures, and hernias.

Workers should also be reminded to stop and think before lifting any load and ask yourself whether there is an even safer way to do the job.

MMH is always hazardous but the level of hazard depends on **what you are handling**, **what the task is**, and **what the conditions are at the workplace or work site**. For example, the material or load that you are handling may be:

* too heavy for the task that you are doing
* located too high or low for a safe lift
* too big or may have a shape that makes it hard to handle
* wet, slippery, or have sharp edges that makes it hard to grasp
* unstable or can shift its centre of gravity because the contents may flow (e.g., a partially filled drum or concrete in a wheelbarrow)
* too big to let you see where you are putting your feet

The task can make MMH hazardous if a worker:

* uses poor lifting techniques (lifting too fast, too often, too long, with back bent, while twisting or reaching too far, etc.)
* has to move material over long distances
* does not take appropriate rest breaks
* has insufficient recovery time
* has a combination of handling tasks (e.g. lifting, carrying and lowering).

The conditions where you are working can also contribute to hazards of MMH and result in injuries. Examples of these conditions are:

* surfaces that are uneven, sloping, wet, icy, slippery, unsteady, etc.
* differences in floor levels or elevations
* poor housekeeping
* inadequate lighting
* cold or very hot and humid working environment
* windy conditions
* fast pace of work
* restricted movement because of clothing or lack of space

Manual materials handling also involve pushing and pulling motions at work. You use various pushing and pulling techniques in a wide range of activities, such as:

* using manual carts and trucks
* sliding objects such as cartons on flat surfaces (tables, floors, etc.)
* operating tools and controls
* opening and closing doors
* wrapping or enclosing objects in packaging materials

Because these actions are among the most common work activities, they are also the cause of many injuries. However, there are no comprehensive injury statistics. The injuries resulting from these activities are not always recorded very specifically as well.

Most common are overexertion injuries (e.g., back strain). Injuries due to slips and falls are also often associated with pushing and pulling. Additionally, injuries to fingers and hands can result when caught in, on, or between objects (e.g., between a cart and the wall) and to lower legs when bumped by carts. Therefore, existing statistics do not reflect the importance of pushing and pulling as work factors causing injury because the injuries fall into different categories making them difficult to analyze.

Because of the complex nature of body motion during pushing and pulling, no numerical standard has yet been developed that can be directly applied in industry. Many factors affect the amount of force that you exert in a horizontal push and pull:

* body weight and strength
* height of force application
* direction of force application
* distance of force application from the body
* posture (bending forward or leaning backward)
* friction coefficient (amount of friction or grip between floors and shoes)
* duration and distance of push or pull

**3.6 Types of protective clothing to be worn**

DO WEAR

* + lightweight, flexible, tear and puncture-resistant clothing;
  + safety boots with toe caps and slip-resistant soles, and
  + protective gloves, appropriate for the materials being handled.

DO NOT WEAR

* + aprons, coats,
  + clothing with exposed buttons, zippers or loose flaps, or
  + heavy duty mitts.

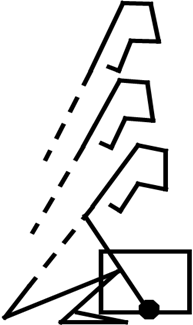
**3.7Lifting guidelines**

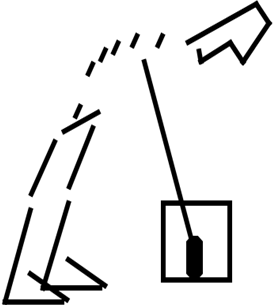
**Before lifting…**

* + - * Always check to see if mechanical aids such as hoists, lift trucks, dollies, or wheelbarrows are available.
      * Get help with heavy or awkward loads.
      * Assess and identify the weight of the load.
      * Be sure that you can lift the load without over-exertion.
      * Be sure that the load is "free" to move.
      * Check if the planned location of the load is free of obstacles and debris.
      * Be sure that the path to the planned location of the load is clear. Grease, oil, water, litter and debris can cause slips and falls.
      * Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, [**compact loads**,](http://www.ccohs.ca/oshanswers/ergonomics/mmh/compactloads.html)[**smallbags**,](http://www.ccohs.ca/oshanswers/ergonomics/mmh/compactbags.html)**large sacks**, **drums, barrels, cylinders, sheet materials like meta**l or glass).
      * Do not lift if you are not sure that you can handle the load safely.

**General tips for lifting**

* + - * Examine the load and the surrounding area prior to lifting.
      * Prepare for the lift by warming up the muscles.
      * Stand close to the load and face the way you intend to move.
      * Use a wide stance to gain balance.
      * Be sure you have a good grip on the load.
      * Look forward to keep back straight
      * Keep arms straight.
      * Tighten abdominal muscles.
      * Tuck chin into the chest.
      * Initiate the lift with body weight.
      * Use muscle power of the legs in lifting
      * Lift the load as close to the body as possible.
      * Lift smoothly without jerking.
      * Avoid twisting and side bending while lifting.

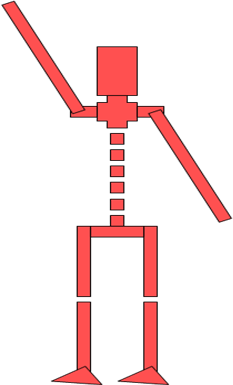
**Wrong Way** **Right Way**



**Human Body**

**Your back**

**Protect it**



**WEAK**

**STRONG**

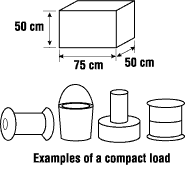
**Your legs**

***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

**Use their power to lift**  **correctly…and safely!**

***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

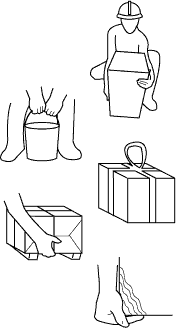
**A. Lifting a compact load**

 A compact load can be lifted between the knees.

***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

**Remember to:**

* + - * + Stand close behind the load.
        + Straddle the load:

Place the leading foot flat beside the load in the direction of travel.

Place the rear in the direction of travel.

* + - * + Bend the hips and knees.
        + Keep your back straight.

**When lifting…**

* + - * + Grasp the load with elbows inside the thighs:

Use a power grasp for loads with handles.

Use slings or hooks to improve grasp when loads do not have handles.

Use blocks under loads without handles to make lifting them up easier and safer.

o Use a ledge grasp for loads without handles.

* + - * + Grasp with one hand at the outer, upper corner, over the leading foot and the other hand on the lower, opposite corner.
        + Lean forward with the rear arm straight. This position gets the load moving.
        + Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
        + Keep the load close to the body.
        + Keep the rear arm straight.
        + Move off without twisting the body.

**When putting a load down…**

* + - * + Take a wide stance with one foot in front of the other.
        + Keep the load close to the body.
        + Keep the back straight.
        + Bend the hips and knees.
        + Set the load down onto the ground.
        + Keep the load tilted to avoid bruising fingers.
        + Remove fingers from under the load.
        + Stand up smoothly, easing muscles.
        + Avoid jerky releases.

***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/compactbags.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/compactbags.html)

**B. Lifting compact bags**

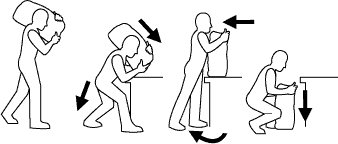
The best way to handle a bag depends on its size, weight and how far it is to be carried.

**When lifting, remember to:**

* + - * Straddle the end of the bag.
      * Bend the hips and knees.
      * Keep the back straight.
      * Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.
      * Lean forward, straightening the knees to set the bag upright.
      * Readjust the straddle position moving feet closer to the bag.
      * Readjust the grasp, with one hand clasping the bag against the body and the other under it.
      * Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
      * Thrust the bag up with the knee while straightening the body.
      * Put the bag on the shoulder opposite the knee used to thrust the bag up.
      * Stabilize the bag on the shoulder.
      * Move off without bending sideways.

**When lowering the bag…**

* + - * Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from your coworker.
      * Stand close to the platform.
      * Place one foot in front of the platform.
      * Bend hips and knees.
      * Keep the back straight.
      * Ease the bag off the shoulder and put it upright on the platform.
      * Pull the bag slightly over the edge of the platform.
      * Stand close to the platform with the bag touching the chest.
      * Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
      * Step back.
      * Bend hips and knees, keeping back straight.
      * Ease the bag on the floor.

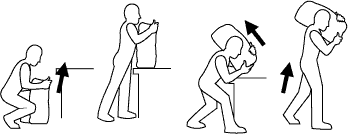


***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/sacks.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/sacks.html)

**C. Lifting sacks**

**C.1. Heavy/large sacks -** Lift heavy and large sacks in two stages using an intermediate platform. When lifting, remember to:

* + - * Straddle the end of the sack.
      * Bend the hips and knees.
      * Keep the back straight.
      * Grasp the bag with both hands under the end closest to you. Keep elbows inside the thighs.
      * Lean forward and straighten the knees to set the bag upright.
      * Move your feet closer to the sack.
      * Squat with the sack between the thighs with one foot flat on the floor in front of the other.
      * Grasp with elbow inside the thighs. With one hand clasp the sack against the body and the other hand is holding the bottom of the sack.
      * Stand up in one smooth motion.
      * Place the sack upright on the platform.
      * Place one foot in front of the other with the front foot alongside of the platform.
      * Bend the hips and knees and keep the back straight.
      * Put one shoulder against the sack.
      * Readjust your grasp.
      * Lean the sack on the shoulder.
      * Stand up and straighten the hips and knees.



**C.2. Bulky sacks -** Bulkier sacks are easier to carry on your back. Lift onto your back from a platform as described above.

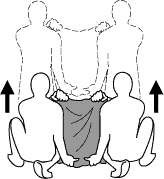
* + - * Move the sack to the edge of the platform.
      * Put your back against the sack.
      * Grasp with both hands on the upper corners of the sack.
      * Ease the sack onto the back, bending hips and kneesbefore taking the weight.
      * Keep the back straight.
      * Stand up and straighten the hips and knees.
      * Stabilize the sack.
      * Move away without bending sideways.

**C.3. "Two-person lift and stack"**

* + - * Position one person on either side of the sack.
      * Squat with one foot balancing behind the sack.
      * Keep back straight.
      * Grasp with the outer and on the upper corner, the other holding the bottom of the sack.

On one person's command:

* + - * Stand up and straighten the hips and knees.
      * Move towards the stack
      * Put the sack on the stack



***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

### **3.8Mechanical materials handling**

As the name suggests, this pertains to use of rigid, manually or mechanically-powered equipment mainly for handling bulky and heavy items.

***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

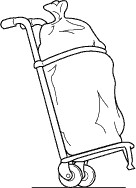
1. **Manually powered materials handling equipment** reduce physical effort, making materials handling easier and safer. Here are some tips when using mechanical aids:
   * Check for the availability of mechanical aids before lifting or moving loads.
   * Do not operate any equipment if you are not trained to use it.
   * Keep the equipment in good operating condition. It saves effort while transporting loads.
   * Select the right equipment to complete the task.
   * Specific tasks or objects require specialized equipment.
   * Do not operate any equipment if you are not trained to use that equipment.
   * Keep the equipment in good operating condition. It saves effort while transporting loads.

Here are some manually powered materials handling equipment:

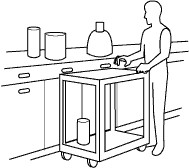
* + Use **rolling platforms** to assist in carrying and handling heavy objects where limited space does not allow for comfortable body position.



* + Use a **hand truck** to move bulky objects.

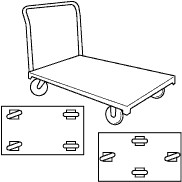


* + Use a **shelf truck** to move a variety of objects.

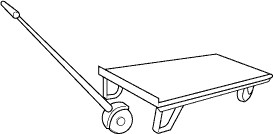


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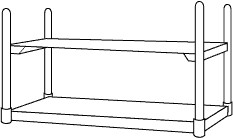
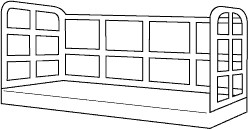
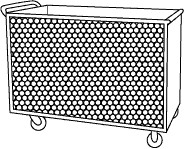
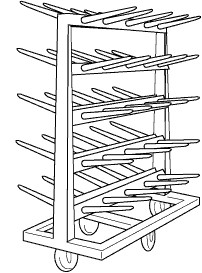
Use a **platform truck** to move heavy, irregularly shaped objects.



* + Use a **semi-live skid** for temporary storage.

