



NATIONAL OPEN UNIVERSITY OF NIGERIA

FACULTY OF HEALTH SCIENCES

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES

COURSE CODE: EHS 513



COURSE TITLE: INDUSTRIAL SAFETY



EHS 513: INDUSTRIAL SAFETY

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INTRODUCTION

EHS 513: Industrial Safety is a two(2) unit course with four (4) modules and eleven (11) units. Environmental Health Science deals with the aspects of Industrial Safety. There are various risks in the mechanical industry and the whole industrial world overall. Working between huge machines and precisely handling environment has its own risks, sometimes leading to catastrophic situations. For this reason, Industrial Safety is considered important because it teaches how to stay safe as well as implement safety in these environments. It teaches various safety guidelines and regulations that are taught to be followed and kept in mind to maintain no risk factor. Further to that it introduces the causative factors of industrial accidents, the basic elements in safety and management for accidents control and risk management. In essence therefore, learning the fundamental components of a comprehensive Industrial Safety will enable you protect employees in any organization and help reduce risks and avoid costly liability.

WHAT YOU WILL LEARN IN THIS COURSE

In this course, you have the course units and a course guide. The courseguide will tell you what the course is all about. It is general overview ofthe course materials you will be using and how to use those materials. Italso helps you to allocate the appropriate time to each unit so that youcan successfully complete the course within the stipulated time limit.The course guide also helps you to know how to go about your Self-Assessment Exercises and Tutor-Marked Assessments (TMAs) - which will form part of your overall assessment atthe end of the course. Also, there will be regular tutorial classes that arerelated to this course, where you can interact with your facilitator andother students. You are hereby encouraged to attend these tutorial classes, please.

COURSE AIM

The aim of this course is to give you understanding of Industrial Safety which is animportant aspect of Environmental Health Science.

COURSE OBJECTIVES

To achieve the aim of this course a number of objectives were outline at the beginning of each unit, in accordance with the designed module. These objectives willguideand provide you focuswhile studying the units. You are advised to read the objectives before studying the unit and during your study for checking your progress.

The comprehensive objectives of this course are provided as thus:

At the end of this course/after going through this course, you should be able to:

- i. Provide the concise meaning of “Industrial Safety”
- ii. Identify the programmes of Industrial Safety
- iii. Identify the extent to which Industrial Safety can be practiced
- iv. Appreciate that safe working environment make social justice/economic growth achievable
- v. Explain the origin of Industrial Safety
- vi. Describe the historical development of Industrial Safety
- vii. Identify the need for Industrial Safety
- viii. Provide the significance of Industrial Safety
- ix. Explain industrial safety management systems
- x. Understand points on the repetition of the PDCA cycle
- xi. Understand steps for avoiding pitfalls
- xii. Understand mechanical hazards
- xiii. Understand electrical hazards
- xiv. Understand chemical hazards
- xv. Understand fire and explosion hazards
- xvi. Understand machinery guarding and protection against mechanical hazards
- xvii. Understand protection against electrical hazards
- xviii. Understand control of chemical hazards in a workplace
- xix. Understand fire and explosion protection and preventions
- xx. Know the types of industrial accidents
- xxi. Understand causes of industrial accidents
- xxii. Explain factors responsible for accidents in industries
- xxiii. Understand working conditions affecting health
- xxiv. Understand the concept, scope and definition of industrial management
- xxv. Understand the development of industrial management
- xxvi. Understand the functions and importance of industrial management
- xxvii. Understand management process and occupational safety
- xxviii. Understand management safety responsibilities
- xxix. Understand establishment of safety management systems
- xxx. Understand vitalization of safety management activities

WORKING THROUGH THIS COURSE

To successfully complete this course, you are required to read each study unit, read the textbooks materials provided by the National Open University of Nigeria (NOUN) as well as the referenced materials, which can also be of great assistance. You are advised to do the self-assessment exercises in each unit and at certain periods, during the

course you will be required to submit your assignments for the purpose of assessing and recording your performance.

There will be a final examination at the end of the course. The course should take you about 15 weeks to complete. This course guide will provide you with all the components of the course how to go about studying and how you should allocate your time to each unit so as to successfully finish on good time.

THE COURSE MATERIALS

The main components of the course are:

- The Study Guide
- Study Units
- References/Further Readings
- Tutor Marked Assessments
- Presentation Schedule

STUDY UNITS

The study units in this course are given as follows:

MODULE 1	INTRODUCTION TO INDUSTRIAL SAFETY
Unit 1	Definition and Programmes of Industrial Safety
Unit 2	Origin, History and Development of Industrial Safety Movement
Unit 3	Need and Significance of Industrial Safety
MODULE 2	BASIC ELEMENTS IN INDUSTRIAL SAFETY
Unit 1	Occupational Safety and Health Management System (OSHMS)
Unit 2	Identification of Industrial Hazard
Unit 3	Major Hazard Control
MODULE 3	INDUSTRIAL ACCIDENTS
Unit 1	Types and Causes of Industrial Accidents
Unit 2	Factors Contributing to Industrial Accidents
MODULE 4	INDUSTRIAL SAFETY MANAGEMENT
Unit 1	Industrial Management
Unit 2	Roles of Management in Ensuring Industrial Safety
Unit 3	Establishment of Safety Management Systems and Vitalization of Safety Management Activities

There are self-assessment exercises related to the lecture in each unit which will help your progress and comprehension of the units. You are required to work on these exercises which together with the TMAs will enable you to achieve the objectives of each unit.

ASSESSMENTS

There are three (3) types of assessments in this course. The first one is self-assessment exercises; the second one is the Tutor-Marked Assessments (TMAs), whereas the third assessment is the written examination. In solving questions in the assessments, you are expected to apply the information, knowledge and experience acquired during the course. The TMAs must be submitted to your facilitator for formal assessment in accordance with prescribed deadlines stated in your assignment file. The work you submit to your facilitator for assessment accounts for 30% of your total course mark. At the end of the course, you will be required to sit for a final examination of about 2 hours duration at your study centre. This final examination will account for 70% of your total course mark.

TUTOR-MARKED ASSESSMENTS (TMAs)

This is the continuous assessment component of this course and it accounts for 30% of the total score. You will be given four (4) TMAs by your facilitator to answer. Three of TMAs must be answered before you are allowed to sit for the end of course examination. These answered assignments are to be returned to your facilitator. You're expected to complete the assignments by using the information and material in your readings references and study units. Reading and researching into your references will give you a wider view and deeper understanding of the subject. It is advisable that you:

1. Make sure that each assignment reaches your facilitator on or before the deadline given in the presentation schedule and assignment file. If for any reason you are not able to complete your assignment, make sure you contact your facilitator before the assignment is due to discuss the possibility of an extension. Request for extension will not be granted after the due date unless in exceptional circumstances.
2. Make sure you revise the whole course content before sitting for the examination. The self-assessment activities and TMAs will be useful for this purpose and if you have any comment please do so before the examination. The end of course examination covers information from all parts of the course.

PRESENTATION SCHEDULE

There is a time-table prepared for the early and timely completion and submissions of your TMAs as well as attending the tutorial classes. You are required to submit all your assignments by the stipulated time and date. Avoid falling behind the schedule time.

Table 1: Course Marking Scheme

Assessments	Marks Allocation
Four TMAs	Best three marks of the four TMAs count at 10% each = 30% of the course marks.
End of course examination	70% of overall course marks
Total	100% of course marks

Adapted from NOUN; EHS 202: Introduction to Ecology and Environmental Science

Table 2: Course Guide Organisation

Module	Unit	Week	Activity/Work Title	Assessment
1	1	1	Definition and Programmes of Industrial Safety	One Tutor-Marked Assessment out of Unit 1, 2 or 3
	2	2	Origin, History and Development of Industrial Safety Movement	
	3	3	Need and Significance of Industrial Safety	
	4		First Tutor Marked Assessment	
2	1	5	Occupational Safety and Health Management System (OSHMS)	One Tutor-Marked Assessment out of Unit 1, 2 or 3
	2	6	Identification of Industrial Hazard	
	3	7	Major Hazard Control	
	8		Second Tutor Marked Assessment	
3	1	9	Types and Causes of Industrial Accidents	One Tutor-Marked Assessment out of Unit 1 or 2
	2	10	Factors Contributing to Industrial Accidents	
	11		Third Tutor Marked Assessment	
4	1	12	Industrial Management	One Tutor-Marked Assessment out of Unit 1, 2 or 3
	2	13	Roles of Management in Ensuring Industrial Safety	
	3	14	Establishment of Safety Management Systems and Vitalization of Safety Management Activities	
	15		Fourth Tutor Marked Assessment	

Adapted from NOUN; EHS 202: Introduction to Ecology and Environmental Science

HOW TO GET THE MOST OUT OF THIS COURSE

In distance learning, the study units replace the university lecturer. This is one of the huge advantages of distance learning mode; you can read and work through specially designed study materials at your own pace and at a time and place that suit you best. Think of it as reading from the teacher, the study guide tells you what to read, when to read and the relevant texts to consult. You are provided exercises at appropriate points, just as a lecturer might give you as in class exercise.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next to this is a set of learning objectives. These learning objectives are meant to guide your studies. The moment a unit is finished, you must go back and check whether you have achieved the objectives. If this is made a habit, then you will significantly improve your chances of passing the course. The main body of the units also guides you through the required readings from other sources. This will usually be either from set books or from other sources.

Self-Assessment Exercises are provided throughout the unit, to aid personal studies and answers are provided at the end of the unit. Working through these self-tests will help you to achieve the objectives of the unit and also prepare you for TMAs and examinations. You should attempt each self-test as you encounter them in the units.

The following are practical strategies for working through this course:

- i. Read the Course Guide thoroughly.
- ii. Organize a study schedule. Refer to the course overview for more details. Note the time you are expected to spend on each unit and how the assignment relates to the units. Important details, e.g. details of your tutorials and the date of the first day of the semester are available. You need to gather together all this information in one place such as a diary, a wall chart calendar or an organizer. Whatever method you choose, you should write your own dates for working on each unit.
- iii. Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their course works. If you get into difficulties with your schedule, please let your tutor know before it is too late for help.
- iv. Read the introductions and learning objectives of each unit in this guide.
- v. Assemble the study materials. Information about what you need for a unit is given in the table of contents at the beginning of each unit. You will almost always need both the study unit you are working on and one of the materials recommended for further readings, on your desk at the same time.

- vi. Work through the unit, the content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit, you will be encouraged to read from your set books.
- vii. Keep in mind that you will learn a lot by doing all your assignments carefully. They have been designed to help you meet the objectives of the course and will help you pass the examination.
- viii. Review the objectives of each study unit to confirm that you have achieved them. If you are not certain about any of the objectives, review the study material and consult your tutor.
- ix. When you are confident that you have achieved a unit's objectives, you can start on the next unit. Proceed unit by unit through the course and try to pace your study so that you can keep yourself on schedule.
- x. When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your tutor's comments, both on the TMAs form and also that which is written on the assignment. Consult your tutor as soon as possible if you have any questions or problems.
- xi. After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this course guide).

FACILITATORS/TUTORS AND TUTORIALS

Sixteen (16) hours are provided for tutorials for this course. You will be notified of the dates, times and location for these tutorial classes. As soon as you are allocated a tutorial group, the name and phone number of your facilitator will be given to you. These are the duties of your facilitator: i) Marking and commenting on your assessments, ii) Monitoring your progress and providing any necessary assistance you may need, and iii) Marking your TMAs and returning them to you as soon as possible.

You are expected to mail your tutored assignments to your facilitator at least two days before the scheduled date. Do not delay to contact your facilitator by telephone or e-mail for necessary assistance if you; do not understand any part of the study in the course material, have difficulty with the self-assessment activities, have a problem or question with an assignment or with the grading of the assignment. It is important and necessary you attend in the tutorial classes, because, this is the only chance to have face to face contact with your facilitator and to ask questions which will be answered instantly. It is also a period where you can say any problem encountered in the course of your study.

FINAL EXAMINATION AND GRADING

The final examination for EHS 513: Industrial Safety will be of 2 hours duration. This accounts for 70 % of the total course grade. The examination will consist of questions which reflect the practice, exercises and the TMAs you have already attempted in the past. Note that all areas of the course will be assessed. To revise the entire course, you must start from the first unit to the eleventh unit in order to get prepared for the examination. It may be useful to go over your TMAs and probably discuss with your course mates or group if need be. This will make you to be more prepared, since the examination covers information from all aspects of the course.

SUMMARY

Industrial Safety as a course will introduce you to the scientific approach to management of all operations and events within an industry in order to protect employees and assets by minimizing hazards, risks, accidents, and near misses. This course reflects protections put in place to ensure plant and factory worker protection from hazards that could cause injury, loss or both.

On completion of this course, you will have an understanding of basic knowledge of introduction to industrial safety, basic elements in industrial safety, industrial accidents and industrial safety management. Further to that, the history of scholars who contributed to this field of study by their discoveries during their research works will be made known to you, these I so much acknowledged with much appreciation. In addition, you are expected to apply the knowledge you have acquired during this course to your practical life.

I wish you success in this course.

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MODULE 1 INTRODUCTION TO INDUSTRIAL SAFETY

Unit 1	Definition and Programmes of Industrial Safety
Unit 2	Origin, History and Development of Industrial Safety Movements
Unit 3	Need and Significance of Industrial Safety

Unit 1 DEFINITION AND PROGRAMMES OF INDUSTRIAL SAFETY

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2.0	Objectives
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3.1	Definition/Meaning of Industrial Safety
3.2	Industrial Safety Programme
3.3	Extent of Industrial Safety Practices
3.4	Working Environment and Social Justice/Economic Growth
4.0	Conclusion
5.0	Summary
6.0	Tutor Marked Assessment
7.0	References/Further Readings

1.0 INTRODUCTION

This unit will expose you to understanding the meaning and programmes of Industrial Safety. The meaning will be best appreciated when its teachings are geared toward understanding that without safe and healthy working conditions, social justice and economic growth cannot be achieved and that safe and healthy working environment is recognized as a fundamental human right. In essence therefore, this unit despite providing a concise meaning of the term “Industrial Safety”, it also considered the extent to which Industrial Safety can be practiced.

2.0 OBJECTIVES

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

- Provide the concise meaning of “Industrial Safety”
- Identify the programmes of Industrial Safety
- Identify the extent to which Industrial Safety can be practiced
- Appreciate that safe working environment make social justice/economic growth achievable

3.0 MAIN CONTENT

3.1 Definition/Meaning of Industrial Safety

Safety is very important aspect for any industry as an accident free work environment boosts the morale of the team members working in any hazardous situations. Recognising these facts, industries involving various hazards and risks industries prepare their own safety policy/manual and have a separate department for safety, so as to create proper awareness and provide the knowledge about the safety. The term 'Safety' refers to the precautions people take to prevent accidents, harm, danger, damage, loss and pollution. Safety also deals with improvement in working conditions for better health. Management is responsible to provide safe working condition and individual's safety.

Industrial Safety is important as it safeguards human life, especially in high risk areas such as nuclear, aircraft, chemical, oil and gases, and mining industries, where a fatal mistake can be catastrophic. Industrial Safety reduces risks to people and processes. The importance of Industrial Safety can be traced to the fact that every year millions industrial accidents occur which results in loss of production time, equivalent to millions of man hours and machine hours. In taking care of the damage caused by accident, about one-fifth of industrial production time is usually lost by those actually injured due to temporary and permanent disablement and the remaining production time is lost by fellow operators in helping the injured. The loss to the industrial unit would appear much more alarming when death cases due to accidents are considered.

It is not only sufficient to care for safety; rather employees' health and environment are to be given equal importance and considerations. Therefore, Safety, Health and Environment (SHE) are inter related and affect each other. For instance, if health of employee is not given due regards, it may lead to accidents. Accordingly, if industry pollutes the environment around work place, it will affect health of employees which may ultimately affect production. It is only if health and environment are in control then safety can be ensured. As such, each industry has certain obligations towards keeping good environment and also towards health of people.

In view of the above, it is essential to define 'Industrial Safety' as observing strategic manufacturing/production processes by a company/employee(s) with utmost freedom from or lack of danger in production, ensuring adequate protection and minimal level of exposure to the risk of harm or injury. In other words 'Industrial Safety' refers to the management of all operations and events within an industry in order to protect its employees and assets by minimizing hazards, risks, accidents, and near misses. It is also referred to as policies and protections put in place to ensure plant and factory worker protection from hazards that could cause injury (e.g. safety policies put in

place by the Occupational Safety & Health Administration (OSHA)). Industrial Safety is overseen by federal, state, and local laws and regulations.

SELF-ASSESSMENT EXERCISE

- i. In your own understanding, why is safety very important aspect for any industry?
- ii. Discuss the assertion that ‘safety, health and environment are inter related and affect each other’.
- iii. What might generally be considered as the concise meaning to the term ‘Industrial Safety’?