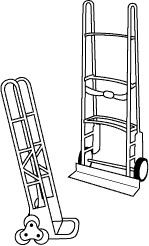


* + Select the **rack or bin** that suits the task and mount on semi-live skid or platform truck.



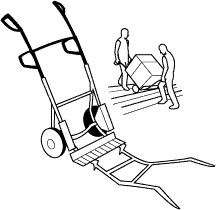
***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

Select a **stair climbing truck** when moving load on stairs.

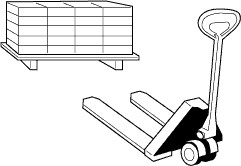


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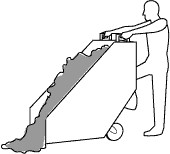
* + Choose a sturdy **frame hand truck** with larger wheels to move materials in rough terrain. Additional set of handles allows for assistance.

  
***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

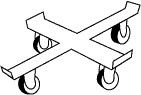
* + Use a **pump truck** to move materials stored on pallets.

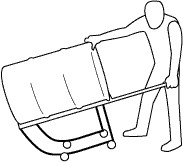


* + Move and dump waste materials with **dump trucks.**

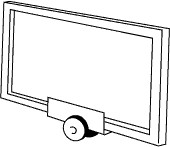
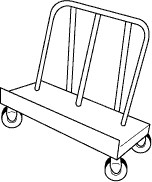


Move and empty drums with **tilting drum cradles** and **drum dollies**.





* + Handle sheet materials with an **"A" frame hand truck** or **dolly**.



***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

1. Mechanically-powered materials handling equipment are classified into two: lifting equipment and transport equipment. Lifting equipment includes a variety of items for lifting heavy and bulky items with minimal human intervention such as hoists and cranes. Transport equipment, on the other hand, consists of forklifts, dump trucks, trailers and conveyors among others.

To ensure safe operation of mechanically-powered handling equipment, the following precautions must be observed:

* + A worker must not operate an equipment if he is not trained to use it;
  + Operators must be certified and authorized;
  + Operators must be trained in safety and health involving handling equipment operation; and,
  + Equipment must be properly maintained and regularly inspected.

In both manually-powered and mechanically-powered materials handling equipment, you can use **accessories** such as ropes, chains or steel/plastic straps to secure loads and prevent them from sliding or falling from the equipment.

**Ropes**

* + You should know what particular rope can handle particular tasks/loads.
  + Keep rope in good condition all the time.

**Chains**

* + Do not let chains get kinked, knotted or twisted.

**Steel and plastic straps**

* + Make sure straps are not too loose or tight.
  + Do not lift by the strap unless the same is designed for that purpose.

**3.9Workspace lay-out**

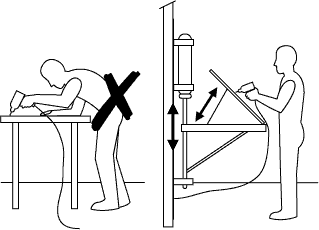
**Workspace** is the area within which you perform the tasks that add up to your job. The physical design of a workspace includes setting the amount of space needed and the positioning of furniture, tools, equipment and any other items necessary to perform the tasks, in respect to proper posture, access, clearance, reach and vision of the user.

Poor design of the workspace or bad arrangement of furniture or equipment, may result in injuries and strains due to adoption of uncomfortable working postures, less 'spare' capacity to deal with unexpected events or emergencies, increased possibility of errors or accidents, and inefficiency.

How do you optimize your workspace for maximum protection and productivity?

Thelayout or organization of the work area must allow materials to be handled without excessive bending, twisting and stretching reduces injuries.

* Have all materials at work level.
* Use adjustable elements at the workplace.

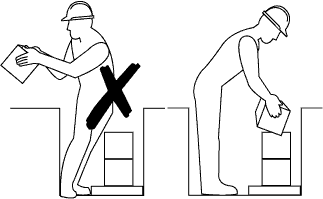


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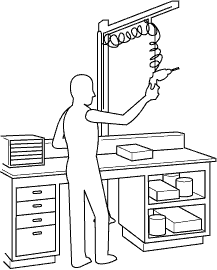
* Workbench with adjustable height and tilt improves working position.



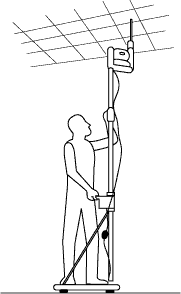
* Self-adjusting platform automatically matches worker's height.



* Ensure that there is enough room to turn around to prevent twisting.



* Use adjustable supports or suspenders to operate heavy tools.
* Tool suspender reduces muscular effort and compression on the back.



***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

* Tool support eliminates over-stretching and overreaching.
* Lift-and-tilt device and side opening on bin reduces bending.
* Use bins that allow easy access.

**3.10 Materials Storage**

Materials storage could easily be neglected at times in an actual work setting. When neglected, it leads to cluttering, piling of one material over another and obstruction of passageways. Understanding some general requirements on proper and safe materials storage would be useful.

Materials should be stored neatly and orderly. A variety of ways and means could easily be adopted and maintained.

Firstly, materials should be housed in a storage room with the following features:

* at least two exits
* properly illuminated
* properly ventilated
* restricted access

Next, materials should be stored in limited amounts. This can be accomplished by providing special storage racks of limited capacity for similar items, examples of which are special storage racks.

Also, materials that you need more frequently and use must be placed closer to you.

Furthermore, materials must not obstruct alarm boxes, sprinkler system control, firstaid equipment, fuse boxes and importantly, aisles and exits.

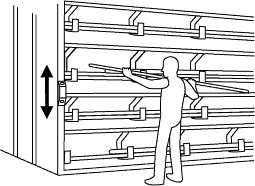
This sounds familiar, yet this has been a common observation in companies OSHC has audited. Particularly common are unmarked fuse boxes obstructed by raw materials and drums, making them difficult to reach in case of an electrical emergency.

Even more common are aisles cluttered with raw materials and finished products. During normal occasions clutter can prevent you from knowing where to go. How much more in case of emergencies? Obstructed passageways will surely cause disaster when employee evacuation is necessary.

***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

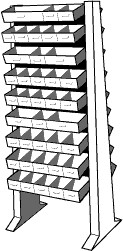
**What should be remembered when setting up a storage area?**

* Store materials at a convenient height.
* Leave the lowest shelf unused if necessary.
* Use vertically mobile shelves to avoid bending and overhead reaching.

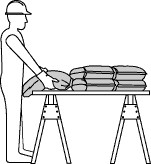


***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

* Use bin racks for storing small items.



* Store heavy and frequently used materials at waist height.

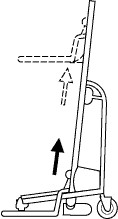
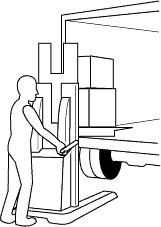


* Do not store materials at floor level.

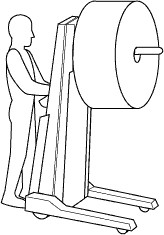


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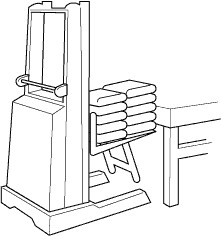
* Use hand trucks with elevating devices in storage and loading areas.



Winch-operated

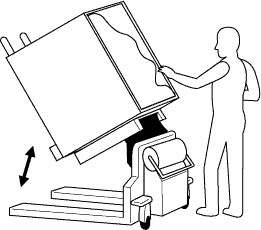


Coil handling



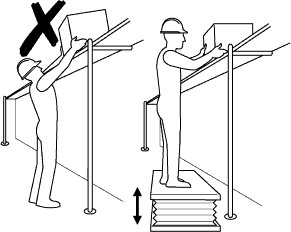
Position work

* Use trucks with a tilting device to avoid bending.



Box tilter

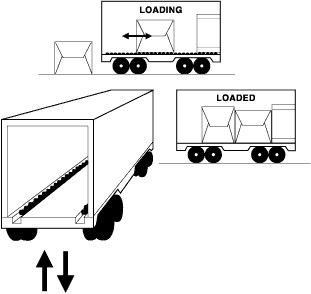
* Use elevating platforms to avoid overhead reaching.



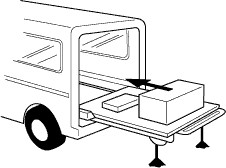
***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/materials\_flow.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/materials_flow.html)

**What can be done to reduce the amount of times material is moved or handled?**

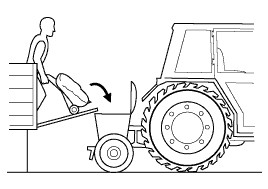
* Use rollers to eliminate manual lifting and carrying.
* Use floor rollers while loading or unloading trucks to reduce lifting.



* Use a sliding bed while loading and unloading small trucks to avoid overreaching and carrying in an awkward position.

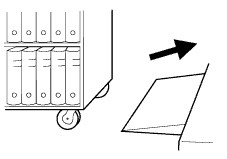


* Eliminate extra loading or unloading steps where possible.
* Unload as close as possible to the place where material will be needed.

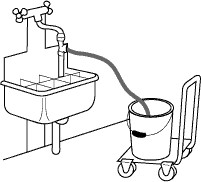


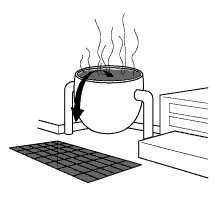
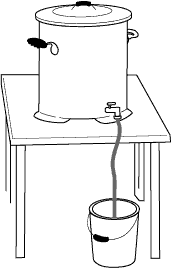
***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

* Use ramps to avoid lifting and dragging over edges.



* Use containers that allow fluids to pour or empty without lifting the container.





***Source:*** [***http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html***](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mmhintro.html)

**3.11Solving materials handling problems**

While quick and easy mobilization and storage of materials is a necessity in the workplace, the tendency to deviate from a safe way of doing it happens, unmindful of the adverse consequences to both the person and the material.

These are simple things to consider in solving materials handling problems:

**What will be moved?** Determine the item/s you wish to move and then adopt the applicable method that will provide safety for you and protection for the material.

**Where to move these items?** A simple mapping of the movement direction could save time and effort.

**How often will these be moved?** There are certain materials that are moved every now and then depending on the need. Provisions for easy movement should be made in these cases.

**How many will be moved?** Always have special handling equipment that could do the job especially if there is a large number of a material to be moved.

**How far will the materials be moved?** In order to minimize time and effort, the distance to be moved must be considered. It is suggested that only in rare instances should an item or material be moved to a far location, particularly if this would involve manual handling. Observe the location of the storage with respect to its movement: the closer it is, the less movement is needed.

**How will the materials be moved?** Manual or mechanical handling may be used, depending on the circumstances and characteristics of the materials.

With these guidelines, possible injury to you or your co-workers can be eliminated and total protection for materials when handling and storing them can be ensured.

**3.12Terminology**

Housekeeping entails the general care, maintenance, orderliness and maintenance of business or property.

**3.13 Activity**

Discuss safe procedures in mechanical handling.

**3.14 Reflection**

What do you think are the standard requirements on materials storage?

**3.15 Summary**

In this unit, you have learnt it is you who can prevent materials handling accidents and injuries. You have also learnt that prevention of materials handling accidents and injuries can be achieved by remembering the following:

* Be alert for hazards.
* Follow company safety regulations.
* Take your time and don't take chances.
* Use proper lifting techniques; use legs not the back.
* Get help or mechanical assistance if in doubt.
* Wear protective gear.
* Keep an eye on what others are doing.
* Let other workers know what you're doing.

In the next unit, you will learn about fire and electrical safety.

**UNIT 4****: FIRE AND ELECTRICAL SAFETY**

**4.1 Introduction**

In this unit, we will talk about fire and electrical safety. Having a fire in the workplace is one of the most highly preventable situations if and only if we follow all the safety regulations and use our common sense as well as our awareness in looking out for possible fire hazards. It may seem too common for some thus, we often overlook these fire safety tips, and before we know it, everything will have gone up in smoke.

The triangle of fire demonstrates how fire occurs and the principles of extinguishing fire. Fire is caused by variety of factors, all of which can be prevented and controlled. Most fires start small and can be controlled through immediate response and knowledge of extinguishing medium. Prevention and control of the hazards from fire should be a part of the safety program in each workplace, and even in your own home.

**4.2 Learning Outcomes**

By the end of the unit, you should be able to:

* describe principles of fire occurrence and extinguishment using the fire triangle model
* explain the five principles of fire prevention and control
* explain the methods used in preventing electrical accidents.

**4.3 Time Frame**

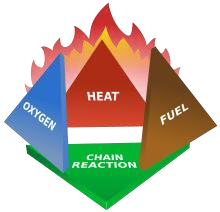
You need about six (2) hours per week to interact with this material.

**4.4 Content**

* + Fire Triangle and Tetrahedron
  + Extinguishing Fire
  + Principles of Fire Prevention and Control
  + Common Causes of Fire
  + Prevention of Fire
  + General Fire Safety Precautions
  + Lightening Protection
  + Causes of Electrical Fire

**4.5 Definition of Fire**

Fire is a chemical reaction between a flammable or combustible material and oxygen. This process converts the flammable or combustible materials and oxygen into energy. Other by-products of fire include light, smoke and other gases. Many of these gases such as carbon monoxide, carbon dioxide, hydrogen bromide, hydrogen cyanide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, etc. are toxic to humans.

**4.6 The Fire Triangle and the Fire Tetrahedron**

The fire triangle and the pyramid of fire illustrate the elements necessary for fire to start and the methods of extinguishment. Each side represents an essential ingredient for fire. The three elements are Fuel, Oxygen and Heat. When a fire starts, a fourth element, which is the chemical reaction itself, is necessary for flame propagation. The four-sided figure is called the **Fire Tetrahedron**.

**4.6 Extinguishing a fire**

The fire triangle demonstrates the principles of extinguishing fire. If we remove any of the three legs of the triangle, we will be able to extinguish the fire.

1. **Removing fuel**

Taking away fuel from a fire is difficult and often times dangerous. However, there are examples that can be employed in controlling fire such as:

* + LPG tank flame at the nozzle of the valve is best extinguished by shutting off the valve. When there is no fuel supply the flame will die out.
  + Flammable liquid storage tanks can be arranged so that contents can be pumped to an empty tank in case of fire.
  + Fire lanes cut in forests prevents conflagration
  + Grasses and undergrowth are burned ahead of an advancing bush fire so that when the main fire reaches these burnt areas, there is no more fuel to feed the fire.

1. **Removing oxygen**

Oxygen cannot be eliminated completely so what one can do is:

* 1. Separate it from the fire through smothering the burning area with a non-combustible material – this is called “suffocating the fire.”

Examples:

* + 1. If there are oil spills, you can cover it with wet blanket or you can throw sand or soil on it.
    2. Covering with foam
    3. Smothering it with inert gas
  1. Reduce the concentration of oxygen below the concentration necessary to support combustion. This is accomplished by discharging carbon dioxide or other inert gases into the fire.

Example:

Light candle and cover with glass until the candle dies

Light candle with inverted glass on top of the candle, then lower the glass until the middle of the candle as illustrated below. Flame will also be extinguished as in the first example.

From the above illustrations, extinguishment using the oxygen side of the triangle can be accomplished by totally eliminating oxygen or by reducing the concentration of oxygen below the level that will support combustion.

1. **Removing heat**

If we reduce the heat below the kindling point or flashpoint, we stop the release of combustible vapours and gases and extinguish the fire. To achieve this, it is necessary to remove the heat at a greater rate than the total heat that is being evolved from the fire. The most common agent used is water or incorporated in foam.

Example:

- After cooking barbeque we normally put off the charcoal using water applied directly to the flame.

1. **Interrupting the chain reaction**

In order for fire to propagate continuously, there must be uninhibited and continuous chain reaction. Speed up the process and an explosion results.

Interrupt the chain reaction by inhibiting the oxidation process and the production of flammable vapors that react with oxygen, then we extinguish the fire.

Example:

- Use of dry chemicals extinguishes fire with this principle.

In summary, control of fires can be accomplished by removing one of the sides of the triangle and/or inhibiting the chain reaction.

**4.7 Principles of fire prevention and control**

**Prevent the outbreak of fire**

We prevent fire by preventing the combination of the three elements at the right proportion. Ordinarily, oxygen is the most difficult of the three factors to control, since it is in the air and is a necessity of life. But fuel and heat can be controlled. Therefore the simplest control measures will have to do with fuel and heat. Actually, control in this sense merely means keeping them separated.

**4.8Common causes of fires**:

1. **Electricity**

Hazards of electricity involve electrocution and fire. Usually, fire is caused by overheating, arcs and sparks.

Overheating happens when there is overloading of system, short circuit and poor insulation. These are caused by improper wiring connection/practice, tampering with safety devices such as fuse and circuit breakers, and old and poorly maintained electrical installation.

**Control**

conduct regular inspection and maintenance of electrical installation

employ trained and licensed electrician

follow Philippine Electrical Code and Occupational Safety and Health Standards

Arcs and sparks normally happen when one opens or closes a circuit. The danger arises when arcs and sparks occur in a flammable or explosive atmosphere which could result to explosion.

To control arcs and sparks, use explosion proof equipment or intrinsically safe devices.

1. **Mechanical heat**

Heated surfaces on furnaces, flues, heating devices and light bulbs can cause fires if flammable or combustible materials are close enough to absorb sufficient heat to cause combustion. Care should be taken to ensure that all such devices are properly installed, especially with respect to clearance and barrier materials.

1. **Friction sparks**

Friction generates heat. Excessive heat generated by friction causes a very high percentage of industrial fires. Fire usually results from:

overheated power-transmission bearings and shafting from poor lubrication and excessive dust

jamming of work material during production

incorrect tension adjustment of belt-driven machinery. If the belt is too tight or too loose, excessive friction could develop

**Control**

Preventive maintenance program to keep bearings well oiled and do not run hot. And keep accumulation of flammable dust or lint on them to a minimum.

Keep oil holes of bearings covered to prevent dust and gritty substances from entering the bearings.

1. **Open flames**

Carelessly discarded cigarettes, pipe embers, and cigars are a major source of fire. Prohibit smoking, especially in woodworking shops, textile mills, four mills, grain elevators, and places where flammable liquids or combustible products are manufactured, stored or used.

**Control**

providing a "No Smoking Area" at specified times where supervision can be maintained.

marking areas where exposure is severe with conspicuous “No Smoking” signs, prohibiting employees from even carrying matches, lighters and smoking material of any kind

1. **Spontaneous heat (auto-ignition)**

Spontaneous ignition results from a chemical reaction where there is a slow generation of heat from oxidation of organic compounds that, under certain conditions, is accelerated until the ignition temperature of the fuel is reached.

It is a condition usually found only in quantities of bulk material packed loosely enough, with large amount of surface to be exposed to oxidation, yet without adequate air circulation to dissipate heat.

1. **Welding and cutting sparks**

Hazardous sparks such as globules of molten, burning metal or hot slag are produced by both welding and cutting operations. Sparks from cutting, particularly oxy-fuel gas cutting, are generally more hazardous than those from welding because the sparks are more numerous and travel greater distances.

**Control time for welding and cutting:**

Move combustibles a safe distance away - 35 ft. horizontally or

Move work to a safe distance

Protect the exposed combustibles with suitable fire resistant guards and provide a trained fire watcher with extinguishing equipment readily available

Cover openings in walls, floors or ducts should be if within 35 ft of the work.

Implement "Hot Work Permit System"

1. **Generation of static charge**

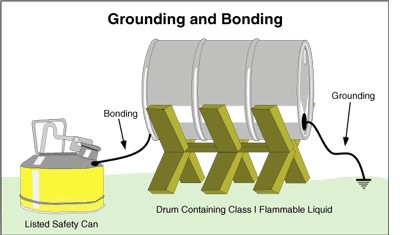
**Static Electricity** is electricity at rest. It is formed by the contact and separation of dissimilar materials. Examples that produce static electricity: flow of fluid through a pipe

* + agitation and mixing
  + splash filing

Static spark created may cause ignition of flammable vapours, dust and fibers. Also, a worker could be injured through accidental reaction caused by static spark shock.

**Control**

Bonding and grounding are key control measures for fire related to static electricity. Bonding is done to eliminate a difference in static charge potential between objects. The purpose of grounding is to eliminate the difference in static charge potential between an object and ground. Bonding and grounding are effective only when the bonded objects are conductive.



***Source:*** [***http://www.ccohs.ca/oshanswers/safety\_haz/electrical.html***](http://www.ccohs.ca/oshanswers/safety_haz/electrical.html)

1. **Highly flammable or combustible materials** – Take care that the following materials are not stored with machinery or near any type of electrical or heat source. Highly flammable materials may include:
   * + - * Hay and straw
         * Bedding material (especially sawdust and shredded newspaper)
         * Cobwebs, dust, and grain dust
         * Horse blankets
         * Paint
         * Fertilizer
         * Pesticides and herbicides
2. **Accelerants** - Accelerants are substances that increase the speed at which a fire spreads. All accelerants are highly flammable or combustible, but not all highly flammable or combustible materials are accelerants. Accelerants must be stored in approved containers and properly labelled as such (plastic milk bottles do not qualify as approved containers for storing chemicals). An updated list of all chemicals in the workplace should be maintained. The list should include the name of the chemical, date purchased, the quantity of the chemical, and the place of storage on the farm. This list should be kept in a safe, handy place such as an office (not in the building where the products are stored). In case of a fire, the list should be given to the fireperson in charge to aid the fire department in knowing what potential toxic fumes or explosions may result and how best to contain the situation.

Common accelerants include:

* + - * + Gasoline
        + Kerosene
        + Oil
        + Aerosol cans

1. **Ignition sources** - An ignition source is something that can cause an accelerant or flammable material to ignite or smolder.

Examples of ignition sources are:

* + - * + Cigarettes and matches
        + Sparks from welding machines and machinery (trucks, tractors, mowers)
        + Motors
        + Heaters
        + Electrical appliances
        + Electrical fixtures and wires
        + Batteries
        + Chemicals which may react with each other or with water or dampness

**4.9 Prevention of fire**

(a) **Provide for early detection of fire**

Except for explosions, most fires start out as small ones. At the initial stage, extinguishing a fire seldom presents much of a problem. Once the fire begins to gain headway, it may develop into conflagration of disastrous proportions. Fire can be more easily controlled if detected early. It is critical that fire be extinguished in the first five minutes.

Detection serves to:

warn the fire brigade to start extinguishing procedure

warn occupants to escape

**Means of detection include**:

automatic sprinklers

human observer

smoke, flame and heat detectors

**Smoke detectors**

Monitor changes within the area

Provide early warning

Changing stages in the development of fire

When smoke is produced

**Heat detectors**

Fixed temperature types – which responds when the detection element reaches a predetermined temperature

Rate-of-rise temperature – which respond to an increase in heat at a rate greater than some predetermined value.

**Flame detectors**

* Infra-red – sensing elements responsive to radiant energy outside the range of human vision; useful in detecting fire in large areas, e.g. storage areas
* Ultra-violet – sensing elements responsive to radiant energy outside the range of human vision

**(b) Prevent the spread of fire**

Once a fire is discovered, it is of prime importance to confine it to the smallest area possible - that is, to prevent its spread. This can be accomplished by details of construction and by safe practices, but neither is sufficient alone. An understanding of the means by which heat is transmitted will be of value in taking the necessary steps to prevent the spread of fire.

These are the **three (3) methods of heat transfer** and how it can be controlled

* + - **Conduction** is the transfer of heat from molecule to molecule. Thermal conductivity is important in terms of fire spread. A steel girder passing through an otherwise fireproof wall may cause fire spread by conducted heat.
    - **Convection** is caused by movement of heated gasses produced by any burning material or by heated air rising to the upper limits of the space in which it is contained. During a fire in a building convection currents convey combustion gases up through stairways or lift shafts, spreading the fire to other parts of the building.
    - **Radiation** is the transfer of heat in straight rays.

**Control**

**Barriers** are one means of control that will limit the area of a fire or at least retard its spread. Examples are: firewalls, fire doors, shutters or louvers, fire stops, baffles, fire dampers, fire windows, parapets, dikes and enclosures of vertical openings

**(c) Provide for prompt extinguishment**

In providing for prompt extinguishment, the two categories of fire extinguishers should be kept in mind – permanent or “built-in” extinguishers and portable fire extinguishers.

**(d)Provide for prompt and orderly evacuation of personnel**

Once a fire is discovered in a building, the first and foremost step is the prompt evacuation of all personnel to a safe place. People should be trained on orderly evacuation through fire drills. Exits that will empty the ordinary structure in ample time to prevent loss of life or injury should be also a primary concern.