3.2 Industrial Safety Programme

A safety programme intends to identify when, where and why accidents occur. In the same vein a safety programme aims at reducing accidents and associated losses. A safety programme is initiated with the assumption that it is possible to prevent most work connected accidents. A safety programme is a continuous process and tries to decrease the influence of personal and environmental factors which cause accidents. Normally a safety programme consists of providing safety equipment's and special training to workmen or employees.

The moral imperative of an enterprise to actively seek to reduce damages, pain and suffering in the workplace will be tempered by the ability of the organization to sustain such an effort. Most human activities have risk attached to them, and risks in the workplace vary widely, from those much lower than those associated with normal, non-occupational activities, to very significantly more hazardous ones. An essential part of an organization is its willingness to accept the risks of business which have the potential for producing financial losses and are based on the pain and suffering of employees that result from accidents. A successful safety programme is intended to control a portion of these losses by reducing the risks, particularly where such risks arise from unsafe conditions or unsafe acts.

A safety programme should produce complementary benefits: a reduction in damages and pain and suffering in the workforce and a resultant reduction in the financial burden to the organization due to such accidents. To achieve such benefits, a successful safety programme will follow the general approach of all management tools by establishing goals, monitoring performance and correcting deviations. This approach will be applied to a rather wide range of organizational activities, including organizational design, the production processes and the behaviour of the workers.

Training and education are major components of any safety programme. This begins with the dissemination from senior management not only of the programme's objectives and goals, but also information on progress towards those goals, measured through record keeping and cost accounting. Education meant a more general understanding of the nature of a hazard and of approaches to risk reduction, appears to work well, particularly in circumstances where there is still doubt about individual risk factors. An increased awareness of risks allows individual workers to avoid such conditions by recognizing their exposures and modifying them by changes to procedures.

SELF-ASSESSMENT EXERCISE

- i. Why it is that successful industrial safety programme is a continuous process?
- ii. Explain how safety programmes should produce complementary benefits to industries.
- iii. Examine the relevance of training and education as significant components of industrial safety programme.

3.3 Extent of Industrial Safety Practices

Industrial Safety is the most important aspect while designing a factory. Construction architects and engineers of various industries such as process, product and service industries stress on the Industrial Safety systems and they place it as a centre piece in their design. An Industrial Safety system differs according to the nature of the factory. Most of the process industries have two phased safety systems. A Process safety system comes first followed by safety mechanism system. A Process safety system ensures that the necessary processes shut down automatically when there is an emergency, whereas, the safety mechanism system works in tandem to safeguard the lives and other tangible resources in the factory in order to minimize or prevent the resource losses in a factory.

In these days of nuclear technologies, a process shutdown system takes precedence to a safety mechanism system. Many private and publicly run companies stress on the importance of the safety systems and build their businesses without any compromise in the safety guidelines. With the development of internet and other software based companies, a safety mechanism precedes the process shutdown systems as most of the software companies are man intensive operations without much heavy machinery involved. Safeguarding and evacuation steps take a bigger priority in those companies as the chances of collateral damages in the nearby neighbourhoods are less. Though safety systems have long been practiced in the developed economies, it is a

welcoming sign that the developing nations stress the importance of adherence to safety measures.

There are multiple methods of utilizing Industrial floor signs and experts always keep the end user in the mind while designing the safety mechanism for a factory. In heavy machinery involved industries, even the smallest of action like a proper placing of a foam tool box and tool organizer will help the employees and workers in times of disaster. Six sigma and other quality certification bodies ensure that the industries keep an eye on small things that will greatly help them in maintaining and improving the safety and security standards. There are many benefits for a factory that has properly adhered to Industrial Safety signs and other practices to keep their industry safe. It is a big need of the hour as reduction or prevention of loss of life followed by monetary and other financial benefits must take utmost importance for any factory.

SELF-ASSESSMENT EXERCISE

- i. With regard to industrial safety practices, briefly differentiate the two phased safety systems according to the nature of factory.
- ii. 'There are many benefits for a factory that properly adhered to industrial safety signs and other practices', discuss.

3.4 Working Environment and Social Justice/Economic Growth

The work place environment in a majority of industry is unsafe and unhealthy. These includes poorly designed workstations, unsuitable furniture, lack of ventilation, inappropriate lighting, excessive noise, insufficient safety measures in fire emergencies and lack of personal protective equipment. People working in such environment are prone to occupational disease and it impacts on employee's performance. Thus, productivity is decreased due to the workplace environment. It is a wide industrial area where the employees are facing a serious problem in their workplace like environmental and physical factors. So it is difficult to provide facilities to increase their performance level.

Interestingly, the workplace of today is characterized by two opposing trends. On the one hand, employees are given leeway in the way they dress and act. On the other hand, the management's tendency to micromanage has increased. Though the two are different aspects they are certainly related. The possible explanation for the increased tendency to micromanage is because of the fact that the today's manager has to change his style of functioning in order to bring about effective changes in these aspects. He has to spend more time on controlling these factors of the work environment rather than micromanage. For this, he has to: Give adequate authority to

employees, Delegate responsibilities, Increase their accountability and Encourage teamwork.

The manager must curb the tendency to micromanage and instead display that he has confidence in the ability of his team members and trusts them to do their work efficiently. If he treats his subordinates as professionals then there is no reason that they should not behave in that way. Such an attitude promotes trust and loyalty among the employees and encourages better teamwork among them. Besides, they develop a sense of ownership towards the company. Creating a work environment in which employees are productive is essential to increased profits for your organization, corporation or small business. Principles of management that dictate how, exactly, to maximize employee productivity centred around two major areas of focus: personal motivation and the infrastructure of the work environment.

To successfully draw a number of core ideas central to better understanding the concept, 'social justice' can be viewed as the virtue which guides us in creating institutions which, when justly organized, provide access to what is good for the person, both individually and in association with others. Therefore, Social justice imposes on each of us a personal responsibility to work with others to design and continually perfect our institutions as tools for personal and social development.

Furthermore, social justice entails human rights promotion. The human being is in a permanent quest for the satisfaction of his basic needs: the most fundamental physical needs such as food, health care and shelter, but also the moral needs of security, affection, valorisation and actuation. To secure and ensure respect of these and other related rights, the society has agreed upon a number of conventions, laws and regulations to abide with. It is the Government role to guarantee social justice through the enforcement of these.

For instance, Rwanda Government has undertaken to adopt national, regional and international legal instruments promoting and protecting these rights and to ensure they are upheld, through membership and dialogue with organizations such as the New Partnership for Africa's Development (NEPAD) whose members have pledged to promote democracy and support human rights activities and institutions in Africa, to support African efforts to implement human rights obligations, and ensure accountability for violations of human rights and humanitarian law, including genocide, crimes against humanity and other war crimes.

SELF-ASSESSMENT EXERCISE

- i. What makes the work place environment unsafe and unhealthy and decreases productivity in majority of industries?

- ii. How can the indices of social justice be utilised in safe guarding the essentials of work environment and employees productivity?

4.0 CONCLUSION

From the fore going it has become clear that Industrial Safety is important because it safeguards human life, as it is the management of all operations and events within an industry providing protection to its employees and assets by minimizing hazards, risks, accidents and near misses. Further to that, safety programme is all about continuous process that decreases the influence of personal and environmental factors causing accidents by providing safety equipment's and special training to workmen or employees. Therefore, Industrial Safety is important while designing a factory. In this regard construction architects and engineers of various industries such as process, product and service industries stress on the Industrial Safety systems and they place it as a centre piece in their design.

Certain persons are made responsible for safety aspect in organisations. Nowadays, safety committee concept is becoming popular. A safety committee consists of executives, supervisors and shop floor workers. This also helps in creating safety consciousness. This is a body which deals with all matters related to safety. In order to create awareness, safety weeks are needed to be organised and safety instructions be displayed. It is also necessary to make required safety rules and enforce them. For effectiveness of the safety programmes in an industry, it is necessary to identify the causes of accidents, study them, and take effective steps for their prevention.

As such, creating a work environment in which employees are productive is essential to increased profits for an organization, corporation or small business. All undesired events in a workplace which can give rise to death, ill health, injury, damage or other loss need to be thoroughly investigated, these need to be eliminated and that people need to be trained to safeguard against them. Similarly, all hazards (source/situation capable of injury or ill health, damage to property or workplace environment) should be identified and action plan be drawn for safeguard against them.

5.0 SUMMARY

We have been able to trace the meaning of Industrial Safety, programmes of Industrial Safety, extent of Industrial Safety practices and working environment and social justice/economic growth. In fact, adherences to the prescribed measures will essentially protect employees and assets thereby minimizing hazards, risks, accidents and near misses as well as increased industrial productivity. The implementation of the safety programme must reflect its being an integral component of the management

of the enterprise. Success would depend on clearly identifying the responsibilities of the various levels of management.

6.0 TUTOR MARKED ASSESSMENT

1. Define the term 'Industrial Safety'.
2. With reference to programmes aimed at reducing accidents and associated losses, discuss the extent to which industrial safety is relevant.
3. Explain the relevance of social justice and economic growth in a working place environment.

7.0 REFERENCES/FURTHER READINGS

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Unit 2 THE ORIGIN, HISTORY AND DEVELOPMENT OF SAFETY MOVEMENTS

CONTENTS

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1.0 INTRODUCTION

Industrial Safety practice has evolved gradually over the decades starting from the industrial revolution days of early 19th century. This unit will expose you in the understanding of the origin and history as well as the development of Industrial Safety movements. Particularly, you will be guided toward understanding the origin and historical development of Industrial Safety movements.

2.0 OBJECTIVES

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

- Explain the origin of Industrial Safety
- Describe the historical development of Industrial Safety

3.0 MAIN CONTENT

3.1 Origin of Industrial Safety

The origins of occupational health and safety concerns can be traced back to the Industrial Revolution (late 18th to 19th century), which was marked by innovations like cotton spinning and textiles, steam engines and iron founding. This resulted in the emergence of cotton mills, semi-automated factories and iron industries, which became the leading sectors, which established the base for the industrial revolution. Although the industrial revolution contributed to economic development, it had a negative impact on the health and safety of the workers working in these factories and industries. Men and women workers were exposed to harmful gases, toxins, acids, extreme heat and cold temperatures, light and sound that had a harmful

impact on their physical, social, and psychological health. The injuries, diseases and health hazards faced by workers as a result of the industrial revolution drew the interest of scholars and leading thinkers of that period, who felt that issues of industrial health and hygiene must be addressed.

In this regard, Annie Hamilton, an American toxicologist, physician and educator studied the impact of industrial metals and chemical compounds on human beings. She became a pioneer in industrial diseases and hygiene and contributed immensely to the discipline through her publications, which included *Industrial Poisoning in the United States* (1925), *Industrial Toxicology* (1934) and *Exploring the Dangerous Trades, an Autobiography* (1943).

Historical incidents of industrial hygiene and safety can also be traced back to the time of Hippocrates, who in the fourth century recognized and recorded the problem of lead toxicity in the mining industry. Other incidents include:

1. About 500 years after Hippocrates, the Greek physician Galen wrote at length on occupational diseases and recognized the dangers of acid mists to copper miners.
2. Other reports during the subsequent centuries described mining accidents and offered suggestions for mine ventilation and protective masks for miners, and discussed silicosis, a lung disease caused by inhaling silica dust.
3. During the 18th and 19th centuries industrial hygiene became of increasing importance and the period saw the publication of numerous works on the subject, as well as the passage in both England and Europe of the first effective legislation designed to protect the health of workers.
4. Occupational Safety and Health Administration (OSHA) of USA estimates that each year in the United States about 100,000 Occupational Health Safety and Hygiene people die from occupational illnesses and in 1990 alone there were about 1.8 million disabling injuries on the job.
5. Worldwide there were an average of are 33 million occupational injuries per year with about 145,000 deaths. Such conditions may not get better as employment in firms and industries is increasing from year to year.
6. According to the Bureau of labour statistics in US, Over 280,000 occupational illnesses were identified recognized or diagnosed in 1989.
7. Among job related mortality figures, one study among workers in US from 1980 to 1989 found that motor vehicle accidents, machine injuries and homicide were the top three causes of work related deaths. From the 63, 589 on job deaths during the period, there were 14, 625 motor vehicle related deaths, 8903 happened from machine injury and 7,603 homicides were recorded.

SELF-ASSESSMENT EXERCISE

- i. Provide a detailed explanation on the origin of Industrial Safety.
- ii. Highlight the historical incidents of industrial hygiene and safety

3.2 Historical Development of Industrial Safety

Industrial Safety in the United States as we know it today did not begin to take shape until the early 20th century. Before that, many risked their lives daily going to work in industrial settings that included mines, construction, mills and manufacturing. In today's world, work safety statistics are usually measured by the number of injuries or deaths that take place yearly. Prior to 1900 these types of statistics are hard to come by, in part because it appeared that no one cared enough to make tracking on the job injuries and deaths a priority. The major elements of concern as regards historical development of Industrial Safety are as follows;

3.2.1 19th Century Bleakness

There is little doubt that workers faced new and unprecedented dangers when the industrial revolution arrived on U.S. shores. American entrepreneurs developed labour saving devices and machinery that, albeit profitable and highly productive, were often very dangerous. Workplace accidents did not impact the bottom line, since the only legal recourse for victims was suing the company. Those that went to court rarely won their case, and thus made work safety an unprofitable venture for many industrialists of the time. Mining, train transportation and manufacturing were probably the most hazardous occupations of the time, and workers responded by taking out insurance policies to cover themselves in the case of a death or an accident, or by leaving a job altogether. This resulted in companies paying higher wages for jobs that were deemed more dangerous.

Concern over workers' safety and health on the job arose in the late 1900s as the United States became an industrial power. The increasing use of heavy machinery in areas like mining, railroad freight and manufacturing resulted in accidents that crippled or even killed workers. Workers and their families during the late 1800s had little recourse except to sue employers who could afford more talented lawyers. States took tentative steps toward regulating industries like coal mining and manufacturing as early as 1869, but not until the early 1900s did the actions of states force industries to reduce the possibility of workrelated accidents or illness

3.2.2 Public Efforts Lead to Improvements

Federal safety regulation traces its birth to the creation of the Food and Drug Administration (FDA), and the Bureau of Mines, both which occurred prior to the United States' entry into World War I. Thanks in part to news coverage, the efforts of labour unions and some more progressive business men, the issue of work safety came to the forefront. Unions representing trainmen campaigned for equipment improvements to ensure train and freight cart safety and in 1910 the Bureau of Mines was established to identify new ways to make mines safer after a series of dangerous mine explosions.

3.2.3 Progressive Era Reforms

During the Progressive Era in U.S. history (roughly 1900-1920), a coalition of journalists, businessmen, unions and politicians used the power of the government to mitigate the worst effects of rapid industrialization. In 1911 New York's Triangle Shirtwaist Company caught fire, and 146 of 300 employees died. Managers had locked the exit doors, claiming employees would steal from the company and could be permitted to leave only under supervision. The tragedy became a rallying point for reformers.

3.2.4 Workman's Compensation Birth

Congress passed a federal employers' liability law in 1908 that made it more expensive for companies to have an accident on their books. The law applied to railroad workers in interstate commerce, and made it harder for companies to claim that the employee was partially responsible for an injury. Thanks to the new law, worker injuries that once cost companies \$200 to resolve now cost almost \$2,000. In 1910, the state of New York created a workmen's compensation law that forced companies to automatically compensate for workplace injuries (eliminating the need for families to take corporations to court). By 1921, 43 more states had followed New York's lead and established their own compensation laws.

3.2.5 The Intervention of the Federal Government

While the state workers' compensation and other regulatory laws helped decrease the incidence of accidents, they did not cover all of the potential workplace hazards. So Congress passed the Occupational Safety and Health Act of 1970 (OSH Act). The OSH Act created the Occupational Safety and Health Administration (OSHA) within the Department of Labour, making the safety and health of private-sector workplaces the purview of the federal government. OSHA established safety standards, researched workplace hazards and educated workers about their rights. Since its inception, OSHA

has inspired controversy along political lines. Politically liberal critics assert OSHA takes too long to act on new information requiring a revision of safety standards and poorly enforces the standards it has enacted. Political conservatives argue OSHA is overly cautious, imposing costly and unnecessary regulations on industry. As a result, politicians on both sides of the aisle have repeatedly called for the reform of OSHA.

3.2.6 Employers Take Action

Compensation laws and other liability costs suddenly made workplace injuries an expensive proposition for many employers. What followed was a slow but steady increase in workplace safety. Large firms in railroading, mining and manufacturing suddenly became interested in safety. Manufacturing companies began to work to create safer equipment, and managers in many industries began getting tasked with identifying workplace dangers. In mining and construction, for instance, workers began to wear safety glasses and hard hats.