Exit requirements for life safety in case of fire:

* + - * at least two ways out remote from each other
      * additional exits according to number of persons and relative fire danger
      * evacuation drills well planned, frequently practiced (at least twice a year)
      * exits are well-marked, clear, unobstructed and well lighted
      * correct exit design
      * regular exit drills
      * makeshift fire escapes are often dangerous
  1. **General fire safety precautions**
  + Smoking should never be permitted in any storage area, tack room or lounge. “No-Smoking” signs should be posted in these areas and at all exterior entrances. Butt cans should be provided as an incentive to extinguish all cigarettes.
  + Exit doors should be clearly marked.
  + Aisles should be raked or swept clean at all times. Vacuum up cobwebs and dust regularly. Wipe dust/dirt off light fixtures, outlet covers, switches and panel boxes
  + Weeds, twigs, and other trash should be kept mowed or picked up from around the outside of the building.
  + Paper storage should not be near lights, fans, electrical boxes, heaters or outlets.
  + Flammable substances should be kept elsewhere outside the building.
  + Vehicles and machinery should be stored in a separate building.
  + A fire hose and buckets should be available and kept for the purpose of extinguishing class A fires rapidly.
  + Practice fire drills should be held so employees and boarders are familiar with their responsibilities should a real fire occur.
  1. **Lightning protection**

Buildings should be equipped with professionally installed lightning rods of copper or aluminum. The system should be properly grounded. All pipes, water systems, electrical systems and telephone lines should also be grounded.

**4.12 Causes of electrical fire**

The more frequent causes of electrical fires may be listed under three general classes namely, **arcs, sparks and overheating**. An arc is produced when an electric circuit carrying a current is interrupted, either intentionally – by a knife switch or accidentally – where a contact at a terminal becomes loose. The intensity of the arc depends, to a great extent, on the current and voltage of the circuit. The temperature of the electric arc is very high and any combustible materials in its vicinity may be ignited by the heat.

An electric arc may not only ignite combustible materials in its vicinity such as the insulating covering of the conductor, but it may also fuse the metal with the conductor. Hot sparks from burning combustible material and hot metal are thrown about, and may set fire to other combustible materials.

When an electric conductor carries a current, heat is generated in direct proportion to the resistance of the conductor and to the square of the current. The resistance of conductors is used to convey current to the location where it is used, or to convey it through the windings of a piece of apparatus, except in resistance devices and heaters.

1. **Hazardous Locations**

Hazardous locations are areas where explosive or flammable gases or vapours, combustible dust, or ignitable fibers are present or likely to become present. Such materials can ignite as a result of electrical causes only if two conditions co-exist:

1. The proportion of the flammable substance to oxygen must permit ignition and the mixture must be present in a sufficient quantity to provide an ignitable atmosphere in the vicinity of electrical equipment.
2. An electric arc, flame escaping from an ignited substance in an enclosure, heat from an electric heater, or their source, must be present at a temperature equal to or greater than the ignition point of the flammable mixture.

1. **Safe Practices and Procedures**

The following are the simple rules when working with electricity:

* Always assume that a circuit is energized.
* Use the appropriate instrument for testing circuits.
* Use protective devices (ELCB, fuse, rubber mats, etc.).
* Use personal protective equipment (rubber gloves, boots, safety devices).
* Inspect tools, power cords, and electrical fittings for damage or wear prior to each use. Repair or replace damaged equipment immediately.
* Use warning signs and isolate dangerous areas.
* Observe proper maintenance schedules of electrical equipment, loads and wires.
* Always tape cords to walls or floors when necessary. Nails and staples can damage cords causing fire and shock hazards.
* Use cords or equipment rated for the level of amperage or wattage that you are using.
* Always use the correct size fuse. Replacing a fuse with one of a larger size can cause excessive current~~s~~ in the wiring and possibly start a fire.
* Conduct regular electrical inspection~~s~~ for the electrical circuit.
* Be aware that unusually warm or hot outlets may be a sign that unsafe wiring conditions exist~~s~~. Unplug any cords to these outlets and do not use until a qualified electrician has checked the wiring.
* Place halogen lights away from combustible materials such as cloths or curtains. Halogen lamps can become very hot and may be a fire hazard. Risk of electric shock is greater in areas that are wet or damp. Install Ground Fault Circuit Interrupters (GFCIs) as they will interrupt the electrical circuit before a current sufficient to cause death or serious injury occurs.
* Make sure that exposed receptacle boxes are made of non-conductive materials.
* Know where the breakers and boxes are located in case of an emergency.
* Label all circuit breakers and fuse boxes clearly. Each switch should be positively identified as to what outlet or appliance it is for.
* Do not use outlets or cords with exposed wiring.
* Do not use power tools when protective guards are removed.
* Do not block access to circuit breakers or fuse boxes.
* Do not touch a person or electrical apparatus in the event of an electrical accident. Always disconnect the current first.
* Ensure that only qualified personnel work on any part of an electrical circuit or equipment/apparatus.
* Always replace a fuse with the same kind and rating. Never bridge a fuse using metal wires or nails, etc.
* Make sure that there is someone to look after you whenever you work with any part of the electrical circuit.
* Observe lock-out/tag-out (LOTO). Always lock safety switches and place tags before working on a circuit. Before energizing a circuit, ensure all personnel are clear of the circuit or the equipment concerned.
* Ensure that temporary electrical installations do not create new hazards.
* Always use ladders made of wood or other non-conductive materials when working with or near electricity or power lines.
* Adhere to strictly established regulations of the Philippine Electrical Code.

1. **Tips for working with power tools:**

* Switch tools OFF before connecting them to a power supply.
* Disconnect power supply before making adjustments.
* Ensure tools are properly grounded or double-insulated. The grounded tool must have an approved 3-wire cord with a 3-prong plug. This plug should be plugged in a properly grounded 3-pole outlet.
* Test all tools for effective grounding with a continuity tester or a ground fault circuit interrupter (GFCI) before use.
* Do not bypass the switch and operate the tools by connecting and disconnecting the power cord.
* Do not use electrical tools in wet conditions or damp locations unless tool is connected to a GFCI.
* Do not clean tools with flammable or toxic solvents.
* Do not operate tools in an area containing explosive vapors or gases.

1. **Tips for working with power cords:**

* Keep power cords clear of tools during use.
* Suspend power cords over aisles or work areas to eliminate stumbling or tripping hazards.
* Replace open front plugs with dead front plugs. Dead front plugs are sealed and present less danger of shock or short circuit.
* Do not use light duty power cords.
* Do not carry electrical tools by the power cord.
* Do not tie power cords in tight knots. Knots can cause short circuits and shocks. Loop the cords or use a twist lock plug.

We hope you have become more aware of electrical safety as a result of this module. You can visit these websites to get a more information on electricity:

**4.13 Terminology**

Fire is a chemical reaction between a flammable or combustible material and oxygen.

**4.14 Activity**

Discuss the five principles of fire prevention and control.

* 1. **Reflection**

What do you could be the most effective method in preventing electrical accidents?

* 1. **Summary**

In this unit, you have learnt about the Fire Triangle how fire starts and how it could be extinguished. In the next unit, you will learn about machine safety.

**UNIT 5****: MACHINE SAFETY**

**5.1 Introduction**

This unit aims to introduce you to the principles of machine safety as a tool to eliminate industrial injuries and accidents. As an OHS officer, you must be able to understand the basics of machine guarding to prevent accidents, injuries and deaths happening in your assigned work area.

Machines make things easy and comfortable for us. They enable us to do a lot of things that we won’t be able to do otherwise. They are very much a part of our lives but we must be aware that they may also be sources of injuries and even deaths in the workplace if not used properly.

Any part, function or process involving machines may cause injuries. To eliminate the hazards posed by machines, you must have sufficient understanding of machine safety particularly of the four major areas: adjustment and repair, servicing and maintenance, moving parts (machine guarding), and point-of-operation in every machine.

Machine guards are classified into those that prevent access and those that prevent hazardous motion. However, machine guards alone cannot prevent injuries – there is a need to educate and train workers on machine safety. Lock-Out/Tag-Out (LOTO) is an effective system for controlling accidents in servicing and maintenance of machines.

**5.2 Learning Outcomes**

By the end of the unit, you should be able to:

* explain the principles of machine guarding
* identify areas where machine guards are needed
* describe the types of machine guards
* differentiate a lock-out from tag-out

**5.3 Time Frame**

You need about six (2) hours per week to interact with this material.

* 1. **Content**
* Hazardous Mechanical Motions and Actions
* Importance of Machine Safety
* Types of Machine Guards
* Hierarchy of Measures
* Lock-out/Tag-out System

**5.5 Definition of a machine**

**A machine** is a tool used to make work easier. It is basically an assemblage of parts that transmit forces, motion and energy in a predetermined manner. **Simple machines** are mechanical devices that change the direction or magnitude of a [force.](http://en.wikipedia.org/wiki/Force) They are the "building blocks" of which the more complicated [machines](http://en.wikipedia.org/wiki/Machine)or **compound machines** are made.

**The Industrial Revolution**

It was only during the industrial revolution that modern machines were used extensively. Prior to this, all operations were manually done. The start of the 18th century marked the start of the industrial revolution. Modern machines were conceptualized and created. These enabled factories to produce goods faster, but at the same time lead to poor working conditions and a lot of accidents, giving rise to a growing concern for machine safety. Machine safety covers 4 basic areas: adjustment and repair, servicing and maintenance, moving parts and point of operation.

**5.6Hazardous mechanical motions and actions**

The important aspect of machine safety – the basic types of hazardous mechanical motions and actions.

These include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any other part that impacts or shears. These different types of hazardous mechanical motions and actions are present in varying combinations in nearly all machines and recognizing them is the first step toward protecting workers from the dangers they present.

**Motions**

* Rotating
* Reciprocating
* Transversing

Rotating motion can be dangerous - even smooth, slowly rotating shafts can catch clothing, and through mere skin contact force an arm or hand into a dangerous position. Injuries due to contact with rotating parts can be severe.

Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, meshing gears, and horizontal or vertical shafting are some examples of common rotating mechanisms which may be hazardous. The danger increases when projections such as set screws, bolts, nicks, abrasions, and projecting keys or set screws are exposed on rotating parts.

**Nip Points**

In-running nip point (or points where parts of the hand, body or clothes can get caught in-between) hazards, are caused by the rotating parts of machinery. There are three main types of in-running nips.

* Parts rotating in opposite directions
* Nip points between rotating and tangentially moving parts. Some examples are: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, and a rack and pinion.
* Nip points between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are: spoked hand wheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

**Reciprocating**

Reciprocating motions may be hazardous because during the back-and-forth or up-and-down motion, a worker may be struck by or caught between a moving and a stationary part.

**Transversing**

Transverse motion (movement in a straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.

**Mechanical Actions**

The danger of cutting action exists at the point of operation where finger, arm and body injuries can occur and where flying chips or scrap material can strike the head, particularly in the area of the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials.

Examples of mechanisms involving cutting hazards include band saws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.

**5.7Importance of machine safety**

Why it is necessary to have safety programme for machine operations? Because, we know that machines can cause:

* severe accidents
* loss of trained and skilled employees
* loss of production
* damage to equipment
* incurring training cost for new employee/s
* overtime cost
* possible litigation
* accident investigation

Machines can also cause:

* lost time expense
* cost of machine down time
* cost of machine damage and repairs
* lost time due to time spent on accident investigation and other statutory requirements
* loss of production

**5.8Types of machine guards**

**(a) Preventing access**

Fixed enclosing guards

If the hazard is on a part of the machinery which does not require access, it should be permanently guarded with fixed enclosing guards.

**(b) Preventing dangerous motions**

When frequent access is required, physical guarding at the hazard is sometimes too restrictive for part loading or adjustment. In this situation, a device is required to prevent dangerous motion while allowing unrestricted access by sensing the presence of the operator and sending a stop signal.

Movable guards with interlocking switches

If access is required in a hazardous area of a machine, an operator can be protected by an inter-lock with the power source which ensures that whenever the guard door is not closed, the power is switched off.

Two hand controls

There are other ways of preventing access while the machine is in a dangerous condition. The use of two hand controls (also referred to as bi-manual controls) is common in certain types of machinery. Two start buttons have to be operated at the same time to run the machine. This ensures that both hands of the operator are in a safe position and therefore cannot be in the hazard area.

Pullback Devices

These are mechanical devices attached to the operator's hands and connected to the moving portion of the die. If properly adjusted, it withdraws the operator's hands if they are inadvertently within the point of operation as the dies close.

Photoelectric light curtain

These devices emit a “curtain” of harmless infrared light beams in front of the hazard area. When any of the beams are blocked, the light curtain control circuit sends a stop signal to the guarded machine.

Light curtains are extremely versatile and can guard areas many meters wide. By using mirrors, light beams can be diverted all around the corners to enclose a machine.

There are many applications ranging from totally enclosing perimeter guards for industrial robots, to point of access guards for certain types of presses.