In 1913 the National Safety Council was formed by a group of business owners to pool shared knowledge, and to apply the information gathered through national agencies like the Bureau of Mines. Between World Wars I and II accidents in the workplace declined at an uneven rate, and it should be noted that during times of economic boom safety law enforcement tended to take a back seat.

3.2.7 Post World War II to the Present

The Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration were established in 1970. In addition worker's unions became more powerful than ever after World War II, and made work safety a priority. Safety in the workplace remains a top concern for most U.S. industries which must follow OSHA rules as well as rules and regulations established by other safety councils within specific industries. Workplace injury has steadily declined since World War I, and today meticulous records are kept of every injury, illness or fatality that occurs in a workplace.

Since its inception, OSHA has inspired controversy along political lines. Politically liberal critics assert OSHA takes too long to act on new information requiring a revision of safety standards and poorly enforces the standards it has enacted. Political conservatives argue OSHA is overly cautious, imposing costly and unnecessary regulations on industry. As a result, politicians on both sides of the aisle have repeatedly called for the reform of OSHA. On December 29, 1970, President Richard Nixon signed into law the Williams Steiger Occupational Safety and Health Act, which gave the Federal Government the authority to set and enforce

Safety and health standards for most of the country's workers. This act was there sul to fathered fought legislative battle which began in 1968 when President Lyndon Johnson unsuccessfully sought a similar measure. However, the roots of government regulation of workplace hazards date back to the late 19th century.

3.2.8 State Factory Laws

In

The factories that sprang up after the Civil War, chemicals, dusts, dangerous machines, and confusing jumble of belts, pulleys, and gears confronted inexperienced, often very young workers. The reports of State labour bureaus in the 1870's and 1880's were full of tragedies that too often struck the un wary or the unlucky. The Massachusetts report of 1872 described some particularly grisly accidents. These tragedies and the industrial accident statistics that State labour bureaus collected, spurred social reformer sand the budding labour movement to call for State factory safety and health laws. In 1870, the Massachusetts Bureau of Statistics of Labour urged legislation to deal with" the peril to health from lack of ventilation. "In 1877, Massachusetts passed the Nation's first factory inspection law. It required guarding of belts, shafts and gears, protection on elevators, and adequate fire exits.

Its passage prompted flurry of State factory acts. By 1890, nine States provided for factory inspectors, 13 required machine guarding and 21 made limited provision for health hazards. The labyrinth of State job safety and health legislation covered a wide range of work place hazards but was badly flawed. There were too many holes in the piece meal system and numerous hazards were left uncontrolled. The laws had to beam ended often to cover new hazards. Many legislatures failed to provide adequate funds for enforcement. Inspectors, who were often political appointees, were not always given the legal right to enter work places. State with strong safety and health laws tended to lose industry to those with less string entones, which made States competitive and limited their legislative efforts. The Progressive Era and the growth of mass circulation news papers and national magazines helped forge national movement for workers' safety and health. In 1907, 362 coalminers

Were killed at Monongah; the worst U.S. mine disaster. This widely publicized tragedy shocked the Nation and led to the creation in 1910 of the U.S. Bureau of Mines to promote mine safety. That same year William, B. Hard, amuckraking journalist, published an article in Everybody's Magazine titled, "Making Steel and Killing Men," based on his first hand investigation sofa Chicagomill.

Safety programs in subsidiaries dated back to the 1890's. In 1908, U.S. Steel formed a safety committee within structions from the company president, Judge Elbert Gary, to

cut the accident rate as much as possible. A highly successful "safety-first" movement developed from this which spilled over to other industries and led to the creation of the National Safety Council in 1915.

One of the major topics of the investigation, which was sponsored by the Russell Sage Foundation, was industrial accidents. The survey found that the injured workers and the survivors of those killed on the job bore the economic burden of accidents', even though most were the employers' fault. The author of the survey agreed that, for reasons of social equity, employers should bear a substantial share of the economic burden, giving them more incentive to eliminate the causes.

3.2.9 Workers' Compensation Started

Years before the Pittsburgh Survey, the idea of compensating injured workers from an insurance fund to which employers would contribute had gained foothold in this country, though it was not at first promoted as a preventive measure. Prince Otto von Bismarck had initiated the first workers' compensation program in Germany in 1884, and the idea soon spread throughout Europe. In the United States, a few States tried to establish early compensation systems. Organized labour successfully opposed the concept precisely because it was intended as a palliative, not a preventive measure. In 1908, Congress passed, with President Theodore Roosevelt's support, a limited workers' compensation law for Federal employees. Encouraged by this example, several States appointed study commissions. However, until the Pittsburgh Survey, compensation was treated mainly as a humanitarian measure. The survey's call for an economic incentive to encourage accidents prevention struck a responsive chord. It quickly became a key part of the rationale for workers' compensation. This seems evident on the scales. Both labour and business rallied in support.

In 1911, Wisconsin became the first State to successfully establish a workers' compensation program. Within one year it was joined by nine other states and by 1921 most States had followed suit. Ironically, it was as a preventive measure that workers' compensation accomplished the least. The general level of this type of insurance premium was already so low that there was no real incentive for companies to invest heavily in safety improvement. Those eligible for slightly lower rates suffered from firms with good safety records. Very few States included compensation for disease, although much was already known about occupational illness. Still, insurance company safety experts helped improve their clients' safety programs and the establishment of compensation gave the safety movement a moral boost.

An idea that developed alongside of workers' compensation probably produced more significant long run results. If the States would create industrial commission with authority to establish specific safety and health regulations, it would not be necessary

to go back to the legislatures and amend the factory laws in order to cover new hazards or change requirements. A workers' compensation advocate, John R. Commons of the University of Wisconsin, found this system in use in European drug edicts adoption in the United States.

SELF-ASSESSMENT EXERCISE

- i. Briefly describe industrial safety in the United States before the early 20th century.
- ii. Describe the major elements of concern as regards historical development of Industrial Safety.

4.0 CONCLUSION

Occupational health is the promotion and maintenance of the highest degree of physical, mental and social wellbeing of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs. The workplace has become dramatically safer with respect to personal safety seeing a significant reduction in accidents, injuries, and fatalities over time. As work continues to become more complex, however, there is a need to develop a more comprehensive and integrated model integrating personal safety, process safety and total workers' health.

5.0 SUMMARY

Precisely, we were able to trace the origins of occupational health and safety concerns to the industrial revolution in the late 18th to 19th century. The injuries, diseases and health hazards faced by workers as a result of the industrial revolution drew the interest of scholars and leading thinkers of that period, who felt that issues of industrial health and hygiene must be addressed. In today's world, work safety statistics are usually measured by the number of injuries or deaths that take place yearly. Historical developments of Industrial Safety were observed in respect of the 19th century bleakness; public efforts lead to improvements, progressive era reforms, workman's compensation birth, and the intervention of the federal government, action taken by employers, post-world war II to the present, state factory laws and the start of workers compensation.

6.0 TUTOR MARKED ASSESSMENT

1. The origin of Industrial Safety concerns can be traced to industrial revolution in the late 18th to 19th century, Discuss.

2. Provide an extensive discourse about the elements of historical development regarding industrial safety

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Unit 3 THE NEED AND SIGNIFICANCE OF INDUSTRIAL SAFETY

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 The Need for Industrial Safety
 - 3.2 The Significance of Industrial Safety
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assessment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit, you will be guided in understanding the need for Industrial Safety. This need is considered important in ensuring safe and healthy working conditions. This unit, apart from providing details on Industrial Safety need, it further stresses the significance of Industrial Safety. Workplace health and safety procedures are important for the wellbeing of both employees and employers because human loss is immeasurable and intolerable.

2.0 OBJECTIVES

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

- Identify the need for Industrial Safety
- Provide the significance of Industrial Safety

3.0 MAIN CONTENT

3.1 The Need for Industrial Safety

Need and concern for safety is to be considered as the need of the hour. There are some direct costs/effects of an accident but there are certain indirect costs involved in it. For instance, this can be seen in machine down time, damage to machine, ideal time of nearby equipment and horror created among workers and loss of time. So safety measures would not only eliminate/avoid above cost but would mean performing their moral responsibility towards workmen/operators also.

3.1.1 Unsafe acts

An unsafe act results in the form of operator/people doing things without proper authority, misuse of safety devices, ignoring warnings and precautions. So to prevent the occurrence of accidents, unsafe acts have to be avoided/eliminated/checked. For rectification of the causes because of unsafe acts attention must be paid to the following factors:

Personnel adjustment: If a foreman/supervisor identifies that a worker is unfit either physically or mentally or a job/task, he should be quickly taken off the work in consultation with the personnel department.

Method/technique used: Some techniques requiring change should be replaced by safe methods.

Operator training: Job method may be safe or unsafe but the operator must be trained to perform the job.

Publicity and education about accident prevention: The workers/people are led by the skill, energy and leadership of foreman/supervisor. So it is the duty of these people to educate the workmen about prevention of accidents. The aim is to teach them to become safety conscious so that they are able to recognize an unsafe act or situation and act in such a manner that accident is avoided.

3.1.2 The unsafe conditions:

An unsafe condition may be present in various forms e.g. faulty or defective electrical fittings, inadequate maintenance of gang way and use of defective tools. To avoid accidents due to unsafe conditions, Factories Act should be more concerned with moving parts of prime movers, electrical generators and transmission machinery, fire protection devices, control of dangerous fumes, lifting of excessive weights and safe guards over lighting machines, chains and ropes. Thus safety in industry helps in i) Increasing the production rate, ii) Reducing the cost of production, iii) Reducing damage to machinery and equipment, iv) Preventing unwanted suffering and pain to employees of the organization, and v) Preventing premature/untimely death of talented workers who may be an asset to the enterprise and society.

SELF-ASSESSMENT EXERCISE

- i. Highlight the direct and indirect costs of an accident involved in industrial safety.
- ii. Explain the forms of unsafe acts and unsafe conditions involved in industrial operations.

3.2 The Significance of Industrial Safety

Workplace safety is very important for each and every employee in the industry because all the workers desire to work in a safe and protected atmosphere. Health and safety are the key factors for all the industries in order to promote the wellness of both employees and employers. It is a duty and moral responsibility of the company to look after the employee's protection. Each and every person who leaves home for his work in the morning should come back home in the evening in good health condition. Have you ever imagined that your loved one will never be returning home? Or you get a call that he/she is in the hospital due to some incident occurred? These thoughts only get us goose bumps. This is the reason why it is important to create a safe working environment.

All the industries do have safety risks but the management should devote their time to think and strategize what safety precautions are required in their company, to make sure that their workers are safe enough for all the time. Among the important strategies that help industries in improving the productivity and quality of their products are as follows;

3.2.1 Awareness about the Surroundings

There are many employees who don't bother about their surrounding hazards. But, it is important to observe your co-employees working circumstances. Once you get to know about the particular hazards that occur at your workplace, then it will help you in reducing the risk and allow you to take the precautionary steps.

3.2.2 Reduce Workplace Stress

Most of the employees are not fit and healthy because of their busy schedule, which includes long working hours, work-pressure and conflicts occur with co-workers or with the boss of the organization. And, all these can lead to some illness or depression to the employees. Also, this not only affects their professional life but also creates the nuisance in their personal lives too. So, instead of waiting to get unfit, it is better that you start taking care of your health, by taking regular breaks, sit in an appropriate posture with appropriate diet. It will be better for you to schedule your work accordingly and manage the things to reduce your workplace stress.

3.2.3 Appropriate Use of Tools

Take appropriate precautions while using machinery or any other tool, instead of taking any shortcuts. Taking shortcuts is one of the biggest reasons behind workplace loss. It's a biggest safety risk to use scaffolding as a ladder or one tool instead of another for a particular job. So, it is always recommended to use the correct tools and reduce the opportunity of workplace injury.

3.2.4 Keep Easily Accessible Crisis Exits and Stay Alert

In case there is an emergency, you will need quick access to the exits. It is also advisable to keep clear usage of equipment shutoffs which might stop you from performing at emergency. There are many employees who usually compromise or ignore the alerts of advance warning and due to this, a number of workplace injuries or fatalities occur.

3.2.5 Update Supervisor about Unsafe Conditions

It is important that you keep updating your supervisor about the hazards or risks occur at workplace. They should be legally obligated to ensure that their employees are working in a safe environment or not. In the event that, employees are not working in safe conditions, then it is the responsibility of the supervisor to listen and understand their condition and create safe working environment for employees.

3.2.6 Use Mechanical Assistance

Whenever, you want to carry or lift up some heavy equipment's then you should use a conveyor belt, crank or forklift. There are lot of risks involved, if you try to lift something which is heavier, it can affect your weighing capability and can lead to some muscle displacement. So, make sure that you use the appropriate tools for not harming yourself.

3.2.7 Reduce Workplace Environment Stress

Stress to any employee or to any co-worker, can lead into depression and into concentration problems. And the main reason includes, extended working hours, excess of work, insecurity of job and issues which occur at co-workers or professionals. So, instead of taking stress on your shoulders, you should discuss it with your supervisor and ask him/her to look after your problems which you are facing in the organization.

3.2.8 Wear the Right Safety Equipment

It is essential that you wear the right protection equipment tools during your work. Furthermore, the equipment's can be in any form like, earplugs, earmuffs, hard hats, gloves, full-face masks, safety gloves and any other equipment which is required to wear while working. These tools will prevent the workers from the incidents that occur at workplace.

3.2.9 Sit in a Proper Posture

If you have a sitting job, then it is essential that you keep your posture correct, while working on a desk. You need to keep your shoulders in line and straight back to avoid any spine problem. Try to ignore stooping and twisting regularly and if possible, then try to use the comfort designed furniture and the safety equipment's, so that the desired things will be in your reach.

SELF-ASSESSMENT EXERCISE

- i. Explain why health and safety are key factors for employees and employers promotion's wellness in industries.
- ii. What are the strategies that improve industries productivity and products' quality?

4.0 CONCLUSION

Safety is one of the biggest issues and it is completely the responsibility of the managers and the business owners to make sure that their employees are working in safe environment or otherwise. The management should make sure that they keep on motivating and boosting the employees to make them active in the working process. There should be appropriate discussions about the work and the culture of the office on regular intervals, so that the management remain aware that they simplify employee's comfort. Also, to motivate workers, management should provide rewards as an appreciation towards their work. Thus, these steps will make workplace very secure and safe for the employees.

5.0 SUMMARY

From the foregoing you have been guided in identifying the need for Industrial Safety, significantly considered in ensuring safe and healthy working conditions in respect of unsafe act and unsafe conditions. Apart from providing details on Industrial Safety need, significance of Industrial Safety was further provided in terms of: Awareness about the surroundings, Reduce workplace stress, Appropriate use of tools, Keeping easily accessible crisis exits and stay alert, Updating supervisor about unsafe conditions, Use mechanical assistance, Reduce workplace environment stress,

Wearing the right safety equipment and Sitting in a proper posture . As such, workplace health and safety procedures are important for the wellbeing of both employees and employers being the fact that human loss is immeasurable and highly intolerable.

6.0 TUTOR MARKED ASSESSMENT

1. a) Justify health and safety as the key factors for employees and employers promotion's wellness in industries.
b) Account for the direct and indirect costs of an accident involved in industrial safety.
2. Give an account of the distinguishing forms of unsafe acts and unsafe conditions involved in industrial operations.
3. Examine the strategies that improve industries productivity and products' quality.

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Module 2 BASIC ELEMENTS IN INDUSTRIAL SAFETY

- Unit 1 Occupational Safety and Health Management System (OSHMS)
- Unit 2 Identification of Industrial Hazard
- Unit 3 Major Industrial Hazard Control

Unit 1 OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT SYSTEM (OSHMS)

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Industrial Safety Management Systems
 - 3.2 Points on the Repetition of the PDCA Cycle
 - 3.3 Avoiding Pitfalls
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assessment
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1.0 INTRODUCTION

The Guidelines on Occupational Safety and Health Management Systems (OSHMS) were released by the Ministry of Labour (now the Ministry of Health, Labour and Welfare) in 1999. The Guidelines have now been revised in conjunction with the creation of an obligation to make efforts to implement risk assessment under the amended Industrial Safety and Health Act that came into effect in April 2006.

The amended Industrial Safety and Health Act provides for exemption from submission of plans when the chief of the Labour Standards Inspection Office with jurisdiction finds that certain conditions such as the proper implementation of an OSHMS, which includes risk assessment, have been fulfilled. The effectiveness of OSHMS is recognized in industrial circles and the number of workplaces introducing them is increasing rapidly. Meanwhile, there are opinions in some quarters that methods for introducing an OSHMS are not well understood. This unit provides a simple summary of points on the introduction of an OSHMS.

2.0 OBJECTIVES

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

- Explain industrial safety management systems
- Understand points on the repetition of the PDCA cycle
- Understand steps for avoiding pitfalls

3.0 MAIN CONTENT

3.1 Industrial Safety Management Systems

General safety management systems in the past have tended to put the focus on taking measures so as not to violate laws and regulations. However, with the diversification of processes, there has also been an increase in hazards and toxicity that are not regulated by legislation. Moreover,

OSHMS aims to promote constant voluntary safety and health activities and improve the level of safety and health in the workplace as the employer establishes a series of processes with the cooperation of the workers. In order to achieve this goal, it is necessary to repeatedly implement the serial PDCA cycle of “establish a plan” (Plan), implement the plan” (Do), “evaluate the outcome of the plan” (Check) and “Review and improve based on evaluation” (Act) based on the results of a survey of hazards and toxicity present in the workplace. Moreover, the establishment of a structure, reflection of the opinions of workers, stipulation and recording must be implemented as fundamental elements that underpin these activities.

SELF-ASSESSMENT EXERCISE

- i. Explain the term ‘industrial safety management systems’.
- ii. Why it is necessary to implement the serial PDCA cycle in improving safety and health in workplace.

3.2 Points on the Repetition of the PDCA Cycle

1. The effects of OSHMS do not appear in a short time, but rather the level of safety and health in the workplace improves gradually during the repetition of the PDCA cycle. Therefore, with regard to workplace management, involvement at each important point in the PDCA cycle while eliminating factors that lead to injuries is key to the smooth operation of the system following the top management’s statement of the basic management philosophy on safety and health and the clarification of the stance on safety and health. Top management should avoid hasty pursuit of OSHMS results alone.

2. It is important to steadily promote the risk assessment that is a requirement of an OSHMS. The method of proceeding should be based on risk assessment and measures based on the results.
3. In order to put a safety and health plan into practice, the appointment of the respective people in charge and the clarification of their responsibility and authority as well as a mechanism points on the introduction of an Occupational Safety and Health Management System (OSHMS) for following up on the results of plan implementation are needed. It is effective to take advantage of the safety and health committee if one has been established in the workplace.
4. Finally, it is necessary to perform periodical auditing of the OSHMS to determine whether the system is running without any problems. The system auditing is in principle conducted by a person from within the workplace, and the role necessitates making statements that may be disagreeable to colleagues. From a long term perspective, however, it is certainly helpful in improving the level of safety and health in the workplace. Therefore, it is important for the workplace management to establish an environment that facilitates the activities of auditors, such as explaining the role of the system auditors to the people concerned.

SELF-ASSESSMENT EXERCISE

- i. Outline the points needed to be considered on the repetition of the PDCA cycle.
- ii. Briefly explain the points of consideration on the repetition of the PDCA Cycle.

3.3 Avoiding Pitfalls

1. OSHMS is for major corporations

OSHMS is basically a system that is transferable from conventional safety and health management activities. Many workplaces that have already implemented an OSHMS have created their systems by adding areas related to risk assessment and evaluation and improvement onto their existing safety management activities. The Ministry of Health, Labour and Welfare guidelines only indicate the framework for the mechanism, assuming that concrete systems will be created to suit the actual circumstances of the workplace. Therefore, even small and medium sized workplaces can realize the creation of a system by starting at a reasonable level taking account of the accumulation of existing safety and health activities and the structures for promotion and gradually enhancing the details through the repetition of the PDCA cycle.

2. **Documentation in an OSHMS is not burdensome**

The documents that are required to be prepared under OSHMS guidelines are all useful documents that are needed in the promotion of daily safety and health activities. Amid the changing shape of corporations, including spin offs, the diversification in forms of employment, and the greater mobilization in employment of recent years, it is important to specify such areas as safety and health management activities, thus making it easier to transmit skills and processes when the person in charge changes, in order to reliably pass on safety and health expertise and experience. Moreover, specification also has the advantage of facilitating the detection of problems and weaknesses. If, despite this, it is felt that documentation is a burden, it should be checked whether the content of documents diverges from daily safety and health activities.

3. **Objective to lower the risk score**

Being obsessed with lowering the average score for the size of risk, making the evaluation that “risk has been lowered” through the raising of awareness despite failing to implement risk reduction based on radical strategies, and taking priority measures for areas that are easy to improve lose sight of the true form of risk management. In the event that “there is no decrease in the number of accidents although the average risk score has fallen,” it should be checked whether individual risk strategies are being implemented effectively.

4. **Copying and introducing another workplace’s effective system**

An effective workplace system is one that has been created to suit the actual circumstances of the workplace over a long period of time, and it is not necessarily universally applicable. When using positive examples as a reference for the supplementation of areas of inadequacy in the safety management activities that have been conducted in the workplace in the past, it is important to revise the details to match the actual circumstances of the workplace based on the results of surveys of hazards and toxicity and internal inspections.

SELF-ASSESSMENT EXERCISE

- i. Itemise the steps required to be taken in avoiding workplace pitfalls.
- ii. Examine the steps required to be taken in avoiding workplace pitfalls.

4.0 CONCLUSION

In conclusion it became clear that effectiveness of OSHMS is recognized in industrial circles and the number of workplaces introducing them is increasing rapidly. Moreover, although hazard prediction activities, near misses and daily safety activities such as workplace patrols are conducted, there is no mechanism for taking systematic measures for improvement based on collation of the results and prioritization of improvements for the workplace overall. The lack of such a mechanism leads to differences in strategies taken by departments, leaving the workplace without adequate evaluation of improvements or, in other words, no appropriate follow up measures. Therefore, there is also a danger that necessary measures could be left out.

Understanding of OSHMS and its importance could encourage us to abide by the application of OSHMS. It is evident that organizations with effective OSHMS earn positive returns and benefit from their health and safety investment. Effective management of worker safety and health protection is a decisive factor in reducing the extent and the severity of work-related injuries and illnesses. Also, it addresses all work-related hazards, including those potential hazards which could result from a change in worksite conditions or practices. Again, it addresses hazards whether or not they are regulated by government standards.

5.0 SUMMARY

We have been able to explain the Occupational Safety and Health Management System (OSHMS) through industrial safety management systems, understanding of points on the repetition of the PDCA cycle as well as steps for avoiding pitfalls as regards OSHMS for major corporations, Documentation in an OSHMS, Objective to lower the risk score and Copy/introduction of another workplace's effective system.

6.0 TUTOR MARKED ASSESSMENT

1. Explain the term 'industrial safety management systems' and why it is necessary to implement the serial PDCA cycle in improving safety and health in workplace.
2. Outline and briefly explain the points needed to be considered on the repetition of the PDCA cycle.
3. Itemise and explain the steps required to be taken in avoiding workplace pitfalls.

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Unit 2 IDENTIFICATION OF INDUSTRIAL HAZARD

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1.0 INTRODUCTION

Hazards are sources or situations with potential to cause harm in terms of human injury or ill health, damage to property or environment or both. Hazards are identified in the performance of various activities, storage and handling of materials, and operation and maintenance of plants and equipment. Hazards may be classified as Mechanical, Electrical, Chemical and Fire and Explosion Hazards.

2.0 OBJECTIVES

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

- Understand mechanical hazards
- Understand electrical hazards
- Understand chemical hazards
- Understand fire and explosion hazards

3.0 MAIN CONTENT

3.1 Mechanical Hazards

Mechanical hazards are created as a result of either powered or manual (human) use of tools, equipment or machinery and plant. Mechanical hazards are responsible for the majority of the accidents in work situations, therefore every workplace and equipment should be properly examined for identifying mechanical hazards and for taking

mitigating measures. Common sources of mechanical hazards are: i) Unguarded or inadequately guarded moving parts or pits, ii) Machine tools, hand tools, handling materials, lifting and other appliances, iii) Improper ventilation, unsafe dress or apparel, and iv) Improper use of tools.

An example of a mechanical hazard is: contact and/or entanglement with unguarded moving parts on a machine. Some of the injuries that can occur as a result of mechanical hazards are as follows:

- Impact - being hit by ejected parts of the machinery or equipment.
- Friction and abrasion - e.g. use of sander.
- Entrapment - being caught in a moving part of a machine or equipment or plant.
- Stabbing and puncture - e.g. nail gun use.
- High pressure fluid injection - a pinhole leak in a hydraulic hose can burst and inject hydraulic oil into a person's hand for example.
- Crushing - collision of plant with a person is one example.
- Shearing - can be two moving parts (sharp or otherwise) moving across one another.
- Cutting - severing of a human body part by a cutting motion e.g. amputation of finger on a cutting machine.
- Entanglement - for example a loose sleeve getting caught in a moving part and drawing the person into the machine.

SELF-ASSESSMENT EXERCISE

- i. Itemise the common sources of mechanical hazards and explain how they are created.
- ii. Highlight injuries that can occur as a result of mechanical hazards.

3.2 Electrical Hazards

Electrical Hazards may be due to contact of body with wire, cable or rail or from stroke of lightning. The immediate effect of this is shock which may be relatively mild or severe so as to cause death (electrocution) depending upon the strength of the current and/or the path it takes passing the earth through the body. Another result is burning and the burns may be severe and deep, especially with higher voltage. Causes of the electric hazards may be of the following types: i) Electric shocks may be caused by an exposed live conductor or a faulty piece of equipment, ii) A mobile crane boom, a man carrying or climbing an aluminium ladder, or vertical metal bars can come in contact with overhead power lines, electric crane rails, open faced substation switchboards, iii) Other causes may be unskilled electricians, improper instructions, defective wiring which may cause short circuit, poor installations, misuse or

overloading and iv) Ageing and attack by foreign materials causes insulation failures which causes electrical fires or cases of electrocution. In such cases one may need to switch off the current, remove casualty from the contact with current using insulated material to avoid receiving shock by the person rescuing the victim and give artificial respiration to the casualty if breathing has stopped.

The voltage of electricity and the available electrical current in regular businesses and homes has enough power to cause death by electrocution. Even changing a light bulb without unplugging the lamp can be hazardous because coming in contact with the "hot", "energized" or "live" part of the socket could kill a person. All electrical systems have the potential to cause harm. Electricity can be either "static" or "dynamic." Dynamic electricity is the uniform motion of electrons through a conductor (this is known as electric current). Conductors are materials that allow the movement of electricity through it. Most metals are conductors. The human body is also a conductor.

It will be good to note that static electricity is accumulation of charge on surfaces as a result of contact and friction with another surface. This contact/friction causes an accumulation of electrons on one surface and a deficiency of electrons on the other surface. Electric current cannot exist without an unbroken path to and from the conductor. Electricity will form a "path" or "loop". When you plug in a device (e.g. a power tool), the electricity takes the easiest path from the plug in to the tool and back to the power source. This action is also known as creating or completing an electrical circuit.

People are injured when they become part of the electrical circuit. Humans are more conductive than the earth (the ground we stand on) which means if there is no other easy path, electricity will try to flow through our bodies. This situation can result to four main types of injuries: electrocution (fatal), electric shock, burns, and falls. These injuries can happen in various ways including:

- Direct contact with exposed energized conductors or circuit parts. When electrical current travels through our bodies, it can interfere with the normal electrical signals between the brain and our muscles (e.g., heart may stop beating properly, breathing may stop, or muscles may spasm).
- When the electricity arcs (jumps, or "arcs") from an exposed energized conductor or circuit part (e.g. overhead power lines) through a gas (such as air) to a person who is grounded (that would provide an alternative route to the ground for the electrical current).
- Thermal burns including burns from heat generated by an electric arc, and flame burns from materials that catch on fire from heating or ignition by electrical currents or an electric arc flash. Contact burns from being shocked

can burn internal tissues while leaving only very small injuries on the outside of the skin.

- Thermal burns from the heat radiated from an electric arc flash. Ultraviolet (UV) and infrared (IR) light emitted from the arc flash can also cause damage to the eyes.
- An arc blast can include a potential pressure wave released from an arc flash. This wave can cause physical injuries, collapse your lungs, or create noise that can damage hearing.
- Muscle contractions, or a startle reaction, can cause a person to fall from a ladder, scaffold or aerial bucket. The fall can cause serious injuries.

SELF-ASSESSMENT EXERCISE

- i. Examine the major causes of electric hazards in a work place that may occur as result of body contact with wire, cable or rail or from stroke of lightning.
- ii. Show a clear difference between dynamic and static electricity and indicate how electric circuit can be created.
- iii. Itemise the types of injuries resulting from flow of electricity in human body and describe various ways of injuries occurrence.

3.3 Chemical Hazards

Chemical hazards pose a silent, deadly threat. The usage of chemicals with the resultant hazardous gases, vapours and fumes can be termed as one of the most dangerous industrial activities. Among the effects of noxious gases are: i) Simple asphyxiants, the example of which include nitrogen gas, methane gas and carbon dioxide; ii) Chemical asphyxiants, example here include carbon monoxide, hydrogen sulphide and hydrocyanic acid; iii) Irritant gases, such as nitrogen dioxide or peroxide, fluorine, hydrogen fluoride, sulphur dioxide and ammonia; iv) Organic metallic gases, such as arsenic hydride; and v) Inorganic metallic gases. Several toxic chemicals and fluids are found in industries using sulphuric acid, nitric acid, soda, chloride of lime, chloride of phosphorous, sulphur chloride, phosphine chloride of zinc, nitrous chloride, iodine, artificial fertilizers, rubber, petroleum and tar.

The Centres for Disease Control and Prevention (CDCP) identified five chemical hazards that are especially dangerous in the workplace, even with only acute exposure. Companies must work diligently to find safer alternatives to these chemicals, or institute safety programs that significantly reduce risk for employees.

3.3.1 Carbon Monoxide

Though most often associated with leaks in the home, carbon monoxide is a serious problem in enclosed industrial spaces with little circulation. Carbon monoxide is the natural by-product of internal combustion engines, as seen on some forklifts or transport vehicles inside a factory, and is virtually undetectable to human beings. Carbon monoxide poisoning occurs when someone is exposed to more than 50 ppm over several minutes or hours, and OSHA prohibits exposure to more than 100 ppm. People suffering from the condition experience lightheadedness, headaches, and confusion before eventually shutting down the respiratory system. Even low level exposure over weeks or months can have devastating consequences for memory and mental health.

To fight carbon monoxide issues in the workplace, the following recommended courses of action are to be considered. First, companies should substitute battery powered vehicles for gas powered vehicles in any enclosed work area. Second, factories or industrial plants at high risk for carbon monoxide issues should supplement existing ventilation systems with portable, personal ventilators near high risk areas. Finally, the installation of carbon monoxide detectors is a measure of last resort for emergency warnings.

3.3.2 Ammonia

Ammonia is a common ingredient in household and industrial cleaning agents, and poses little threat in small doses or in its liquid form. Ammonia becomes dangerous once the liquid is exposed to oxygen, transforming it into ammonia gas. The onsets of ammonia poisoning are swift, usually within just a few minutes. Exposed victims suffer from runny nose, shortness of breath, red eyes, and a burning throat. If the exposure continues, victims may suffer burns to the respiratory system and the gastrointestinal tract. Severe ingestion can cause problems with the central nervous system, leading to paralysis and death. Companies can combat ammonia exposure through the transition to non-ammonia based cleaners and the distribution of face masks when ammonia is used in the facility. Ventilators and fans operating while cleaning can further limit the risk.

3.3.3 Chlorine

Once used as a weapon of mass destruction during World War I, chlorine is now considered one of the most important chemicals to the modern electronics industry. It plays an essential role in the construction of circuit boards and semiconductors, and continues to be the bleaching agent of choice for the paper industry. Chlorine, especially in its gaseous form, is deadly at much lower levels than other industrial chemicals. As little as 15 ppm, victims experience irritation, and by 60 ppm,

permanent respiratory damage may occur. Chlorine gas becomes deadly at 1000 ppm, even if the victim is only exposed for a few minutes.

Incidents of chlorine exposure are difficult for employers to combat, because there are very few chemicals that can replace chlorine. Instead of eliminating the risk or substituting the chemical, employers must focus on administrative and engineering hazard controls. Education about the safe transport and handling of chlorine can have a substantial impact on the rate of incident. Additionally, ventilators and fans located near the floor can be effective in moving chlorine away from employee workspaces.

3.3.4 Hydrochloric Acid

Hydrochloric acid is a vital chemical in the processing and manufacture of metals, textiles, and rubber. It is one of the world's strongest acids, and may cause permanent damage at very low levels of exposure. Short term exposure to hydrochloric acid will cause irritation of the eyes and other soft tissues. The first warning sign is often a sharp cough and trouble breathing. As exposure increases, victims suffer from internal bleeding and gastrointestinal failure. Longterm exposure may lead to light sensitivity, hyperplasia and severe dental problems. Death and permanent scarring are possibilities for direct exposure to the acid, even if only for a few seconds.