Safety mats

These devices are used to guard a floor area around a machine. Interconnected mats are laid around the hazard area and any pressure will cause the mat controller unit to send a stop signal to the guarded machine.

Pressure-sensitive mats are often used within an enclosed area containing several machines (e.g., flexible manufacturing or robotics cells). When access into the cell is required (example: for setting or robot “teaching”), dangerous motion can be prevented if the operator stays within the safe area.

Pressure-sensitive edges

These devices are flexible edging strips which can be fixed to the edge of a moving part such as a machine table or powered door where there is a risk of crushing or shearing hazard. If the moving part strikes the operator (or vice versa), the flexible sensitive edge is depressed and will send a stop signal to the power source.

Emergency stops

Wherever there is a danger of an operator getting into trouble on a machine there must be a facility for fast access to an emergency stop device.

The usual way of providing this is in the form of a mushroom headed push-button which the operator strikes in the event of an emergency. The emergency stops must be strategically placed, in sufficient quantity around the machine to ensure that there is always one in reach at the occurrence of hazard.

Grab wire switches

For machinery such as conveyors etc., it is often more convenient and effective to use a grab wire device along the hazard area. These devices use a steel wire rope connected to latching pull switches so that pulling on the rope will operate the switch and cut off the machine power.

Telescopic trip switches

Other variations include telescopic antenna switches where deflection of the antenna causes the switch to cut off the machine power. These devices are more commonly used as trip devices on machinery such as pillar drills. The switch is mounted on the drill and the antenna is extended down next to the drill bit. In the event that the operator becomes entangled with the drill, he will be pulled onto the antenna thus operating the switch.

Robotics application

This depends on the nature of the machine and the hazard.

Safeguards should prevent human contact with any potentially harmful machine part. The prevention extends to machine operators and any other person who might come in contact with the hazard.

Safeguards should be attached so that they are secured Workers should not be able to render them ineffective by tampering with or disabling them. This is critical because removing safeguards to speed-up production is a common practice. Safeguards must also be durable enough to withstand the rigors of the workplace because worn-out safeguards can’t protect workers properly.

Objects falling into moving machine mechanisms increase the risk of accidents, property damage, and injury. Objects that fall on a moving part can be thrown out, creating dangerous projectile. Therefore, safeguards must do more than just prevent human contact. They must also shield the moving parts of machines from falling objects.

Safeguards should overcome the hazards in question without creating new ones. A safeguard with a sharp edge, unfinished surface or protruding bolts introduces new hazards while protecting against the old. They can interfere with the progress of work if they are not properly designed. Such safeguards are likely to be disregarded or disabled by workers due to the pressure of production deadlines.

Safeguards should be designed to allow the more frequently performed maintenance tasks (e.g., lubrication) to be accomplished without removal of guards. For example, locating the oil reservoir outside the guard with a line running to the lubrication point will allow for daily maintenance without removing the guard.

**5.9The Hierarchy of Measures**

Each measure must be considered according to the hierarchy below. This may result in a combination of measures being used.

1. **Fixed Enclosing Guards -** If access to dangerous parts is not required, the solution is to protect them by some type of fixed enclosing guard.
2. **Movable (interlocked) guards or protection devices (e.g., light curtains, presence sensing mats, etc.) -** If access is required, things get a little more difficult. It will be necessary to ensure that access can only be permitted while the machine is safe. Protective measures such as interlocked guard doors and/ or trip systems will be required. The choice of protective device or system should be based on the operating characteristics of the machine.
3. **Protection appliances (e.g., jigs, holders, push sticks, etc) -** These are used often in conjunction with guards to feed a work piece while keeping the operator’s body away from the danger zone.
4. **Information, instruction, training and supervision -** It is important that operators have the necessary training in safe working methods for a machine. However, this does not mean that measures (a), (b) or (c) can be omitted. It is not enough to merely tell an operator that he/she must not go near dangerous parts (as an alternative to guarding them). Operators must be trained on the hazards of their work and how to use and maintain the safety devices as well as give safety reminders to make them aware all the time.
5. **Personal Protective Equipment -** In addition to the above measures, it may also be necessary for the operator to use equipment like special gloves, goggles, etc. The machinery designer should specify what sort of equipment is required. The use of personal protective equipment is not the primary safeguarding method but should complement the measures shown above.
6. The protective device must be appropriate for the type of work being undertaken.

**5.10Lock-out/Tag-out System**

Another aspect of machine safety is during maintenance work and servicing. The lockout/tag-out system is effective for preventing accidents during maintenance works.

It is a method that is especially designed to protect against the unexpected startup of a machine that is supposed to be turned off. This is important because statistics indicate that six percent of all workplace fatalities are caused by the unexpected activation of machines while they are being serviced, cleaned, or otherwise maintained. The Lock-out/Tag-out System is designed to protect against the unexpected start-up of machine that is supposed to be "OFF" or an unexpected release of energy (hazardous energy).

1. **The “Fatal Five” Main Causes of Maintenance Injuries:**

* Failure to stop equipment
* Failure to disconnect from power source
* Failure to dissipate (bleed, neutralize) residual energy
* Accidental restarting of equipment
* Failure to clear work areas before restarting

1. **Types of Lock-out Devices**

* Plug Locks
* Ball Valve Lock-out
* Gate Valve Lock-out
* Group Lock-out Hasp
* Electrical
* Hydraulic, pneumatic, and other pressurized systems

1. **Lock-out Procedure**

* Alert the operator(s) that power is being disconnected.
* Preparation for Shutdown
* Equipment Shutdown
* Equipment Isolation
* Application of Lock-out Devices
* Control of Stored Energy
* Equipment Isolation-Verification

1. **Removal of Lock-out**

* Ensure equipment is safe to operate
* Safeguard all employees
* Remove lock-out/tag-out devices. Except in emergencies, each device must be removed by the person who placed it.
* Last person to take off lock
* Follow checklist

To observe proper LOTO procedures, most firms maintain some forms of documentation.

**5.11 Terminology**

A machine is a tool used to make work easier. It is basically an assemblage of parts that transmit forces, motion and energy in a predetermined manner.

* 1. **Activity**

Critically discuss the four basic principles of safeguarding.

**5.13 Reflection**

What do you think is required in order for an interlocking safeguard to be effective?

**5.14Summary**

In this unit, you have that that any machine part, function, or process which many cause injury must be safeguarded. You have also learnt that when the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must be either controlled or eliminated. In the next unit, you will learn about personal protective equipment.

# **UNIT 6: PERSONAL PROTECTIVE EQUIPMENT**

**6.1 Introduction**

This unit introduces you to Personal Protective Equipment (PPE) and how PPE can save your life, or that of your co-worker. The PPE must be considered only after engineering and administrative controls have been found ineffective, not feasible or insufficient. It must be used only as a last resort. The selection of PPE must comply with the existing OHS standards and using these in the workplace must be combined with training and orientation on their proper use, limitations and advantages.

**6.2 Learning Outcomes**

By the end of the unit, you should be able to:

* distinguish the appropriate type of PPE you need in the workplace
* explain the limitation of PPE
* develop programmes to introduce PPE for in an organisation.

**6.3 Time Frame**

You need about six (2) hours per week to interact with this material.

* 1. **Content**
* Programme to Introduce Personal Protective Equipment
* Uses of Personal Protective Equipment

**6.5Defining hazards**

A hazard is anything that produces adverse effects on anyone. Examples of hazards are slippery floors, falling objects, chemicals and many more. What do you think make these occurrences hazardous? As we discussed units 1 and 2, unsafe/unhealthy acts bring about unsafe/unhealthy conditions, causing hazards in the workplace. Although some hazards are intrinsic in nature, a human hand is still behind most of the hazards we now encounter.

1. **Classification of hazards**

Hazards may be classified into direct, physical, chemical, biological and ergonomic. Let us discuss each of these.

1. **Direct hazards –** These are very common in companies that utilize oil, water or any liquid in the production process and in the construction industry where there are a lot of falling debris, like small pieces of wood, nails, and hand tools.

**Examples:**

* + Unguarded moving parts of machines
  + Falling/flying particles
  + Slippery floors

1. **Physical hazards**

* **Noise**.
* **Extreme Temperatures** are of two types**: extreme heat** which can cause heat stroke and **extreme cold** which can cause hypothermia.
* **Radiation** also has two types: **the ionizing radiation** and the **nonionizing type**.
* **Extreme Pressure** – These are pressures beyond the allowable levels needed by the human body. Normal atmospheric pressure is 14.7 psi, and even a small change in the atmospheric pressure has a corresponding effect to humans. Examples of workers exposed to extreme pressure are those involved in excavation work, scuba diving, and piloting airplanes.
* **Vibration**

1. **Chemical Hazards** – These are substances in solid, liquid or gaseous forms known to cause poison, fire, explosion or ill effects to health. Examples include gases, fumes, vapour, mist and dust. These are airborne particles or airborne toxic elements that evaporate in the air and can cause irritation, discomfort and even death. Chemical routes of entry to the body are by inhalation, ingestion and skin absorption.
2. **Biological Hazards** – These are hazards caused by viruses, fungi and bacteria.
3. **Ergonomic Hazards** – These are caused by improper posture or postural stress.
4. **Hazard control measures**

There are three methods in controlling hazards: engineering, administrative and PPE.

1. **Engineering method –** this is the application of engineering technology to control hazards. An example is machine guarding which prevent anyone from coming in contact with moving parts of a machine during the operation. Other examples are installation of safety devices like emergency stop, limit, grab-wire and photo electric switches. These prevent accidents in case of improper work practices. Other forms of the engineering method involve substituting hazardous substances with less hazardous ones (**substitution**) and isolating hazardous process (**isolation**).
2. **Administrative method** – this aims to minimize the exposure of humans to workplace hazards and employs administrative approaches such as rotation and shifting.
3. **PPE** – these are considered as the last line of defence. These devices provide limited protection to the ones using them.

***Source: Krieger, Gary R, ed. “Accident Prevention Manual for Business and Industry 11th ed”. USA: National Safety Council, 1997 p.161***

**6.6 Programme to introduce PPE**

Once it is decided that personal protective equipment is going to be used, then the following steps need to be undertaken:

* write a policy on the usage of PPE and communicate it to employees and visitors as needed
* select the proper type of equipment
* implement a thorough training program
* ensure that employees knows the correct use and maintenance of the equipment
* enforce proper use and maintenance of PPE

1. Policy

The policy should state the need for the use of PPE. It may also contain exceptions or limitations on the use of PPE.

1. Selection of Proper Equipment

After the need for personal protective equipment has been established, the next step is to select the proper type. In selecting the proper protector, consideration should be given to the kind and degree of hazard. Where a choice of protectors is given and the degree of protection required is not an important issue, worker’s comfort may be a deciding factor.

The first step in selecting PPE for respiratory protection is to contact a supplier. Manufacturers and distributors do not just helping the selection of the most useful equipment, but can give valuable aid in fit-sizing, cleaning, care and storage.

1. Proper Training

The next step is to obtain the workers complete compliance with requirements to wear the PPE. Several factors influence compliance, among them are:

* The extent to which the personnel who must wear the equipment understand its necessity
* The ease and comfort with which it can be used, or work with a minimum of interference with normal work procedures

***Source: Krieger, Gary R, ed. “Accident Prevention Manual for Business and Industry 11th ed”. USA: National Safety Council, 1997 p.162***

A training programme outline may include:

* Describing hazards and/or conditions in the workplace
* Telling what can/cannot be done about them
* Explaining why certain types of PPE have been selected
* Discussing the capabilities and/or limitation of the PPE
* Demonstrating how to use, adjust or fit PPE
* Practicing using PPE
* Explaining to workers how to deal with emergencies
* Discussing how PPE will be paid for, maintained, repaired and cleaned.

1. Maintenance Programme

All equipment must be inspected periodically before and after use. A record of all inspections with the date, tabulated results, the recommendation of the manufacturer for the maintenance of the device, and the repair and replacement of parts supplied by the manufacturer of the product should be kept.

1. Enforcement

Employees need to know how the use of PPE will be enforced. Many companies have some kind of disciplinary actions, such as unpaid time-off, and finally, termination. The enforcement of the use of PPE is critical to a successful programme.

**6.7Uses of PPE**

Commonly used PPE in the workplace include: helmet, respirator, spectacles, earplugs, gloves, safety shoes, etc. The following are the functions and uses of PPE.