Currently there are efforts to make safe alternatives to acidic cleaners and compounds in the workplace. Organic salts with a very low PH have demonstrated the same cleaning capacity as hydrochloric acid; this may be considered as the best option. For employers, providing plenty of washing stations and personal protective equipment is the first step, but it must be coupled with education and training programs to have an effect.

3.3.5 Sulphuric Acid

Perhaps the most deadly chemical in the workplace, sulphuric acid is a critical component in the manufacture of most fertilizers, batteries, acids, and metals. Its extremely corrosive nature makes it exceptionally dangerous in its most common concentrations. In low doses, short term exposure to sulphuric acid can cause damage to the respiratory tract and teeth when the acid is inhaled. Physical contact with sulphuric acid will cause burns and scars at most concentrations. Longterm exposure will cause increased sensitivity for the eyes and throat, leading to periodic bleeding and chronic dryness. Over time, scarring in the lungs will cause lung failure and death. Direct exposure to high concentrations will leave serious, immediate scars or burns.

Some alternatives exist to sulphuric acid in the workplace, most notably the process of ion exchange, which eliminates the need for acids in a reverse osmosis system. Other

research has shown that carbon dioxide is a comparable alternative to sulphuric acid when PH is neutralized. As with hydrochloric acid, employers can further increase their commitment to safety with washing stations and personal protective equipment. Chemicals in the workplace represent serious hazards to employees and the public, if the chemicals are improperly handled. It is the responsibility of industrial managers and factory operators to ensure the proper procedures are in place to limit chemical risks.

SELF-ASSESSMENT EXERCISE

- i. Explain how usage of chemicals with resultant hazardous gases, vapours and fumes is dangerous in industries.
- ii. Identify and briefly explain chemical hazards that are dangerous in the workplace, even with only acute exposure.

3.4 Fire and Explosion Hazards

Fire is usually a relatively continuous combustion (burning) process consisting of exothermic (heat producing) chemical reactions involving a fuel and producing besides combustion products, such as water and carbon dioxide, heat and via flame, plus light. In addition to simply burning, an insidious form of fire called smouldering can occur when large volumes of a combustible powder are stored, typically in a pile for an extended time period. Through oxidation of the surface of the particulates, heat is generated, and if the rate of heat generation exceeds the rate of heat loss (as can occur in a large pile), the temperature within the pile can reach the ignition temperature. The result is a relatively slow burning (slow because oxygen must diffuse into the pile and reaction gases/vapours out). Apart from generating poisonous gases (e.g. carbon monoxide), smouldering can lead to fires and even explosions.

Industry handles many different types of materials, many of which are combustible. If the materials can form a dust, mist or gas/vapour cloud suspended in the atmosphere then the hazard changes from one of fire to that of an explosion with potentially far greater consequences in terms of life safety and property damage. Seemingly, innocuous materials such as flour, chocolate, rubber, aluminium, and even dried sewage sludge, in the form of a fine dust, can pose a risk from a dust explosion, in particular when being handled in large quantities. Flammable liquids can also pose an explosion risk especially those being used in confined areas and having low flash points. The effects of temperature and pressure also need to be considered as even flammable liquids with high flash points such as hydraulic oils can form explosive's mist clouds when leaks are formed in high pressure hoses. Thus it can be seen that the first hurdle to overcome when assessing the risks in the workplace from explosion

hazards is to accurately identify the materials involved and, crucially, the conditions under which they are used.

Given the right conditions, most unoxidized materials can burn. Most substances industrially produced (e.g. plastics, oils) or processed (e.g. wood, petroleum) are unoxidized or not fully oxidized and can therefore burn. One must be aware that all powders that can burn can also explode and that all liquids that can burn, can also explode (as particulates (mists)). Explosion create blast as a pressure wave or a more destructive shock wave, both of which can wound/kill people, destroy buildings, and create deadly high velocity fragments. The energy source of explosions can be physical (e.g. lightning) or chemical (e.g. combustion).

A key difference between fire and explosion is that in fire, the fuel (e.g. burning candle) and the oxidizer (air) are clearly separated. Oxygen molecules, necessary to maintain the occurrence of combustion, reach the flame largely by diffusion. By contrast, explosions are characterized by a pre-mixing of fuel and oxidizer. Examples of increasing intimacy of pre-mixing are:

- A cloud of combustible dust or mist (combustible particles suspended in air).
- An explosive gaseous mixture (e.g. methane molecules and oxygen molecules in air).
- A solid high explosive, such as Trinitrotoluene (TNT) (atoms of fuel (carbon and hydrogen) adjacent to atoms of oxidizer (oxygen) in the same molecule). It is this pre-mixing of fuel and oxidizer, and its degree of 'intimacy' (most 'intimate' at the atomic level, as in an explosive such as TNT), that form the basic reason why explosions occur (much) more rapidly than fires do, thereby resulting in a (much) higher (volumetric) rate of energy release.

SELF-ASSESSMENT EXERCISE

- i. Explain how fire is relatively a continuous combustion process and explosion creates blast.
- ii. What is the key difference between fire and explosion?

4.0 CONCLUSION

In conclusion, it becomes clear that in every day industrial workers are exposed to a wide range of environmental dangers that are easily visible and avoidable. However, hazard was viewed as a term associated with a substance that is likelihood to cause an injury in a given environment or situation. Industrial hazard is therefore any condition produced by industries that may cause injury or death to personnel or loss of product or property.

5.0 SUMMARY

We have elicited that mechanical hazards are created as a result of either powered or manual (human) use of tools, equipment or machinery and plant. Electrical Hazards may be due to contact of body with wire, cable or rail or from stroke of lightning. Further to that, the usage of chemicals with the resultant hazardous gases, vapours and fumes were termed as one of the most dangerous industrial activities. Chemical hazards that are dangerous in a workplace were identified by Centres for Disease Control and Prevention (CDCP) as Carbon Monoxide, Ammonia, Chlorine, Hydrochloric Acid and Sulphuric Acid. In the end it was pointed out that materials handled by an industry that can form a dust, mist or gas/vapour cloud suspended in the atmosphere results in hazard changing from fire to an explosion. This usually comes with potentially far greater consequences in terms of life safety and property damage.

6.0 TUTOR MARKED ASSESSMENT

1. Examine the common sources and injuries that can occur as a result of mechanical hazards.
2. Give an account of the major causes of electric hazards in a work place and describe various ways of injuries occurrence.
3. Identify and briefly explain chemical hazards that are dangerous in the workplace, even with only acute exposure.
4. 'Fire is relatively a continuous combustion process and explosion creates blast'. Discuss this statement in the context of industrial safety.

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Unit 3 MAJOR INDUSTRIAL HAZARD CONTROL**CONTENTS**

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1.0 INTRODUCTION

Effective controls protect workers from workplace hazards; help avoid injuries, illnesses, and incidents; minimize or eliminate safety and health risks; and help employers provide workers with safe and healthful working conditions. The processes will help employers prevent and control hazards identified in the previous Module. To effectively control and prevent hazards, employers should:

- Involve workers, who often have the best understanding of the conditions that create hazards and insights into how they can be controlled.
- Identify and evaluate options for controlling hazards, using a "hierarchy of controls".
- Use a hazard control plan to guide the selection and implementation of controls, and implement controls according to the plan.
- Develop plans with measures to protect workers during emergencies and non-routine activities.
- Evaluate the effectiveness of existing controls to determine whether they continue to provide protection, or whether different controls may be more effective. Review new technologies for their potential to be more protective, more reliable, or less costly.

2.0 OBJECTIVES

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

- Understand machinery guarding and protection against mechanical hazards
- Understand protection against electrical hazards
- Understand control of chemical hazards in a workplace
- Understand fire and explosion protection and preventions

3.0 MAIN CONTENT

3.1 Machinery Guarding and Protection against Mechanical Hazards

The following need to be considered in machinery guarding and protection against mechanical hazards:

3.1.1 Machine Associated Risks

Machine associated risks mainly involve the following considerations;

Risk of loss of stability: Machinery and its components and fittings should be stable enough to avoid overturning, falling or uncontrolled movements during use, transportation, assembly and dismantling. If the shape of the machinery itself or its intended installation does not offer sufficient stability, appropriate means of anchorage should be incorporated and indicated in the instructions.

Risk of break up during operation: The various parts of machinery and their linkages should be able to withstand the stresses to which they are subject when used. The durability of the materials used should be adequate for the nature of the working environment foreseen by the manufacturer, in particular as regards the phenomena of fatigue, ageing, corrosion and abrasion, and the maintenance schedule of the owner. The instructions should indicate the type and frequency of inspections

and maintenance required for safety reasons. They should, where appropriate, indicate the parts subject to wear and the criteria for replacement.

Where a risk of rupture or disintegration remains despite the measures taken, the parts concerned should be mounted, positioned and guarded in such a way that any fragments will be contained, preventing hazardous situations. Rigid or flexible pipes carrying fluids, particularly those under high pressure, should be able to withstand foreseeable internal and external stresses and should be firmly attached and protected to ensure that no risk is posed by a rupture. Where the material to be processed is fed to the tool automatically, the following conditions should be met so as to prevent risks to persons:

- When the work piece comes into contact with the tool, the latter should have attained its normal working condition.
- When the tool starts and stops (intentionally or accidentally), the feed movement and the tool movement should be coordinated.

Risks due to falling objects and surfaces and edges/angles: Measures should be taken to prevent risks arising from falling or ejected objects. Machines that allows parts accessibility during use and maintenance of the machinery should have no sharp edges/angles or rough surfaces that are likely to cause injury.

Risks related to combined machinery: Where the machinery is intended to carry out several different operations with manual removal of the piece between each operation (combined machinery), it should be designed and constructed in such a way as to enable each element to be used separately, without the other elements constituting a risk to exposed persons.

Risks related to variations in operating conditions: Where the machinery performs operations under different conditions of use, it should be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably.

3.1.2 Risks Related to Moving Parts

Prevention of hazards due to moving parts of machinery should take into account:

- The movement of machinery parts consisting basically of rotary, sliding or reciprocating motion, or a combination of these, such as the movements of spindles, chucks, fan blades, counter-rotating gear wheels or rollers, and stroking blades.
- The movement of machinery parts which may have the potential to cause injury, for example by entanglement, friction or abrasion, cutting, shearing, stabbing or puncture, impact, crushing, or drawing a person into a position where injury can occur.

Moving parts of machinery should be designed and constructed in such a way as to prevent risks of contact which could lead to accidents and should, where risks persist, be fitted with guards or protective devices. All necessary steps should be taken to prevent accidental blockage of moving parts involved in the work. If a blockage remains possible despite the precautions taken, the necessary specific protective devices and tools should be provided to enable the equipment to be unblocked safely. The instructions and, where possible, a sign on the machinery should identify these specific protective devices and how they are to be used.

When a process requires access to a danger zone and a fixed guard is impracticable, an interlocking guard should be considered. Guards or protective devices designed to protect persons against the hazards generated by moving parts involved in the process should be: i) fixed guards; ii) interlocking movable guards; iii) protective devices; or iv) a combination of the above. However, when certain moving parts directly involved in the process cannot be made completely inaccessible during operation because of the need for operator intervention, such parts should be fitted with: a) fixed guards or interlocking movable guards preventing access to parts to which access is not necessary for the purpose of the work which has to be performed; and b) adjustable guards restricting access to those sections of the moving parts to which access is necessary.

3.1.3 General Requirements for Guards

Guards and protective devices should protect you against danger, including risks from moving parts. They should: a) be of robust construction; b) be securely held in place; c) not give rise to any additional hazard; d) not be easy to bypass or render non-operational, or be easily defeated; e) be located at an adequate distance from the danger zone; f) cause minimum obstruction of the view of the production process; and g) enable essential work to be carried out on the installation and replacement of tools and for maintenance purposes by restricting access exclusively to the area where the work has to be done, if possible without the guard having to be removed or the protective device having to be disabled. In addition, guards should protect against the ejection or falling of materials or objects and against emissions generated by the machinery.

3.1.4 Special Requirements for Guards

Fixed guards should be used whenever practicable. They should be designed so as to prevent access to the dangerous parts of the machinery. Fixed guards should be fixed by systems that can be opened or removed only with tools. Their fixing systems should remain attached to the guards or to the machinery when the guards are

removed. Where possible, guards should be incapable of remaining in place without their fixings (attachments). Interlocking movable guards should, as far as possible, remain attached to the machinery when open. Interlocking movable guards should be associated with an interlocking device, which prevents the start of hazardous machinery functions until the guards are closed and gives a stop command whenever the guards are opened.

Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery functions has ceased, movable guards should be associated with a guard locking device in addition to an interlocking device which: a) prevents the start of hazardous machinery functions until the guard is closed and locked; and b) keeps the guard closed and locked until the risk of injury from the hazardous machinery functions has ceased. Interlocking movable guards should be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous machinery functions.

Adjustable guards restricting access to those areas of the moving parts strictly necessary for the work should be: adjustable manually or automatically, depending on the type of work involved and readily adjustable without the use of tools. Protective devices should be designed and incorporated into the control system in such a way that: a) moving parts cannot start up while they are within the operator's reach; b) persons cannot reach moving parts while those parts are moving; and c) the absence or failure of one of their components prevents starting or stops the moving parts.

SELF-ASSESSMENT EXERCISE

- i. What need to be considered in terms of machine associated risks and hazard prevention due to moving parts?
- ii. Explain the steps necessarily needed for guarding and protection against mechanical hazards in a workplace.

3.2 Protection against Electrical Hazards

Most electrical accidents result from unsafe equipment or installation, unsafe environment, or unsafe work practices. Some ways to prevent these accidents are through the use of insulation, guarding, grounding, electrical protective devices, and safe work practices.

3.2.1 Insulation Protection

Insulators such as glass, mica, rubber, or plastic used to coat metals and other conductors help stop or reduce the flow of electrical current. This helps prevent shock,

fires, and short circuits. To be effective, the insulation must be suitable for the voltage used and conditions such as temperature and other environmental factors like moisture, oil, gasoline, corrosive fumes, or other substances that could cause the insulator to fail. Insulation on conductors is often colour coded. Insulated equipment grounding conductors usually are either solid green or green with yellow stripes. Insulation covering grounded conductors is generally white or grey. Ungrounded conductors, or “hot wires,” often are black or red, although they may be any colour other than green, white, or grey.

3.2.2 Guarding Protection

Guarding involves locating or enclosing electric equipment to make sure people don't accidentally come into contact with its live parts. Effective guarding requires equipment with exposed parts operating at 50 volts or more to be placed where it is accessible only to authorized people qualified to work with it. Recommended locations are a room, vault, or similar enclosure; a balcony, gallery, or elevated platform; or a site elevated 2.44 meters or more above the floor. Sturdy, permanent screens also can serve as effective guards. Conspicuous signs must be posted at the entrances to electrical rooms and similarly guarded locations to alert people to the electrical hazard and to forbid entry to unauthorized people. Signs may contain the word “Danger,” “Warning,” or “Caution,” and beneath that, appropriate concise wording that alerts people to the hazard or gives an instruction, such as “Danger/High Voltage/Keep Out.”

3.2.3 Grounding Protection

Grounding a tool or electrical system means intentionally creating a low resistance path that connects to the earth. This prevents the build-up of voltages that could cause an electrical accident. Grounding is normally a secondary protective measure to protect against electric shock. It does not guarantee that you won't get a shock or be injured or killed by an electrical current. A service or system ground is designed primarily to protect machines, tools, and insulation against damage. One wire, called the “neutral” or “grounded” conductor, is grounded. In an ordinary low-voltage circuit, the white or grey wire is grounded at the generator or transformer and at the building's service entrance. An equipment ground helps protect the equipment operator. It furnishes a second path for the current to pass through from the tool or machine to the ground. This additional ground safeguards the operator if a malfunction causes the tool's metal frame to become energized. The resulting flow of current may activate the circuit protection devices.

3.2.4 Circuit Protection Devices

Circuit protection devices limit or stop the flow of current automatically in the event of a ground fault, overload, or shortcircuit in the wiring system. Well known examples of these devices are fuses, circuit breakers, ground fault circuit interrupters, and arc fault circuit interrupters. Fuses and circuit breakers open or break the circuit automatically when too much current flows through them. When that happens, fuses melt and circuit breakers trip the circuit open. Fuses and circuit breakers are designed to protect conductors and equipment. They prevent wires and other components from overheating and open the circuit when there is a risk of a ground fault.

Ground fault circuit interrupters, (GFCIs) are used in wet locations, construction sites, and other high risk areas. These devices interrupt the flow of electricity within a little as 1/40 of a second to prevent electrocution. GFCIs compare the amount of current going into electric equipment with the amount of current returning from it along the circuit conductors. If the difference exceeds 5 mill amperes, the device automatically shuts off the electric power. Arc fault devices provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when an arc fault is detected.