1. **Head Protection**

A safety hat is a device that provides head protection against impact from falling objects and protection against electrocution. Safety hats should be inspected prior to each use. Any one of the following **defects** is a cause for immediate removal of the PPE from service:

* + Suspension systems that show evidence of material cracking, tearing, fraying or other signs of deterioration. Suspension should provide a minimum clearance of 1 to 1.25 in. (2.5 – 3.2 cm) between the top of the worker’s head and the inside crown of the hat.
  + Any cracks or perforations of brim or shell, deformation of shell, evidence of exposure to excessive heat, chemicals or radiation. Shells made of polymer plastics are susceptible to damage from ultraviolet light and gradual chemical degradation. This degradation first appears as a loss of surface gloss called chalking. With further deterioration, the surface will begin to flake away.

1. **Eye Protection**

A device that provides eye protection from hazards caused by:

* Flying particles oSparks oLight radiation oSplashes
* Gases

Goggles come in a number of different styles for a variety of uses such as protecting against dust and splashes: eye cups, flexible or cushioned goggles, plastic eye shield goggles and foundry men’s goggles.

Eye protectors must meet the following minimum requirements:

* + - Provide adequate protection against the particular hazards for which they are designed
    - Be reasonably comfortable when worn under the designated conditions
    - Be durable
    - Be capable of being disinfected oBe easily cleaned
    - Be kept clean and in good condition

1. **Face Shields**

Face shields should only be used as eye and face protection in areas where splashing or dusts, rather than impact resistance is the problem. In the case of grinding operations (plus other operations), a face shield is only secondary protection to other protective devices, such as safety goggles.

1. **Ear Protection**

The prevention of excessive noise exposure is the only way to avoid hearing damage. Engineering and administrative controls must be used if acceptable sound levels are exceeded. If such controls fail to reduce the sound levels to acceptable limits, personal hearing protection must be used.

1. **Respiratory Protection**

Respiratory protection is required when engineering improvements and administrative controls can’t eliminate risk. Engineering controls include, isolation of the source of contaminants; design process or procedural changes, etc. Administrative controls on the other hand include, monitoring, limiting worker exposure, training and education, etc.

1. **Hand and Arm Protection**

Hand and arm protection is required when workers’ hands are exposed to hazards such as harmful substances that can be absorbed by the skin, severe cuts or lacerations, severe abrasions, chemical burns, thermal burns, and temperature extremes.

Selection of hand PPE shall be based on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards identified.

Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure. There is no one type of gloves that provides protection against all potential hand hazards, and commonly available glove materials provide limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated; e.g., chemical hazards, cut hazards, flame hazards, etc. Before purchasing gloves, request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated.

1. **Foot and Leg Protection**

**Conductive Shoes** protect against the buildup of static electricity or equalize the electrical potential between personnel and the ground. These shoes should be worn only for the specific task(s) for which they are designed, and should be removed at task completion and not used as general purpose footwear. This type of shoes must not be used by personnel working near exposed energized electrical circuits. Personnel must avoid wearing 100 percent silk, wool, or nylon hose of socks with conductive hose because these materials are static producers. Likewise, foot powders must be avoided because they are insulators and interfere with electrical conductivity.

**Electrical Hazard Safety Shoes** are non-conductive and protect against open circuits of 600 volts or less under dry conditions. The insulating qualities may be compromised if the shoes are wet, the rubber sole is worn out, or metal particles are embedded in the sole or heel. Electrical hazard shoes are not intended for use in explosive or hazardous locations where conductive footwear is required. This footwear should be used in conjunction with insulated surfaces.

1. **Fall Protection**

**Travel restraint system** is an assembly composed of body belt and proper accessories that prevent a worker in a high elevation working area from traveling to an edge where the occurrence of fall may happen.

**Fall arrest system** is an assembly composed of full-body harness, safety lanyard and proper accessories or a safety net which protect a worker after a fall by stopping the fall before hitting the surface below.

**Lifelines** shall be secured above the point of operation to an anchorage or other structural member.

1. **Torso/ Full Body Protection** must be provided for employees if they are threatened with bodily injury of one kind or another while performing their jobs, and if engineering, work practices, and administrative controls have failed to eliminate these hazards.

As with all protective equipment, protective clothing is available to protect against specific hazards. Depending upon the hazards in the workplace, it may be needed to provide the workers with one or more of the following:

* Vest oJacket oApron oCoverall oSurgical gowns
* Full-body suits

These protective clothing come in a variety of materials, each suited to particular hazards. Be aware that different materials will protect against different and physical hazards. When chemical or physical hazards are present, check with the clothing manufacturer to make sure that the material selected will provide protection from the specific chemical of physical hazards in the workplace.

**6.8 Terminology**

Personal Protective Equipment are equipment that are meant to protect users or employees against health or safety risks at work.

* 1. **Activity**

Discuss the personal protective devices that would require training, fit testing, and medical authorization.

**6.10 Reflection**

What types of personal protective equipment do you think would notgenerally be appropriate for welding hazards?

**6.11 Summary**

In this unit, you have learnt about the many factors you could consider when selecting PPE to protect yourself, your colleagues or your workers from workplace hazards. You also learnt about the types of operations that can present hazards and all of the types of PPE available to protect the different parts of a worker’s body from specific types of hazards. In the next unit, you will learn about industrial hygiene.

**UNIT 7: INDUSTRIAL HYGIENE**

**7.1 Introduction**

In this unit, you will introduce you to the processes involved in identifying and recognizing occupational health hazards in the work environment and help you do this in a systematic manner. It will also help you go through the process of evaluating such hazards through the Work Environment Measurement (WEM) which objectively assesses the level of workplace hazards through the use of different industrial hygiene equipment.

**7.2 Learning Outcomes**

By the end of the unit, you should be able to:

* identify the potential occupational health hazards in the workplace.
* explain the process of evaluating the different hazards in the workplace through Work Environment Measurement (WEM), including the instruments used and the standards to be observed
  1. **Time Frame**

You need about six (2) hours per week to interact with this material.

* 1. **Content**
* Classification of Occupational Health Hazards
* Basic Industrial Hygiene Programmes
* Evaluation of Occupational Stresses and Hazards
* Asbestos Exposure at Work
* Infectious Diseases
* Alcoholism and Substance Abuse
* Stress, Burnout and Depression
* HIV/AIDS and the Workplace
* Workplace Smoking
* Violence at the Workplace

**7.5 Classification of occupational health hazards**

The various environmental stresses or hazards, otherwise known as occupational health hazards can be classified as **chemical, physical, biological,or ergonomic.**

**7.6Methods of Recognizing occupational health stresses/hazards**

Now that we are familiar with the classification of hazards, we can now discuss how to identify the different hazards through a combination of the following methods:

1. **Walk-through/ocular inspection** – this is necessary in identifying the potential hazards and determining the critical conditions in the workplace. It will be good to make a checklist for inspection.
2. **Review of the process involved** – The identity of the chemical intermediates formed in the course of an industrial process and the toxicological properties of these intermediates may be difficult to establish. Undesirable chemical by-products such as carbon monoxide resulting from the incomplete combustion of organic material may be formed.
3. **Knowing the raw materials, by-products and finished products –** Knowing about the raw materials used and the nature of the products manufactured will help you determine the specific contaminants to which workers are actually exposed. Possible impurities in raw materials such as benzene in some solvents should be considered.
4. **Gathering workers’ complaints** – the actual chemicals or substances handled may be determined by interviewing the workers. More so, their complaints can also be gathered and assessed in the clinic record.
5. **Safety Data Sheet (SDS)** is a summary of important health, safety and toxicological information on the chemical or the mixture ingredients. It should contain:

* identification
* hazard(s) identification
* composition/information on ingredients
* first-aid measures
* fire-fighting measures
* accidental release measures
* handling and storage
* exposure control/personal protection
* physical and chemical properties
* stability and reactivity
* toxicological information
* ecological information
* disposal considerations
* transport information
* regulatory information
* other information
  1. **Basic Industrial Hygiene Programmes**

Recognizing and developing precautions for hazards like this has become especially Important since the 9/11 incidents and the anthrax mail scares of 2001-2002 managing exposure hazards like these comes under the category of industrial hygiene, and involves a process of recognition, evaluation, and control. First, the facility’s health and safety officers (possibly working with teams of supervisors and employees) must recognize possible exposure hazards. Doing so typically involves conducting plant / facility walk-around surveys, employee interviews, record reviews, and reviews of government and non-governmental standards regarding various occupational exposure hazards.

Having identified a possible hazard, the evaluation phase involves determining how severe the hazard is. This usually requires measuring the exposure, comparing the measured exposure to some beach mark and determining whether the risk is within tolerances.

* 1. **Evaluation of occupational stresses/hazards**

1. **Determining the magnitude or level of hazards using industrial hygiene equipment through Work Environment Measurement (WEM)**

Once the hazards have been recognized, it is necessary to measure the levels of the hazards and the magnitude of workers’ exposure to them. This is done through the **WEM** which employs direct measurement of hazards. WEM is conducted for the following purposes:

* + determine magnitude of harmful environmental agents.
  + physically check the environment through measurement.
  + predict harmfulness of new facilities, raw materials, production processes and working methods.
  + monitor worker’s exposure to harmful substances.
  + evaluate the effectiveness of environmental control measures adopted to improve the workplace.
  + maintain favorable environment conditions.

1. **Analysis of results**

The collected samples from the WEM are analyzed in the laboratory. Some of the analytical instruments used are as follows: UV-VIS Spectrophotometer for analyzing acids, AAS for heavy metals, Gas Chromatograph for organic solvents, and X-ray Diffractometer, Fourier Transform Infra-Red (FTIR) Spectrocopy, and Phase Contrast Microscope (PCM) for quantitative and qualitative analysis of asbestos and silica.

**7.9Asbestos Exposure at Work**

There are four major sources of occupational respiratory diseases: Asbestos, silica, lead, and carbon dioxide. Of these, asbestos has become a major concern, in part because of publicity surrounding asbestos in building such as schools constructed before the mid-1970s. Major efforts are still underway to get rid of these building of the substance.

OHS standards require several actions with respect to asbestos companies must monitor the air whenever an employer expects the level of asbestos to rise to one half the allowable limits. (You would therefore have to monitor if expected asbestos levels of 0.1 fibers per cubic centimeter). Engineering level that complies with OHS standards. Only then can employers use respirators if additional efforts are still required to achieve compliance.

**7.10Infectious Diseases: The Case of SARS and Coronavirus Disease 2019 (COVID- 19)**

With many employees travelling to and from international destinations, monitoring and controlling infectious disease like Ebola, COVID-19 and SARS has become an important safety issue. In 2003 there were 400 potential SARS candidates and 70 confirmed cases in the United States, and, in 2004, SARS reappeared in china. This, therefore, does not seem to be a problem that is about to go away. The centers for disease control [CDC] say workers who travelled to areas with known SARS outbreaks in the last 10 years or who had close contact with people with suspected SARS may be at the risk for developing the disease.

In 2019 and 2020, COVID-19 killed thousands of people world-wide including health workers with more than one million people affected across the globe. This pandemic brought the world to a stand-still and one of its devastating effects saw millions of people out of employment as businesses had to shut down.

Obviously, employers must make provisions for ensuring that a returning employee does not inadvertently infect one or more colleagues. Employers can take a number of steps to prevent the entry or spread of infectious diseases like COVID-19 and SARS into their workplaces. These include:

1. Closely monitor CDC travel alerts. The CDC issues travel advisories (which recommend deferring nonessential) and travel alerts (which simply inform travellers of health concerns and provides precautions).
2. Provide daily medical screening for employees returning from COVID-19 and SARS-infected areas.
3. Deny access to your facility for 14 days to employees or visitors returning from affected areas, particularly those who have had contact with suspected infected individuals.
4. Tell employees to stay home if they have a fever or respiratory system symptoms.
5. Clean work areas and surfaces regularly.
6. Stagger breaks. Offer several lunch periods to reduce overcrowding.
7. Emphasize to employees the importance of frequent hand washing, and make sanitizers containing alcohol easily available throughout the workplace.

**7.11Alcoholism and Substance Abuse**

Alcoholism and substance abuse are serious and wide spread problems at work. While the percentage of full-time U.S. workers engaging in illegal drug use has reportedly dropped in the last 15 years or so, about 15% of workers still report having used illicit drugs in the past year. Studies suggest that 70% of illicit drug users aged 18 to 49 works full-time, and that drug-using employees are over three and a half times more likely to be involved in workplace accidents. Some experts estimate that as many as 50% of all “problem employees” in industry are actually alcoholics. One estimate places the cost of substance abusers damage to a company at $7,000 per year.