3.2.5 Protection against Electrical Hazards and Energised Metal Parts

Electrical accidents are largely preventable through safe work practices. Examples of these practices include de-energizing electric equipment before inspection or repair, keeping electric tools properly maintained, exercising caution when working near energized lines and using appropriate protective equipment.

A break in an electric tool's or machine's insulation can cause its metal parts to become "hot" or energized, meaning that they conduct electricity. Touching these energized parts can result in an electrical shock, burn, or electrocution. The best way to protect your-self when using electrical tools or machines is to establish a low resistance path from the device's metallic case to the ground. This requires an equipment grounding conductor, a low-resistance wire that directs unwanted current directly to the ground. A properly installed grounding conductor has a low resistance to ground and greatly reduces the amount of current that passes through your body. Cord and plug equipment with a three prong plug is a common example of equipment incorporating this ground conductor.

Another form of protection is to use listed or labelled portable tools and appliances protected by an approved system of double insulation or its equivalent. Where such a system is employed, it must be marked distinctively to indicate that the tool or appliance uses an approved double insulation system.

3.2.6 Prevention of Accidental or Unexpected Equipment Start-Up

Proper lock-out/tag-out procedures protect you from the dangers of the accidental or unexpected start-up of electrical equipment. These procedures ensure that electrical equipment is de-energized before it is repaired or inspected and protects you against electrocution or shock. The first step before beginning any inspection or repair job is to turn the current off at the switch box and padlock the switch in the OFF position. This applies even on so called low voltage circuits. Securely tagging the switch or controls of the machine or equipment being locked out of service clarifies to everyone in the area which equipment or circuits are being inspected or repaired. Only qualified electricians who have been trained in safe lockout procedures should maintain electrical equipment. No two of the locks used should match and each key should fit just one lock. In addition, one individual lock and key should be issued to each maintenance worker authorized to lock out and tag the equipment. All employees who repair a given piece of equipment should lock out its switch with an individual lock and that only authorized workers should be permitted to remove it.

3.2.7 Protection against Overhead Power Lines

Before working under or near overhead power lines, ensure that you maintain a safe distance to the lines and for very high voltage lines, ground any equipment such as cranes that can become energized. If working on power lines, ensure that the lines have been de-energized and grounded by the owner or operator of the lines. Other protective measures like guarding or insulating the lines help prevent accidental contact. Employees unqualified to work with electricity, as well as mechanical equipment, should remain at least 3.05 meters away from overhead power lines. If the voltage is more than 50,000 volts, the clearance increases by 10 centimetres for each additional 10,000 volts. When mechanical equipment is operated near overhead lines, employees standing on the ground should avoid contact with the equipment unless it is located outside the danger zone. When factoring the safe standoff distance, make sure to consider the equipment's maximum reach.

3.2.8 Personal Protective Equipment and Role of Tools

Employees who work directly with electricity should use the personal protective equipment required for the jobs they perform. This equipment may include rubber insulating gloves, hoods, sleeves, matting, blankets, line hose, and industrial protective helmets designed to reduce electric shock hazard. All these help reduce the risk of electrical accidents.

On the other hand, appropriate and properly maintained tools help protect workers against electric hazards. It's important to maintain tools regularly because it prevents them from deteriorating and becoming dangerous. Check each tool before using it. If you find a defect, immediately remove it from service and tag it so no one will use it until it has been repaired or replaced. When using a tool to handle energized conductors, check to make sure it is designed and constructed to withstand the voltages and stresses to which it has been exposed.

3.2.9 Employees Special Training

All employees should be trained to be thoroughly familiar with the safety procedures for their particular jobs. Moreover, good judgment and common sense are integral to preventing electrical accidents. When working on electrical equipment, some basic procedures including de-energizing the equipment, using lockout and tag procedures to ensure that the equipment remains de-energized, using insulating protective equipment as well as maintaining a safe distance from energized parts are needed to be followed.

SELF-ASSESSMENT EXERCISE

- i. Most electrical accidents result from unsafe equipment, installation, environment or unsafe work practices, discuss.
- ii. Outline and briefly explain ways for preventing electrical accidents.

3.3 Control of Chemical Hazards in a Workplace

Hazardous chemicals present a number of risks upon the people in the workplace. To help mitigate these risks, the hazards associated with dangerous substances must be controlled in a professional manner. Controlling the risk associated with hazardous chemicals is one part of the four phases of the methodology that is used to manage the risks of hazardous chemicals in the workplace.

3.3.1 STOREMASTA Methodology for Managing Risk

The risk of hazardous chemicals can be managed by following the STOREMASTA methodology. This methodology has four phases. These four phases are Identify, Assess, Control and Sustain. This methodology can be used to manage workplace hazardous chemicals in such a way that you must first identify and assess their potential risks. This must be done before any controls are implemented to mitigate the risks associated with hazardous chemicals.

Identifying risk is a process that involves identifying situations involving hazardous chemicals that could potentially harm people. Once the potential risks associated with hazardous chemicals have been identified, the risk must be assessed. Assessing risk allows you to evaluate what would happen if someone was exposed to hazardous chemicals. A risk assessment will allow you to calculate the magnitude of the risk by determining the severity and likelihood of an incident occurring. Once you have identified and assessed the severity of the risks, you will have valuable data that will allow you to determine the best methods that should be used to control the risk. Once the controls have been implemented, you must review their effectiveness and set up a proactive system to sustain their effectiveness. This proactive system normally consists of a number of periodically scheduled risks assessments.

3.3.2 Control of Risk Associated with Hazardous Chemicals

As outlined above, managing the risks associated with hazardous chemicals has four distinct phases. The third phase of this process is to implement controls to reduce the risks associated with hazardous chemicals. When you are considering what controls to use to reduce the risk associated with hazardous chemicals, you must follow the hierarchy of controls. The hierarchy of controls is a system that outlines the chronological order in which you should implement controls to reduce chemical hazards. The hierarchy of controls ranks the effectiveness of the different methods of controlling risk from those that provide the highest level of protection and reliability, to those that provide the least amount of reliability and protection. This hierarchy of controls is outlined as thus:

Elimination: The risk control measure that has the greatest level of effectiveness is elimination. Before any other control measures are considered, elimination must be applied first. Elimination is the method of totally removing a hazard or hazardous practice from the workplace. Some examples of eliminating the use of a hazardous chemical in the workplace include; i) Eliminating the use of chemical adhesive by using fasteners such as screws or nails, and ii) Eliminating the use of flammable forklift gas by using electric power forklifts instead of LPG powered forklifts.

Substitution: If you can't totally eliminate the use of a hazardous chemical you must then try to substitute it. Substitution is when you replace the use of a hazardous chemical with another chemical that is less hazardous and presents a lower level of risk. Sometimes substitution can be hard to achieve because the dangerous properties of hazardous chemicals are often what makes them very effective in manufacturing and chemical processes. For example, when spray painting cars, it is very important that the thinner used to thin the paint evaporates very easily. However, the more easily a paint thinner evaporates the more volatile it will be. The more volatile a substance

is, the lower its flashpoint and the more easily it will ignite in the presence of an ignition source.

Isolation: If it's not possible to substitute the use of a hazardous chemical with another chemical that is less hazardous, you must then isolate the hazardous chemical from people and other incompatible substances. This can be done in a number of ways. For example; if one part of a manufacturing process involves the use of a hazardous chemical, you could build a ventilated enclosure over this part of the manufacturing process. This enclosure would stop the airborne contaminants from this area moving into other areas of the manufacturing facility where people are present. The airborne contaminants that are generated inside this enclosure should be vented to the outside atmosphere in a safe location where people don't congregate.

If large quantities of hazardous chemicals are stored in the workplace, you could isolate these hazardous chemicals from people by storing them outdoors in a compliant chemical storage container. Isolating hazardous chemicals from people by storing them outdoors reduces the risk of harm to people in the event of a workplace fire or chemical spill. Hazardous substances must also be isolated from other incompatible substances. If incompatible substances mix, it can result in violent chemical reactions that can harm people and property. Incompatible hazardous substances can be isolated by storing them in separate chemical storage cabinets and dangerous goods storage containers.

Engineering Controls: If isolation cannot be achieved, you can implement a number of engineering controls to reduce the risk associated with hazardous chemicals. Engineering controls are physical in nature and are devices or processes that eliminate exposure to hazardous chemicals. Engineering controls can be used to: i) Minimise the generation of hazardous chemicals, ii) Suppress or contain chemicals, and iii) Limit the area of contamination in the event of spills. Engineering controls can include devices such as mechanical ventilation systems, compliant chemical storage containers or the automation of processes involving the use of hazardous chemicals.

Administrative Controls: If a risk still remains after implementing higher order controls, they must be reduced by implementing administrative controls. Administrative controls are not as effective because they don't control the hazard at its source. Administrative controls rely on human behaviour and supervision. Administrative controls are written policies and procedures that outline the best work practices to minimise exposure to hazardous chemicals. These policies can include things such as: i) Reducing the number of people exposed to hazardous chemicals, ii) Reducing the duration and frequency of exposure to hazardous chemicals, and iii) Reducing the quantity of hazardous chemicals kept on site through inventory reduction methods such as just in time supply.

Personal Protective Equipment: Personal protective equipment (PPE) should not be relied on to control risk. PPE should only be used as a last resort when other more effective control measures have been used and the risk has not been totally eliminated. PPE can also be used as interim protection until higher level controls are fully implemented. PPE is also a useful way to supplement higher level controls when carrying out high risk work such as spray painting and abrasive blasting. Some examples of PPE can include; chemical resistant glasses face shields, chemical resistant gloves and respiratory equipment.

SELF-ASSESSMENT EXERCISE

- i. Explain how STOREMASTA methodology can be used in managing chemical hazards in a workplace.
- ii. Account for the hierarchy of controls used in reducing the risk associated with hazardous chemicals.

3.4 Fire and Explosion Protection and Preventions

3.4.1 Fire Protection Systems

The science of fire prevention and fire protection has three goals which include continuity of operations, property protection and life safety. Fire protection is based on the Fire Triangle and controlling the fuel, oxygen, and ignition. In the process industries, the fuel is typically combustible dust, and to prevent fires and deflagrations you must control fugitive dust emissions and ignition sources. Fire and explosion prevention and protection systems are designed around managing risk. Risk management is about controlling the probability of occurrence, and the magnitude or the severity of a fire or deflagration event. Thus active prevention systems are used to reduce the probability of occurrence of a fire or deflagration. Layered protection is based on several stages of safety system design. Each successive layer of protection is designed to prevent or manage another layer of risk. Each layer of protection is designed to mitigate, separate or isolate the risk from the rest of the process.

Fire Prevention: Fire prevention is based on various hazard monitoring systems that include but are not limited to: Spark detection and extinguishing systems, including spark, ember, black body, smoke and flame detection, ii) Bearing temperature, belt alignment, plug-up detection systems, iii) Linear heat detection, iv) Rate of rise heat detection, v) Smoke detection, vi) Co Detection, vii) Combustion gas detection, viii) Emissions monitoring, and ix) Video smoke and flame detection. Various other complimentary detection systems designed to detect and prevent fires in the incipient stage. Various types of detectors can be mounted on conveyors, transitions, ductwork, in the production area, and on production equipment itself to monitor hazards and alert

operators, as well as interlocking various types of alarms, suppression and deluge systems, machinery shutdown. Also, various levels of alarms can be interlocked depending on the threat level. Fire prevention is based on active monitoring systems designed to detect the first signs of combustion and react to prevent the incipient fire from developing.

Fire Protection: Fire protection equipment and systems include but are not limited to: water sprinkler and deluge systems, water mist systems, foam, suppression, inert gas, and dry chemical. Fire protection systems are reactive and designed to suppress a fire once developed and prevent further risk to life and property. Fire protection systems save lives and protect your process, product, profit, facility, assets, people, business continuity and your reputation in industry.

3.4.2 Explosion Protection Systems

Explosion protection systems are designed to prevent or safely vent a deflagration, to prevent the transition to a secondary catastrophic explosion. An explosion is a rapid and abrupt energy release that produces a pressure wave and/or shock wave. A pressure wave has a certain pressure rise time, whereas a shock wave has zero pressure rise time. Because of the pressure and/or shock wave, an explosion is always audible.

Explosion Protection Systems include:

- a. Explosion venting systems including explosion Panels/Doors and indoor explosion venting.
- b. Explosion isolation systems which are used to isolate and prevent deflagrations from propagating to other processes, and including mechanical quick sliding valves, relief valves, check valves, explosion diverters, mechanical and chemical isolation systems.
- c. Explosion suppression systems are fast acting systems that include pressure detection and suppression systems designed to choke deflagrations in early stages of development, thus preventing over pressurization of the vessel being protected. Typically these systems will be engineered and used in conjunction with each other to provide complimentary and prudent safety systems designed to meet all local and national codes and standards.

Explosion Prevention: The first step in taking appropriate countermeasures is preventing an explosion from happening. This can be done by controlling at least one of the three elements of the 'fire triangle' - fuel, oxidizer (usually oxygen) and ignition sources. This can happen in various ways, such as implementing various fire prevention engineering or other combustible dust documents, or replacing or diluting combustible dusts and oxygen, and removing ignition sources. National Fire

Protection Association (NFPA) 68, 69 deal with risk analyses and taking appropriate measures in order to protect the risk from explosive atmospheres, and include additional emphasis on proper isolation and venting to prevent the spread of a deflagration from one process to another.

Explosion Protection: Explosion protection is based on the dust explosion pentagon and controlling one or more elements - the fuel, ignition, oxygen, dispersion or confinement. Knowledge of the production process, the explosive characteristics of the dusts to be handled, and the combustion process are required for appropriate selection and sizing of preventative and protective measures. If early detection and preventative systems fail to prevent propagation, then you need additional defensive safety systems to prevent serious damage to the plant and personnel, and to keep fires and deflagrations from being transported to other processes, causing secondary fires and explosions.

SELF-ASSESSMENT EXERCISE

- i. What is your understanding of the term 'Fire Protection Systems' and 'Explosion Protection Systems'?
- ii. Compare and contrast fire prevention/protection and explosion prevention/protection toward controlling hazard in an industry.

4.0 CONCLUSION

Effective controls protect workers from workplace hazards; help avoid injuries, illnesses, and incidents; minimize or eliminate safety and health risks; and help employers provide workers with safe and healthful working conditions. In conclusion therefore, it becomes clear that machines can significantly improve production and efficiency. But they do not come without risks. The moving parts, sharp edges, and hot surfaces are hazards to workers. Many machine related injuries can be prevented with the proper use of safeguards. It is important to understand what dangers machines present and what elements are needed to implement effective safeguarding practices. Electricity is essential to modern life, both at home and on the job. It has become such a familiar part of our daily life, many of us don't give much thought to how much our work depends on a reliable source of electricity. More importantly, we tend to overlook the hazards electricity poses and fail to treat it with the respect it deserves.

Chemical hazards pose many risks upon people in the workplace. To minimise the negative effects of these hazards, it is very important that you implement the most effective controls first. The most effective control in the hierarchy is elimination. If elimination cannot be achieved, the next most effective controls must be used which

include; substitution, isolation and engineering controls. The lower order controls such as administrative controls and PPE should not be used as a primary method to control risk but to supplement higher order controls. Also, the correct implementation of control measures aims to prevent the formation of potentially explosive atmospheres, or limit their extent. However, due to the way dangerous substances are stored, handled and used, you cannot fully avoid the risk of potentially explosive atmospheres occurring.

5.0 SUMMARY

We have been able to understand what is meant by machinery guarding and protection against mechanical hazards as regards; machine associated risks, risks related to moving parts, general requirements for guards, special requirements for guards, protection against electrical hazards, insulation protection, guarding protection, grounding protection, circuit protection devices, protection against electrical hazards and energised metal parts, prevention of accidental or unexpected equipment start-up, protection against overhead power lines, personal protective equipment and role of tools and employees special training. Also, we were able to understand the control of chemical hazards in a workplace as regards; STOREMASTA methodology for managing risk, control of risk associated with hazardous chemicals. In the long run, understanding of the fire and explosion protection and preventions as regards; fire protection systems and explosion protection systems was made achievable.

6.0 TUTOR MARKED ASSESSMENT

1. What need to be considered in machinery guarding and protection against mechanical hazards?
2. Outline and explain in detail, the procedures for preventing electrical accidents.
3. Account for the hierarchy of controls used in reducing the risk associated with hazardous chemicals.
4. Compare and contrast fire prevention/protection and explosion prevention/protection toward controlling hazard in an industry.