The effects of alcoholism on the worker and the work are severe. Both the quality and quantity of the work declines, and a form “on-the-job absenteeism” occurs as deficiency declines. The alcoholics on-the-job accidents usually don’t increase significantly, apparently, he or she becomes much more cautious (but effectiveness suffers). However, the off-the-job accident rate is higher than for non-alcoholic. Morale of other workers drops as they have to shoulder the work of their alcoholic peer.

Recognizing the alcoholic on the job is another problem. Early symptoms such as tardiness can be similar to those of problems and thus hard to classify. The supervisor is not a psychiatrist, and without specialized training, identifying and dealing with the alcoholic is difficult.

**Dealing with Substance Abuse**

Most firms tests applicants and (often) current employees for drugs. Such testing is generally effective. Pre-employment drug testing discourages those on drugs from applying for work or coming to work for employers who do testing. One study found that over 30% of regular drug users employed full-time said they are less likely to work for a company that conducted pre-employment screening. Some applicants or employees may try to evade the test, for instance, by purchasing “clean” specimens to use.

Other steps involve training of supervisors on company policy regarding substance abuse. Training supervisors to identify alcoholics or drug abusers and the problems they create is advisable. Employers should also establish and communicate a company policy. The policy should indicate management’s position on alcohol and drug abuse and on the use and possession of illegal drugs on company premises. Additional steps employers could take include conducting workplace inspections (searching employees for illegal substances) and using undercover agents.

**7.12Stress, burnout, and depression**

(**a) Stress**

Problems such as alcoholism and drug abuse sometimes result from stress, especially job stress. Here, job-related factors such as overwork, relocation, and problems with customers eventually put the person under so much stress that a pathological reaction such as drug abuse or depression occurs.A variety of external factors can lead to job stress. These include work schedule, pace of work, job security, route to and from work, and the number and nature of customers or clients. Even noise, including people talking and telephone ringing, contributes to stress: 54% of office workers in one recent survey said such noise often bothered them.

However, no two people react to the job in the same way, because personal factors also influence stress. Similarly, the tolerance for ambiguity, patience, self-esteem, health and exercise, and work and sleep patterns can also affect how one reacts to stress. Add to job stress the stress caused by non-job problem like divorce.

Job stress has serious consequences for both employer and employee. The human consequences include anxiety, depression, anger, and various physical consequences, such as cardiovascular disease, headaches, and accidents. For the organization, consequences include reduction in the quantity and quality of performance, increased absenteeism and turnover, and increased grievances and health care costs. A study of 46,000 employees concluded that stress and depression may cause employees to seek medical care for vague physical and psychological problems and can in fact lead to more serious health conditions. High -stress workers’ health care costs were 46% higher than those of their less-stressed co-workers.

**Reducing Job Stress**

There are a number of ways to alleviate dysfunctional stress. These range from commonsense remedies (such as getting more sleep and eating better) to more exotic remedies like biofeedback and meditation. Finding a more suitable job, getting counselling, and planning and organizing each day’s activities are other sensible responses. In his book, Dr. Karl Albrecht suggests the following ways for a person to reduce job stress:

* Build rewarding, pleasant, cooperative relationships with colleagues and employees.
* Don’t bite off more than you can chew.
* Build an especially effective and supportive relationship with your boss.
* Negotiate with your boss for realistic deadlines on important projects.
* Learn as much as you can about upcoming events and get as much lead time as you to prepare for them.
* Find time every day for the detachment and relaxation.
* Take a walk around the office to keep your body refreshed and alert.
* Find ways to reduce unnecessary noise.
* Reduce the amount of trivia in your job; delegate routine works whenever possible.
* Limit interruptions.
* Don’t put off dealing with distasteful problems.
* Make a constructive “worry list” that includes solutions for each problem.

The employer and its HR specialist’s supervisors can also play a role in identifying and reducing job stress. Supportive supervisors and fair treatment are two obvious steps. Based on a survey of 1,299 employees by one insurance company, other steps include:

* Reduce personal conflicts on the job.
* Have an open communication between management and employees.
* Support employees’ efforts, for instance, by regularly asking how they are doing.
* Ensure effective job-person fit, since a mistake can trigger stress.
* Give employees more control over their jobs.
* Provide employee assistance programmes including professional counselling.

1. **Burnout**

Burnout is a phenomenon closely associated with job stress. Experts define burnout as the total depletion of physical and mental resources caused by excessive striving to reach an unrealistic work-related goal. Burnout doesn’t just spontaneously appear. Instead, it builds gradually, manifesting itself in symptoms such as irritability, discouragement, entrapment, and resentment. What can a burnout candidate do? Here are some suggestions:

* Break your patterns. First, survey how you spend your time. Are you doing a variety of things or the same one repeatedly? The more well-rounded your life is, the better protected you are against burnout.
* Get away from it all periodically. Schedule occasional periods of introspection during which you can get away from your usual routing, perhaps alone, to seek a perspective on where you are and where you are going.
* Reassess your goals in terms of their intrinsic worth. Are the goals you have set for yourself attainable? Are they really worth the sacrifices you will have time?
* Think about your work. Could you do as good a job without being so intense or by also pursuing outside interests?

**7.13HIV/AIDS and the work place: Key principles**

## (a) Recognition of HIV/AIDS as a workplace issue

HIV/AIDS is a workplace issue, and should be treated like any other serious illness/ condition in the workplace. This is necessary not only because it affects the workforce, but also because the workplace, being part of the local community, has a role to play in the wider struggle to limit the spread and effects of the epidemic.

## Non-discrimination

In the spirit of decent work and respect for the human rights and dignity of persons infected or affected by HIV/AIDS, there should be no discrimination against workers on the basis of real or perceived HIV status. Discrimination and stigmatization of people living with HIV/AIDS inhibits efforts aimed at promoting HIV/AIDS prevention.

## Gender equality

The gender dimensions of HIV/AIDS should be recognized. Women are more likely to become infected and are more often adversely affected by the HIV/AIDS epidemic than men due to biological, socio-cultural and economic reasons. The greater the gender discrimination in societies and the lower the position of women, the more negatively they are affected by HIV. Therefore, more equal gender relations and the empowerment of women are vital to successfully prevent the spread of HIV infection and enable women to cope with HIV/AIDS.

1. **Healthy work environment**

The work environment should be healthy and safe, so far as is practicable, for all concerned parties, in order to prevent transmission of HIV, in accordance with the provisions of the Occupational Safety and Health Convention, 1981 (No. 155).

A healthy work environment facilitates optimal physical and mental health in relation to work and adaptation of work to the capabilities of workers in light of their state of physical and mental health.

## Social dialogue

The successful implementation of an HIV/AIDS policy and programme requires cooperation and trust between employers, workers and their representatives and government, where appropriate, with the active involvement of workers infected and affected by HIV/AIDS.

1. **Screening for purposes of exclusion from employment or work processes**

HIV/AIDS screening should not be required of job applicants or persons in employment.

1. **Confidentiality**

There is no justification for asking job applicants or workers to disclose HIV-related personal information. Nor should co-workers be obliged to reveal such personal information about fellow workers. Access to personal data relating to a worker’s HIV status should be bound by the rules of confidentiality consistent with the ILO’s code of practice on the protection of workers’ personal data, 1997.

## Continuation of employment relationship

HIV infection is not a cause for termination of employment. As with many other conditions, persons with HIV-related illnesses should be able to work for as long as medically fit in available, appropriate work.

## Prevention

HIV infection is preventable. Prevention of all means of transmission can be achieved through a variety of strategies which are appropriately targeted to national conditions and which are culturally sensitive.Prevention can be furthered through changes in behaviour, knowledge, treatment and the creation of a non-discriminatory environment. The social partners are in a unique position to promote prevention efforts particularly in relation to changing attitudes and behaviours through the provision of information and education, and in addressing socio-economic factors.

## Care and support

Solidarity, care and support should guide the response to HIV/AIDS in the world of work. All workers, including workers with HIV, are entitled to affordable health services. There should be no discrimination against them and their dependants in access to and receipt of benefits from statutory social security programmes and occupational schemes.

1. **Employers and their organizations**

* *Workplace policy*. Employers should consult with workers and their representatives to develop and implement an appropriate policy for their workplace, designed to prevent the spread of the infection and protect all workers from discrimination related to HIV/AIDS.
* *National, sectoral and workplace/enterprise agreements.* Employers should adhere to national law and practice in relation to negotiating terms and conditions of employment about HIV/AIDS issues with workers and their representatives, and endeavour to include provisions on HIV/AIDS protection and prevention in national, sectoral and workplace/enterprise agreements.
* *Education and training*. Employers and their organizations, in consultation with workers and their representatives, should initiate and support programmes at their workplaces to inform, educate and train workers about HIV/AIDS prevention, care and support and the enterprise’s policy on HIV/AIDS, including measures to reduce discrimination against people infected or affected by HIV/AIDS and specific staff benefits and entitlements.
* *Economic impact.* Employers, workers and their organizations, should work together to develop appropriate strategies to assess and appropriately respond to the economic impact of HIV/AIDS on their particular workplace and sector.
* *Personnel policies*. Employers should not engage in nor permit any personnel policy or practice that discriminates against workers infected with or affected by HIV/AIDS.

**7.14 Workplace Smoking**

Smoking is a serious health and cost problem for both employees and employers. For employers, these costs derive from higher health and fire insurance, as well as increased absenteeism and reduced productivity (which occurs when, for instance, a smoker takes a 10-minutes break to finish a cigarette behind the store). In general, “smoking employees are less healthy than non-smokers, are absent more, make more and more expensive claims for health and disability benefits, and endanger co-workers who breathe smoky air”.Non-smoking employees who are concerned with inhaling second hand smoke are suing their employers.

**7.15 Violence at work**

Violence against employees has become an enormous problem at work. Homicide is the second biggest cause of fatal workplace injuries, and surveys by the national institute of occupational safety and health (NIOSH) found that nonfatal workplace assaults resulted in more than 876,000 lost workdays and about $16 billion in lost wages in one recent year.

While robbery was the primary motive for homicide at work, a co- worker or personal associate committed roughly one of seven workplace homicides. And these numbers are just the tip of the iceberg. For example, 29 U.S. Postal service supervisors and colleagues were slain by disgruntled postal workers in one 10-year period, but there were also 350 assaults by postal workers in one year alone.

While men have more fatal occupational injuries than do women, the proportion of women who are victims of assault is much higherFatal workplace violence against women has three main sources. Over two-thirds of all women (many working in retail establishment) murdered at work were victims of random criminal violence carried out by an assailant unknown to the victim, as might occur during robbery. Co-workers, family members, or previous friends or acquaintances carried out the remaining homicides. Specifically, in a survey of nearly 600 full-time men and women workers nationwide, clients, patients, and other strangers accounted for 68% of all violent attacks. Co-workers accounted for about 20% of the attacks and an employer or supervisor about 7%.

With respect to supervisors, one report refers to bullying as the “silent epidemic” of the workplace, “where abusive behaviour, threats, and intimidation often go unreported” and, workplace violence doesn’t just affect people. It can also manifest itself in sabotaging the firm’s property, software, or information databases.

Violence is more associated with some jobs than others. In one study, researchers constructed a risk” for violence scale”. In its final form, this listed 22 jobs characteristics that the researchers found correlated with violence on the job. Jobs with a high likely hood for violence include those jobs that involve physical care of others, decisions that influence other people’s life, involve handing guns, exercise security functions, exercise physical control over others, interact with frustrated individuals and handle weapons other than guns, for instance

Employers need to eliminate workplace violence on humanitarian grounds, but there are also legal reasons for doing so. For example, the employee-victim may sue the employer, on the theory that the employer negligently hired or retained someone the employer should have known could be violent. Employers can take several steps to reduce workplace violence. The following are some of the measures that employers can take to reduce workplace violence:

* Heightened Security Measures
* Improved Employee Screening
* Workplace Violent Training
* Dismissing Violet Employees
* Dealing with Angry Employees
  1. **Terminology**

Industrial hygiene is anticipation, recognition, evaluation, control, and confirmation of protection from hazards at work that may result in injury, illness, or affect the well-being of the workers.

**7.17 Activity**

Explain how you would reduce stress at work.

* 1. **Reflection**

What do you think could be the steps employers can take to reduce workplace violence?

**7.19 Summary**

In this unit, you have learnt that Industrial hygienist uses strict and rigorous scientific methodology and requires professional experience and judgment in determining the potential for hazard, exposure or risk in the workplace and recommend appropriate control measures for hazard abatement. You have also learnt that most workplace health hazards are not obvious ones like unguarded equipment or slippery floors. Many are unseen hazards. Typical workplace exposure hazards may include chemicals and other hazardous materials, excessive noise and vibrations, temperature extremes, biohazards, ergonomic hazards, and safety related hazards such as slippery floors. In the next unit, you will learn about occupational health hazards and their health effects.