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MODULE 3 INDUSTRIAL ACCIDENTS

Unit 1 Types and Causes of Industrial Accidents

Unit 2 Factors Contributing to Industrial Accidents

Unit 1 TYPES OF INDUSTRIAL ACCIDENTS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
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 - 3.2.2 Careless Actions
 - 3.2.3 Natural and Other Reasons
- 4.0 Conclusion
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- 7.0 References/Further Readings

1.0 INTRODUCTION

Accidents at workplaces can be sudden and unexpected which can disrupt the normal activity, whether temporarily or for a prolonged period. Indian factory act specifies that industrial accidents which cause bodily injury to workers making them out of action for 48 hours can be considered as workplace accident. Injuries caused at workplaces can be of various types and so the accidents, which can be occurred due to various reasons.

2.0 OBJECTIVES

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

- Know the types of industrial accidents
- Understand causes of industrial accidents

3.0 MAIN CONTENT

3.1 Types of Accidents

Accidents can be classified according to the nature, severity, number of victims and degree of injury. Mishaps causing mortality, huge property loss, permanent or long term impact on workers, can be defined as major accidents while a small cut or injury which may not render a worker out of action is known as minor accident. Sometimes, accidents caused due to poisonous gas or chemicals can lead to internal injury or acute health problem to workers. Along this line, accidents can be classified as temporary - lasting or occurred to last for a limited time, or permanent - lasting forever or for a very long time, especially without undergoing significant change.

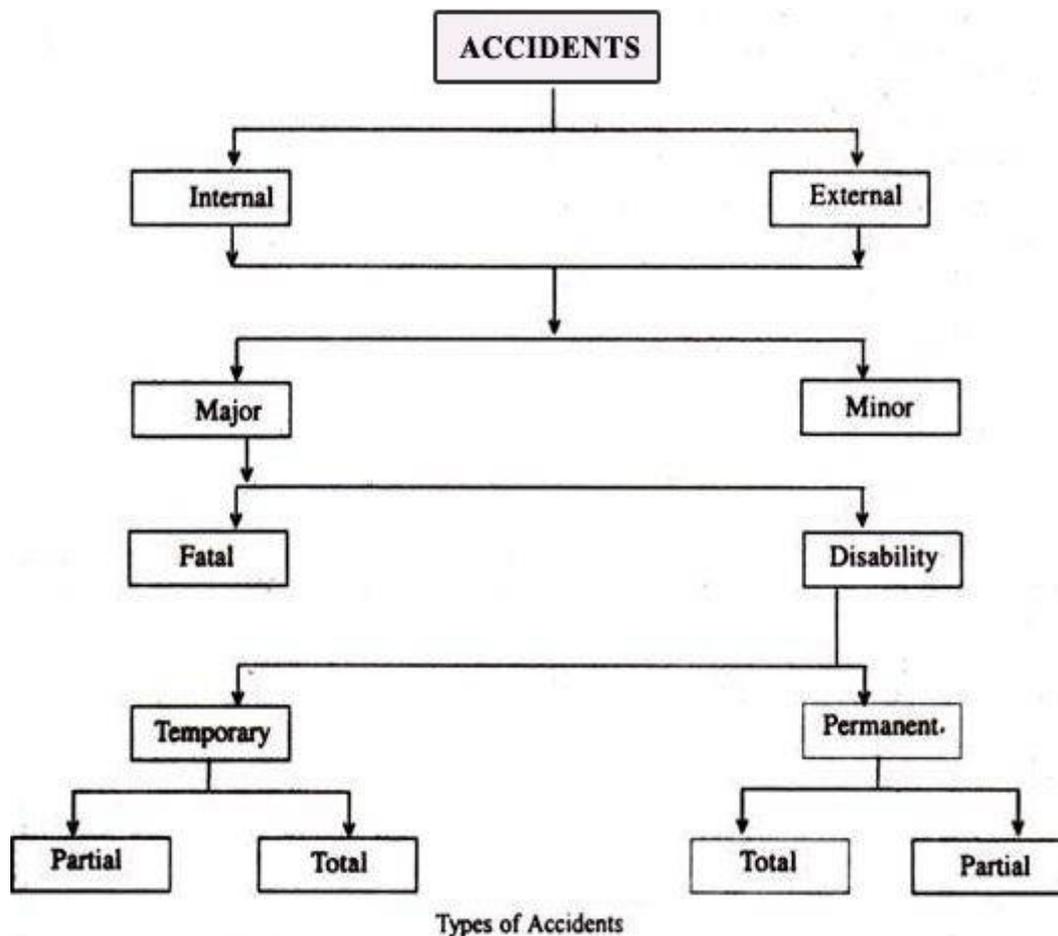


Figure 1: Types of Industrial Accidents
Adopted from Green World Group (2019)

SELF-ASSESSMENT EXERCISE

- i. What is your understanding of the term 'Industrial Accidents'?
- ii. Explain in detail, the types of industrial accidents.

3.2 Causes of Accidents

There will always be a cause for every accident, which can either be man-made or natural. Occupational safety experts have put different causes of accidents under three broad categories which are; unsafe work conditions, careless action by workers, and natural and other causes.

3.2.1 Unsafe Work Conditions

Despite strict regulations and safety procedures, accidents involving unsafe work environments do affect millions of workforce across the world. Unsafe work conditions can be attributed to defective machinery, tools, materials, equipment and safety gadgets. These are known as technical causes which can be rectified if industrial managers work in tandem with safety experts to make the place safety compliance following all necessary safety conditions, laws, regulations and standards.

Apart from these technical causes, there are psychological reasons which can make the workplace untenable. Reasons such as monotony, tiredness, working overtime, personal set back, fatigue, anxiety and frustration are some of the other causes that can lead to accidents. Safety managers identify danger zones in workplaces and take necessary corrective measures to reduce the chance of accidents. For psychological reasons, staff counsellors play a vital role in keeping workers mentally strong, happy and enthusiastic.

3.2.2 Careless Actions

Workers too, due to their ignorance and lack of knowledge and skills, trigger accidents which can be dangerous. Apart from these, accidents can be caused by workers who are unwell, have bodily defects, wrong attitude and mentally unsteady. Unauthorized access, improper usage of safety gadgets and attires, careless usage of materials, working not to the designated speed, usage of faulty equipment and physical disturbances among workers are some of the other reasons which can also cause accidents.

3.2.3 Natural and Other Reasons

Accidents and disasters can also occur due to natural means and climatic conditions.

Some of them are very high temperature, excessive noise and lighting, unhealthy conditions, excessive dust and fumes and uncivilized and arrogant nature of the immediate seniors.

SELF-ASSESSMENT EXERCISE

- i. Explain the different causes of accidents identified by occupational safety experts.
- ii. Why elimination of the causes of accidents and arrangements to shield the hazardous place are effective and efficient steps for eliminating unsafe working environment.

4.0 CONCLUSION

It is every organisation's duty to keep their workers safe by applying industrial safety methods in workplace. Every concern should provide proper training & also provide funds to study bachelor or diploma in industrial safety from a government recognized institute. By having qualified and experienced occupational safety, health and environmental experts, who can devise safety mechanism, workplace managers can contain accidents, reduce fatalities and injuries and associated losses. It is therefore essential to identify/examine the causes of industrial accidents and take steps to control them.

The environment can be termed as a man's closest surrounding which he can manipulate for his survival or existence. If this surrounding is wrongly manipulated, it may lead to unsafe situations rising and making it difficult for man's survival. Hazards as a result of the poorly managed surrounding can hinder employees productivity rate and lead to a low morale. This makes the workplace environment a very crucial determinant of the employee performance, morale, and productivity. The workplace entails an environment in which the worker performs his work while an effective workplace is an environment where results can be achieved as expected by management. Task performed in the workplace can be directly affected by the physical environment where the task is being performed.

5.0 SUMMARY

We have been able to explain types of industrial accidents and causes of industrial accidents with specific reference to unsafe work conditions, careless actions and natural and other reasons. Elimination, if possible, of the causes of accidents and arrangements to shield the hazardous place by guards, enclosures or similar arrangements are the steps to be taken to effectively and efficiently eliminate an unsafe working environment.

6.0 TUTOR MARKED ASSESSMENT

1. What is your understanding of the term 'Industrial Accidents'?
2. Explain in detail, the types and causes of industrial accidents.
3. Why elimination of the causes of accidents and arrangements to shield the hazardous place are effective and efficient steps for eliminating unsafe working environment.

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Unit 2 FACTORS CONTRIBUTING TO INDUSTRIAL ACCIDENTS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Factors Responsible for Accidents in Industries
 - 3.2 Working Conditions affecting Health
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1.0 INTRODUCTION

Accidents in industries, causing loss of man power and productivity, are the major impediment which can stall the establishment's growth. Due to fast track growth in industrialization which involves more usage of electrical power, chemicals, engineering and automation tools and machinery, the process of work has become more complex and difficult. Hence, workers are prone to accidents and various health hazards which undermine the importance of having safe and secure work environments in industries and other work environments.

2.0 OBJECTIVES

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

- Explain factors responsible for accidents in industries
- Understand working conditions affecting health

3.0 MAIN CONTENT

3.1 Factors Responsible for Accidents in Industries

1. Age: It has been observed that accidents are more frequent with younger persons than with the elderly.

2. Experience: Rate of accidents for more experienced workers is less than those of less experienced workers.
3. Physical Condition: Experiments have shown that minor illness like sore throat and headache is responsible for accidents to a large extent. These small frequent illnesses are responsible for lowering general health.
4. Fatigue: It has been observed that suitably arranged rest pauses reduce the number of accidents to a large extent. As these reduce the fatigue, therefore accidents which occur due to excess fatigue are reduced to a large extent. Experiments have shown that when only one lunch break is provided then accidents tend to increase with each successive hour of work in the morning and reaching a maximum approximately at 11 a.m. then reduces in the noon. Number of accidents again starts rising, reaching maximum value towards the later part of the afternoon but a slight drop in the last hour (probably it occurs due to the fact that in this hour speed of work decreases and worker feels relaxed mentally that shortly after he will be free).
5. Rate of Production: This factor should also be considered while considering the cause of accidents. Studies in this aspect showed that number of accidents increases with the increase in production but the proportion of accidents tends to decrease with the increasing production. This indicated that the rate of change in accidents per man's hour is less than the rate of change in production per man's hour.
6. Atmospheric Conditions: Accidents tend to be lowest at a temperature of about 67.5°F (nearly 20°C). At higher temperatures, rate of accidents increases and after 24°C, rate of accidents increases considerably.
7. Illumination: Illumination also affects the accident liability. Dim illumination raises accident frequency. In day light, accidents frequency is less as compared to artificial illumination.

SELF-ASSESSMENT EXERCISE

- i. Examine factors contributing to industrial accidents.
- ii. Outline factors responsible for accidents in industries.

3.2 Working Conditions affecting Health

Working conditions also affect the work. When a worker is allowed to work in good working conditions then his efficiency increases a lot. Bad environment or working condition may ultimately lead to: i) Physiological fatigue; ii) Mental fatigue (feeling of boredom); and iii) Decreased efficiency resulting in reduced output. In earlier days, no attention was paid on the working conditions like illumination, humidity, air

ventilation and temperature, but its importance is now being realised. The working conditions affecting human health are as follows:

3.2.1 Mental Environment

Good working conditions produce a good effect on the workers' psychology in addition to greater efficiency. In such conditions, worker will always be ready to offer his services and cooperation. It is necessary for the success of an industry that workers should have good coordination. A worker working in an atmosphere of badly ventilated and hot conditions will feel discomfort and fatigue. His efficiency will decrease and he will not be able to take interest in the work. Proper ventilation takes away the heat of human body, furnaces, boiler and other equipment thus reducing the effect of heat to some extent. Proper ventilation also removes dampness. Arrangement of air fans in a systematic way also helps to achieve this object. Sometimes, air fans placed in wrong direction send air through furnace and hot parts of machines, thus transmitting the heat to the workers which they would have not received otherwise.

3.2.2 Illumination

Poor illumination reduces the speed of work and results in strain on eyes and causes more accidents. Light should come from the right direction and of desired illumination. In artificial light, glare is most common defect; it is harmful to the eyes. It also produces strain and headache. Spoilage of work also increases due to glare.

3.2.3 Hours of Work

Working hours should be distributed uniformly over the week. A worker should get atleast one weekly holiday so that he can enjoy on that day, and feelings of fatigue and boredom from his mind are removed, and thus he may return on duty as fresh in next week. Rest pauses also reduce mental fatigue of the worker and hence they should be properly distributed (at least 5 minutes break in one working hour) and one lunch break should be allowed. Duration of rest may vary slightly depending upon the nature of work and working conditions.

3.2.4 Noise and Vibrations

Too much noise and vibrations produce mental fatigue and reduce the efficiency of the worker. Although noise cannot be stopped totally for running machinery but can be reduced by enclosing the source of noise or use of baffles and sound proof materials. Its reduction is very necessary because it is very difficult to concentrate on the work in too much noise. Sometimes too much noise also adversely affects the

hearing capacity of the workers. Noise and vibrations can also be controlled to some extent by proper maintenance, checking, lubrication and proper functions.

3.2.5 Plant and Shop Layout

Systematic layout is very helpful for reducing accidents and movement of the products. If the shop layout is such that it looks pleasant then worker will take more interest in his work. The layout should be such that material handling becomes economical and safe as well as reduced overcrowding. Passage for movement should be quite safe and space should be sufficient enough. It should be planned in such a way that every worker gets sufficient natural light in proper direction. A well designed factory looks pleasing where worker feels proud in working and take more interest in his work. Therefore, factory should be kept clean, doors and windows should be properly coloured and walls should be white washed so that atmosphere in the factory looks cheerful.

SELF-ASSESSMENT EXERCISE

- i. Briefly explain how working conditions affects industrial work.
- ii. Outline the working conditions affecting human health.

4.0 CONCLUSION

Doing a job we enjoy and find satisfying can provide a meaningful focus for our lives, as well as bringing in an income. Our standard of living hinges on the money we make, while employment often contributes to our self-image and self-esteem. Work related problems can affect our physical, emotional and mental health. Common issues include job dissatisfaction, workplace injury, stress, discrimination and bullying, violence, accidental death and retirement. Job loss, retrenchment or unexpected loss of income can also cause distress and hardship.

5.0 SUMMARY

Based on the above details concerning factors contributing to industrial accidents, factors responsible for accidents in industries as well as working conditions affecting health in respect of mental environment, illumination, hours of work, noise and vibrations as well as plant and shop layout, were fully captured. An accident is an unplanned incident and for each such incident there is usually a specific cause or causes if one could discover them. Accident may be caused due to technical causes or unsafe conditions reflect deficiencies in plant, equipment, tools, materials handling system and general work environment. Human causes or unsafe acts by the person concerned are due to his ignorance or forgetfulness, carelessness and day dreaming.

6.0 TUTOR MARKED ASSESSMENT

1. In the light of factors contributing to industrial accidents, discuss how industrial accidents serve as impediments stalling establishment's growth, causing loss of man power and productivity.
2. Outline factors responsible for accidents in industries.
3. Give a detailed account of industrial working conditions affecting human health.

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MODULE 4 INDUSTRIAL SAFETY MANAGEMENT

- Unit 1 Industrial Management
- Unit 2 Roles of Management in Industrial Safety
- Unit 3 Establishment of Safety Management Systems and Vitalization of Safety Management Activities

Unit 1 INDUSTRIAL MANAGEMENT

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Concept, Scope and Definition of Industrial Management
 - 3.1.1 Concept of Industrial Management
 - 3.1.2 Scope of Industrial Management
 - 3.1.3 Definition of Industrial Management
 - 3.2 Development of Industrial Management
 - 3.2.1 Study of Workers Performance
 - 3.2.2 Management of Machine
 - 3.2.3 Other Aspects of Management
 - 3.3 Functions and Importance of Industrial Management
 - 3.3.1 Functions of Industrial Management
 - 3.3.2 Importance of industrial management
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- 5.0 Summary
- 6.0 Tutor Marked Assessment
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1.0 INTRODUCTION

The sections to be considered by you in this unit should be on concept, definition, development of industrial management as well as functions and importance of industrial management. Significantly, industrial management is termed as the branch of engineering that deals with the creation and management of systems that integrate people and materials and energy in productive ways. In the other hand, industrial production managers oversee the daily operations of manufacturing and related plants. They coordinate, plan, and direct the activities used to create a wide range of goods, such as cars, computer equipment, or paper products. Industrial management is paramount because it focuses on so many essential aspects that are necessary for an

industry to run smoothly. For instance, industrial engineering focuses an industry and helps in improving the quality of the products being produced. It also ensures that workers are using the right method to complete a job.