**UNIT 8: OCCUPATIONAL HEALTH HAZARDS AND THEIR HEALTH EFFECTS**

**8.1 Introduction**

Exposure to the different hazards in the workplace can cause problems with health which may bring about disease or death. This unit aims to give you basic knowledge on the health effects of the different hazards encountered in the workplace and the means to prevent such occurrences. It is important to understand the key concepts in the causation of disease from work exposures.

Occupational diseases and work-related illnesses can be prevented. It is important to have health programmes in place, which allow for screening susceptible individuals and early diagnosis of diseases to prevent progression of an illness or to immediately control workplace hazards so that optimum workers health is maintained.

**8.2** **Learning Outcomes**

By the end of the unit, you should be able to:

* explain the key concepts of occupational health.
* Analyse common hazards in the workplace and their effects on workers’ health.
* describe the role of medical surveillance in preventing occupational illnesses and injuries.
* identify ways to protect one’s self from health hazards.

**8.3 Time Frame**

You need about six (2) hours per week to interact with this material.

* 1. **Content**
* Workplace Hazards and ill-Health
* Health Effects of Occupational Health Hazards
* Safety and Health Inspection
* Accident Investigations
* Terminologies
* Activity
* Reflection
* Summary

**8.5Workplace hazards and ill-health**

The main thrust of the concepts of occupational health is to emphasize prevention of occupational diseases and work-related illnesses rather than its cure. Occupational health has been defined by the ILO and the WHO as the:

* Promotion and maintenance of the highest degree of physical, mental & social well-being of workers of all occupations
* Prevention among its workers of departures from health caused by their working conditions
* Protection of workers in their employment from risks usually from factors adverse to health
* Placing & maintenance of the worker in an occupational environment adapted to his/her physiological ability

As you know,

* Occupational health encompasses the social, mental and physical well-being of workers in all occupations.
* It includes the protection of workers from illnesses arising from work through promotion of safety and health programmes.
* It should always be a priority to adapt the work to the human being. Poor working conditions have the potential to affect a worker's health and safety.
* Poor working conditions can affect not only the workers but their families, other people in the community, and the physical environment.

**8.6Health Effects of Occupational Health Hazards**

Hazards in the workplace that can cause ill-health among workers including the following:

1. Chemical hazards such as dusts, gases, vapours and mists.
2. Physical hazards such as noise, illumination, extremes of temperature, vibration and radiation (non-ionizing and ionizing).
3. Ergonomic hazards due to repetitive movement, improper posture, forceful exertions, monotonous tasks, mental stress, etc.
4. Biological hazards that can cause harm to humans such as viruses, bacteria, fungi, and parasites.
5. **Health Effects of Chemical Hazards**

Workers are exposed to various chemicals in the workplace. These chemicals have inherent toxicities that can potentially harm humans depending on the amount that has entered the body and the conditions of exposure.

Chemicals can enter the body by several routes. Being familiar with all routes of entry will help in preventing exposures. The most important and most common route of entry is by inhalation through the lungs. Organic solvents and pesticides are examples of chemicals that are easily absorbed through the skin. Chemical substances can also enter the body through the mouth by accidental ingestion.

**(ii) Health effects of physical hazards**

Noise, extremes of temperature, inadequate illumination, radiation, and vibration are among the physical hazards that workers experience in their environments. Hearing damage may be acute or immediate after exposure to very loud sounds such as blasts, or chronic which would be secondary to long-term exposure to hazardous noise levels. The major risk factor that may cause hearing damage from noise is prolonged and unprotected exposure to harmful levels.

* **Health Effects of Biological Hazards**

Biologic hazards are plants, animals and their products that may present risks to the health of persons infected by biologic agents they carry. Such biologic agents are classified as bacteria, virus, fungi, and parasites depending on their physical and other cellular characteristics. For example, bacteria and fungi have cell walls while viruses do not.

* **Health Effects of Ergonomic Stresses**

The International Ergonomics Association (IEA) Executive Council in 2000 defined Ergonomics (or human factors) as the scientific discipline concerned with the understanding of the interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

The three main goals of ergonomics are: to make work safe and humane, to increase human efficiency and to create human well-being. The worker is affected by the following factors at work: tools, workstation, task, environment and organization. A balance must be maintained where one looks at the capabilities and limitations of the worker with the work system.

With an imbalance of all these factors, effects on worker’s performance and their health occurs which may lead to low product quality, high rate of errors, material and equipment loss or wastage, including musculoskeletal and other systemic disorders. An example of musculoskeletal disorders arising from ergonomic stresses is carpal tunnel syndrome, which arises from median nerve compression in the wrist and secondary to repetitive flexion of the wrist.

**8.7Safety and Health Inspection**

Programmes for reducing unsafe acts are no substitute for eliminating hazards. Routinely inspect all premises for possible safety and health problems, using checklists as aids. Investigate all accidents and” near misses”. Have a system in place for letting employees notify managers about hazards. Use employee safety committees to do the inspecting. Committee activities include evaluating safety adequacy, monitoring safety audit findings and suggesting strategies for improving health and safety performance.

The manager can expedite the safety audit process considerably by using a personal digital assistant in such as PalmPilot. For example, one Microsoft windows application for designing and completing safety audit questionnaires is called Process and Performance Measurement (PPM).

# **8.8 Accident Investigation**

After the efforts on prevention, and should there be a chance that hazards lead to accidents or injuries, a sound accident investigation needs to be conducted. As OHS officers, you must understand the basic approaches in accident investigation.

An accident is an unplanned and unexpected occurrence that may result to injury or death to a person and/or damage to properties. The causes of accidents could actually be divided into two (2) categories: unsafe conditions and unsafe acts. Unsafe acts are anything related to employee activities - horseplay, disregarding safety rules, failing to wear PPE, lifting improperly, etc. Any cause of accidents related to the physical environments is considered an unsafe condition. Examples are slippery floors caused by leaking drum of oil, faulty electrical installation, unguarded moving parts of the machine, poorly lighted working environment, etc.

Investigation of accidents is an important element of the safety and health programme that we should establish and implement. All aspects of our daily work operation involve a degree of risk so that some events or actions may not be as safe as we want it to be. These accidents are caused by many contributing factors which make them complicated. Analysis of these accidents through a thorough accident investigation will definitely identify causes and eventually lead to the prevention of its recurrence, or future accidents.

As a matter of safety and health policy, all accidents must be reported and investigated as soon as possible. Everyone in the workplace should be able to adhere to this, in order to have concerted efforts in accident and injuries prevention. The investigation is just the first step, follow-up on the implementation of recommendations should be made. Accident investigation is one of the most important responsibilities of the OHS officer. An accident investigation is really complete ***only*** when accidents are eliminated.

Now let us try to understand the basic principle of accident prevention. Our basic concern on occupational safety and health is on the safety of the worker against accident and injury and health of a person against illnesses and diseases. In order for workers to be safe, we have to prevent or minimize direct contact. On the other hand, in order to be healthy in the workplace, we have to prevent or minimize their exposure to environmental hazards. Earlier, it has been mentioned that a policy is needed in order that all incidents be reported so the appropriate investigation can be performed. A thorough policy would require reporting the following types of accidents:

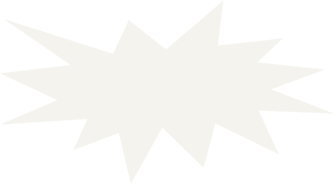
* Fatal
* Injury
* Disease
* Dangerous occurrence
* Near-miss

**Why do you perform accident investigation?**

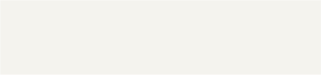
|  |
| --- |
| PURPOSE OF ACCIDENT INVESTIGATION   * **To establish all facts** * **To draw conclusion** * **To make recommendations** * **To prevent recurrence** |

**What are the basic steps in accident investigation?**

Steps in accident investigation

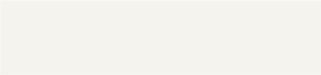


**Accident**



**. Control the Scene**

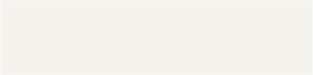
**1**



**. Gather**

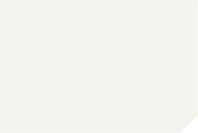
**2**

**Information**



**3**

**. Analyze Data**



**4**

**. Write**

**Report**



**Manage the accident scene**

The first step in any accident investigation is for you to manage the accident scene through the following;

* Treat the injured
* Control the remaining hazards
* Isolate the site to protect people
* Preserve the evidence

**Treat the injured.**  Investigator should be very sure that steps have been taken to ensure prompt and effective rescue of an injured. Planning should address the provision for quick first-aid treatment for the victims.

**Control the remaining hazards.** Immediate or temporary actions should be taken to control the risk of any further injury or damage. There should be an established procedure for the stoppage of any additional work to prevent possible occurrence of another or similar accident.

**Isolate the site to protect people.**  In many cases, the accident scene is a dangerous place. The accident may have damaged electrical equipment, weakened structural supports or may have released radioactive or toxic materials. Isolating or barricading the accident scene must be particularly implemented to prevent the entry of workers.

**Preserve the evidence.**  Immediate action should be made for the protection of evidence. Physical evidences are so important for the success of every accident investigation. Each investigation should be conducted as soon as possible after the accident. A delay of only a few hours may permit these important evidences to be destroyed or removed intentionally or unintentionally. Preservation techniques include photographs, sketches, maps, notes and witness statements. Depending upon the nature of the accident, preservation of evidence may also require additional action to ensure its security.

**Finding the cause**

In accident investigation, it is commonly understood that a combination of factors or causes must usually come together under just the right circumstances to bring about accident. Information on accident causes have led management to conclude that accidents are caused, they don’t just happen and causes can be determined and controlled.

The four (4) elements that interact together for successful business operations are the following;

* People
* Equipment
* Materials
* Environment

However, when something unplanned or undesired occurs within any of these elements, usually some adverse effects might happen.

**8.9 Terminology**

Occupational hazards are hazards experienced in the work place, which include chemical hazards, biological hazards, psychosocial hazards and physical hazards.

* 1. **Activities**

1. Explain the reasons why the magnitude of occupational health hazards is increasing in health care industries (hospitals, health centers, laboratory etc).
2. How does the occupational environment of the worker affect the health of his or her families and the general population?

**8.11 Reflection**

What do you think are the advantages of hazard warning symbols or signs?

**8.12Summary**

In this unit, you have learnt that accident investigation is really an important tool in the prevention of recurrence of accidents. All accidents, whether it is a near miss or injury/ damage causing accident, should be reported. You have also learnt that to be effective, you should always be at the scene of the accident as soon as possible and should follow the basic methods of accident investigation.

**REFERENCES**

Barbara, A. P. (2002) Fundamentals of Industrial Hygiene. 5th edition. National Safety Council Chicago.

Barry, S, L and David, H (1988) Occupational Health. Recognizing and Preventing Work-Related Diseases.3rd edition.London.

Dedglaville, H., R.S.F and Wood, C.H (1987), editors, Occupational Health, A manual for health Workers in developing countries, AMREF.

Dembe AE, Erickson JB, Delbos R (2004) Predictors of work-related injuries and illness: National Survey findings Occup Environ Hyg. 8:542-550.

Fedotov, I.A.; Saux, M.; Rantanen, J. (eds). (1998) “Occupational health services”, in *Encyclopaedia of occupational health and safety*, 4th ed., Vol. I (Geneva, ILO), pp. 161–62.

Hämäläinen, P.; Takala, J.; Saarela, K. L. (2006) “Global estimates of occupational accidents”, in *Safety Science*, Vol. 44, pp. 137–156.

Introduction to Occupational Health and Safety, International Labour Organization, accessed on 25 January 2020[http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm)](http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm)

ILO. 1984. *Conclusions concerning future action in the field of working conditions and environment*, adopted by the 70th Session of the International Labour Conference, 26 June, section I, para. 2.

2001b. *ILO guidelines on occupational safety and health management systems* (ILO-OSH 2001) (Geneva).

Jeremy, S and Malcolm D (1986) RoSPA. Health and Safety practice.2nd edition. Great Britain

Joint Learning Initiative (2004)*Human resources for health: Overcoming the crisis* (Cambridge, Mass., Harvard University Press).

Module 010: Occupational Health, Safety and Environment in Construction, National Council for Construction, accessed on 25 January 2020 <http://www.ncc.org.zm/.../010-Training-Manual-Occupational-Health-and-Safety>

WHO. Occupational Health program of WHO Headquarters, Geneva, Switzerland (2003) The Global Occupational Health Network