2.0 OBJECTIVES

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

- Understand the concept, scope and definition of industrial management
- Understand the development of industrial management
- Understand the functions and importance of industrial management

3.0 MAIN CONTENT

3.1 Concept, Scope and Definition of Industrial Management

3.1.1 Concept of Industrial Management

Industrial management is the organizational process that includes strategic planning, setting; objectives, managing resources, deploying the human and financial assets needed to achieve objectives, and measuring results. Management also includes recording and storing facts and information for later use or for others within the organization. The concept of management planning involves direction, planning, adjustment, control, and cooperation. Management functions are not limited to managers and supervisors. Every member of the organization has some management and reporting functions as part of their job.

3.1.2 Scope of Industrial Management

The scope of Industrial relations includes all aspects of relationships such as bringing cordial and healthy labour management relations, creating industrial peace and developing industrial democracy. This is to be achieved by safeguarding the interest of workers, fixing reasonable wages, providing good working conditions, providing other social security measures, maintaining healthy trade unions and by collective bargaining.

3.1.3 Definition of Industrial Management

Industrial management, as a field of commerce and business administration, studies the structure and organization of industrial companies. It comprises those fields of business administration that are necessary for the success of companies within the manufacturing sector and the encompassing services, particularly primarily operations management, marketing, and financial management. In fact, industrial management

can be seen as a term applied to highly co-ordinated modern methods of carrying out industrial activities, especially manufacturing and operations.

SELF-ASSESSMENT EXERCISE

- i. Define the term industrial management.
- ii. Briefly explain the scope and concept of industrial management.

3.2 Development of Industrial Management

The important points of consideration as far as development of industrial management is concerned are as follows:

3.2.1 Study of Workers Performance

The first sustained effort in the direction of improved efficiency was made by Frederick Winslow Taylor, an assistant foreman in the Midvale Steel Company, who in the 1880s undertook a series of studies to determine whether workers used unnecessary motions and hence too much time in performing operations at a machine. Each operation required turning out an article or part was analysed and studied minutely, and superfluous motions were eliminated. Records were kept of the performance of workers and standards were adopted for each operation. The early studies resulted in a faster pace of work and the introduction of rest periods.

3.2.2 Management of Machine

Industrial management also involves studying the performance of machines as well as people. Specialists are employed to keep machines in good working condition and to ensure the quality of their production. The flow of materials through the plant is supervised to ensure that neither workers nor machines are idle. Constant inspection is made to keep output up to standard. Charts are used for recording the accomplishment of both workers and machines and for comparing them with established standards. Careful accounts are kept of the cost of each operation. When a new article is to be manufactured it is given a design that will make it suitable for machine production, and each step in its manufacture is planned, including the machines and materials to be used.

3.2.3 Other Aspects of Management

The principles of scientific management have been gradually extended to every department of industry, including office work, financing and marketing. Soon after 1910 American firms established the first personnel departments and eventually some

of the larger companies took the lead in creating environments conducive to worker efficiency. Safety devices, better sanitation, plant cafeterias and facilities for rest and recreation were provided, thus adding to the welfare of employees and enhancing morale. Many such improvements were made at the insistence of employee groups, especially labour unions.

Over the years, workers and their unions also sought and often won higher wages and increased benefits, including group health and life insurance and liberal retirement pensions. During the 1980s and 1990s, however, cutbacks and downsizing in many American businesses substantially reduced many of these benefits. Some corporations permit employees to buy stock; others make provision for employee representation on the board of directors or on the shop grievance committee. Many corporations provide special opportunities for training and promotion for workers who desire advancement, and some have made efforts to solve such difficult problems as job security and a guaranteed annual wage.

SELF-ASSESSMENT EXERCISE

- i. Outline the important points needed to be considered in view of development of industrial management.

3.3 Functions and Importance of Industrial Management

3.3.1 Functions of Industrial Management

The functions of industrial management are enlisted according to the following order:

Planning: This is considered first among the functions of management in any organisation. In planning, management helps in deciding the way ahead for any organisation. It involves deeply analysing the market trends and accordingly making moves and plans. Basically, it means setting goals and developing a method to achieve them efficiently. That being said, planning cannot prevent problems but it can definitely provide a way to deal with things when they go out of hand. For example, when principles of management are applied for a company selling a product, they help in planning the quantities of the product, type of product and methods of production in order to perform well in the market and avoid losses.

Organising: Once a plan is laid out, its proper implementation lies somewhat in the next functions of management. This function helps in establishing authorities, dividing workloads, assigning responsibilities, grouping tasks and allocating resources. The tasks are divided into various departments and resources required for completion of tasks are distributed. Organising involves the grouping of the required

tasks into manageable departments or work units and the establishment of authority and reporting relationships within the organisational hierarchy.

Staffing: This simply means finding and building the appropriate staff. Until and unless the right people aren't employed the correct completion of tasks will remain a distant dream. Hence this management function ensures that suitable staff is available when needed by the organisation for completion of tasks. This is known as human resource function involving recruitment, placement, selection and training.

Directing: This function of management involves guiding the team towards the right direction by leading, motivating and encouraging them. Working in a positive environment of motivation and encouragement brings out the best in people. Hence a good manager makes sure to encourage or criticise his subordinates at suitable times to maintain an atmosphere of willingness to work.

Controlling: Finally, a manager needs to ensure that standards are being met by the company. The controlling function involves setting up performance standards, measuring performances and comparing them to the established standards. Every good organisation sets a benchmark for performance which is required to be fulfilled. It is a managerial function to keep this in check. Further, it is the duty of a manager to take appropriate steps when such standards are not met. Lastly, the management decides the actions which play a significant role in success, how and where they can be measured and who should have the authority to take corrective actions.

3.3.2 Importance of industrial management

The importance of industrial management are simplified and listed as thus:

1. Identification of opportunities to get first mover advantage.
2. Sensitization of management to cope with rapid change.
3. Formulation of strategies and policies.
4. Tapping Resources.
5. Better Performance.
6. Continuous learning process.
7. Increasing share of woman in the workforce.
8. Bring changes in the consumption habits of different segments of population.
9. Increase in desire of people for enhancement of quality of life.
10. Advances in Production technology.
11. Advances in information technology.
12. Use of World Wide Web (www) for information sharing.
13. Use of commerce technology like internet and intranet for doing business.
14. Popularity of e-ticketing in case of airlines, rail, water and roadways.
15. Popularity of e-banking.

16. Increased use of e-payment mechanism like credit card, debit card, electronic fund transfer.
17. Simplifying procedures of import and export.
18. Making it easier to attract foreign capital and technology.
19. Free flow of capital across nations.
20. Free flow of technology across nations.
21. Free movement of human resources across nations.
22. Free movement of human resources across nations.
23. Better standard of living of people as a result of availability of better goods.
24. Technology upgradability.
25. Opportunities in international business

SELF-ASSESSMENT EXERCISE

- i. What are the functions of industrial management?
- ii. Enumerate the importance of industrial management.

4.0 CONCLUSION

Industrial management is the organizational process that includes strategic planning, setting; objectives, managing resources, deploying the human and financial assets needed to achieve objectives and measuring results. Industrial production managers work closely with managers from other departments. For example, the procurement (buying) department orders the supplies that the production department uses. A breakdown in communication between these two departments can cause production slowdowns. Furthermore, production techniques mean that companies keep inventory low, so communication among managers in each department and suppliers is important. They also communicate with other departments, such as sales, warehousing and research and design, to assure the company's success.

5.0 SUMMARY

You have already seen how important management is to an organization. Based on the points highlighted it becomes clear that concept, scope and definition, development of industrial management in terms of: study of workers performance; management of machine and other aspects of management as well as functions and importance of industrial management were fully treated in simplicity for easy understanding.

6.0 TUTOR MARKED ASSESSMENT

1. Define and explain the scope and concept of the term ‘industrial management’.
2. Examine the important points needed to be considered in view of development of industrial management.
3. Give a vivid explanation of the functions and importance of industrial management.

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Unit 2 ROLES OF MANAGEMENT IN ENSURING INDUSTRIAL SAFETY

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- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Management Process and Occupational Safety
 - 3.2 Management Safety Responsibilities
 - 3.2.1 Communication
 - 3.2.2 Commitment
 - 3.2.3 Involvement
 - 3.2.4 Implementation
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assessment
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1.0 INTRODUCTION

Understanding what a health and safety manager does depends on a number of factors. For example, day today tasks will vary depending on the industry they work in, the size of the company they work for and their sections/fields of specialisation. Health and safety managers' roles and responsibilities can include, but are not limited to: Monitoring health and safety risks and hazards in the workplace; Advising employees on how to minimise or ultimately avoid risks and hazards in the workplace; First aid / nursing duties; Ensuring the business is legally compliant with all health and safety legislation; Working with and training all employees to manage, monitor and improve the health and safety standards in the workplace; Being responsible for all safety inspections in the workplace (for instance, monitoring noise levels in a warehouse); Assisting with the creation and management of health and safety monitoring systems and policies in the workplace; Managing emergency procedures (such as fire alarm drills) and organising emergency teams such as fire marshals and first aiders; and Offering general health and safety advice to all employees

The degree of responsibility of a health and safety manager ultimately depends on the industry or environment they work in. For example, duties as a health and safety manager on a construction site will vary to that of a health and safety manager in an office block. However, the core responsibilities of all health and safety professionals are similar.

2.0 OBJECTIVES

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

- Understand management process and occupational safety
- Understand management safety responsibilities

3.0 MAIN CONTENT

3.1 Management Process and Occupational Safety

A safe workplace is the end product of a complex and interactive process, and each process is a characteristic of an individual organization. A successful programme will need to address the various aspects of such a system. Safety is often seen as a worker/workplace issue, but figure 1 indicates the pivotal role of management in safety as it responds to the overall goals of the organization. This can be seen from management's clear responsibility for the selection of the industrial processes utilized, the control of supervision, working conditions, and the attitudes and procedures of the worker, all of which are factors that establish the extent of a risk in a particular workplace. Usually there is a large probability that no accident will occur and a small probability that there will be an accident leading to either material damage or injury to a worker. A safety programme is concerned with reducing that risk and also minimizing injuries that occur.

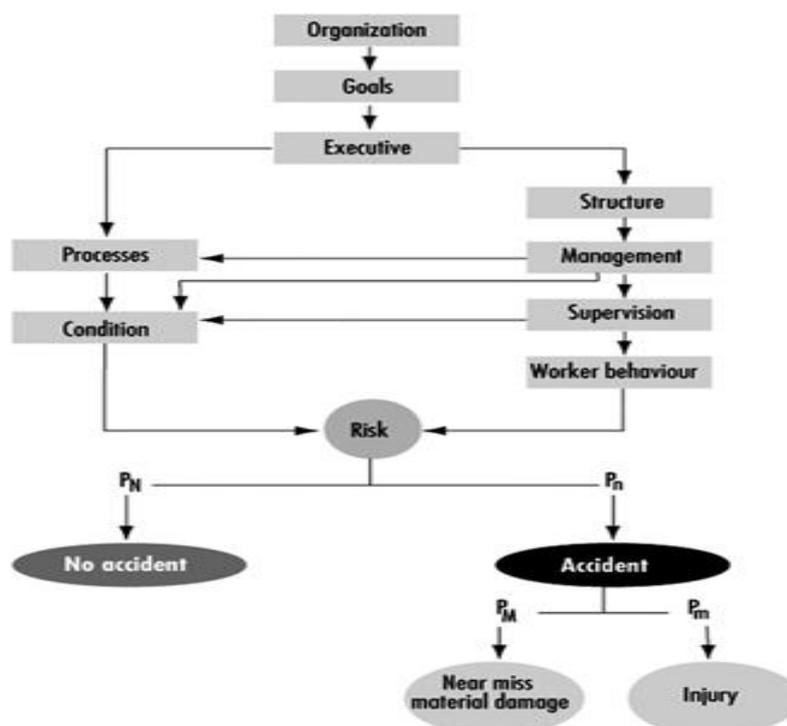


Figure 2: The management process and occupational safety. Adopted from ILO (2011)

3.2.1 Communication

A manager or supervisor who has an open door policy encourages a close working relationship with his employees. It is important that employees feel comfortable in informing the supervisor about potential safety hazards. A good manager and or supervisor needs strong communication and good listening skills, and should practice these skills regularly. Teamwork and a harmonious working atmosphere help to maintain good working relationships. Managers who encourage responsibility and allow employees adequate job control create a supportive environment. When management demonstrates a commitment to safety in the workplace, employees respond by taking a more active interest in safety.

Employees need to be encouraged by their managers and frontline supervisors to make suggestions for improvements in workplace safety and hazard reduction. Managers and supervisors need to respond quickly and positively to those suggestions to show employees that their concerns are not only being heard but also acted upon. A manager who regularly walks around the workplace, who knows employees by name and expresses a genuine interest in the day today operation of the business, inspires confidence in his employees. Problems and hazards are likely to be identified more quickly and employees are more apt to keep their workspace hazard free. Informal inspections are the best method of identifying and correcting hazards on the spot. An informal inspection should be a routine occurrence, especially in small businesses. Five minute safety meetings can address housekeeping, emergency procedures, common accidents like slips, trips and falls, and back injury prevention.

A useful and open exchange of information between supervisors and employees can occur in this more relaxed and informal atmosphere. Formal safety meetings and trainings should be conducted on a regular basis. In this setting, new employees are trained in safe job procedures and experienced employees receive refresher courses related to their job. The workers who participate in formal safety trainings should have their safety skills and knowledge evaluated after the presentation, have their attendance documented, and this information kept on file for possible Occupational Safety and Health Administration (OSHA) inspection.

3.2.2 Commitment

Management commitment is the driving force for organizing and controlling activities within an organization. A safety and health program will be effective when management views a safe and healthy work environment as fundamental and applies its commitment to protect employees as vigorously as its commitment to organizational goals and strategies. OSHA recommends the following actions be taken to show management commitment to the health and safety program:

- State the worksite safety and health policy clearly so all personnel can understand its importance in relation to other organizational values.
- Establish and communicate the goal. Objectives should be clearly defined so all levels of personnel understand the desired results and the required measures to achieve those results.
- Involve employees in decisions that affect their safety and health. If involved, employees will likely commit their insight and energy to achieving the program's goal and objectives.
- Provide visible top management support. Visibility gives employees the sense that the top level management cares and is truly committed to the safety of the employees.
- Assign and communicate responsibility to all personnel levels. Everyone should know what performance is expected and the consequences if performance levels are not achieved.
- Give those assigned responsibilities the authority to act on situations that affect the goal and objectives.
- Hold employees accountable to meet their responsibilities so that essential tasks will be performed.
- Review the safety program periodically to evaluate problems within the program and revise the objectives if the goal is not met.

Employees express their commitment to safety and health protection for themselves and their fellow workers through their involvement. An employee can enhance the program with a positive attitude toward safety.

3.2.3 Involvement

It is important for all levels of management to know and understand the safety rules that employees must follow. Contractors and consultants who work on site must follow the same safe and healthy work practices required by employees. Management must also follow the same rules when walking through with visitors or conducting an inspection. Commitment to workplace safety begins with the visible involvement and practice of the safety program by management itself.

3.2.4 Implementation

In larger organizations, safety committees are one way to involve employees and management in the production and maintenance of a health and safety program. A committee can establish guidelines for activities that involve divisions and departments in the active pursuit of safety. Contests can be initiated and awards given to those individuals or groups who demonstrate a reduction in accident levels or maintain a hazard free workplace.

SELF-ASSESSMENT EXERCISE

- i. Explain the points showing importance of management commitment to a safe working environment.

4.0 CONCLUSION

Although it is difficult to create a hazard free work environment, good managers who are committed to safety and who involves their employees in an effective safety program can work to provide an accident free workplace. Safety is a corporate objective like sales and profit. The bottom line for safety is its profitability in terms of increased quality in products, decreased workers' compensation claims, savings when workers do not have to be replaced or retrained due to accidents, and potential reductions in health and insurance costs.

5.0 SUMMARY

From the foregoing, you have been guided toward understanding management process and occupational safety and management safety responsibilities concerning, communication, commitment, involvement and implementation. Commitment to safety begins with management. In these regards, you became familiar with the management commitment and responsibility required for creating and maintaining a safe work environment for employees.

6.0 TUTOR MARKED ASSESSMENT

1. What do you understand by the term 'Roles of management in ensuring industrial safety'?
2. With the aid of diagram, describe the role of management process and occupational safety.
3. Enumerate and explain the points showing role of management safety responsibilities in ensuring a safe working environment.

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UNIT 3 ESTABLISHMENT OF SAFETY MANAGEMENT SYSTEMS AND VITALIZATION OF SAFETY MANAGEMENT ACTIVITIES

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- 2.0 Objectives
- 3.0 Main Content
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 - 3.1.3 Clarification of Responsibility and Authority for Safety
 - 3.1.4 Implementation of Safety Management Activities
 - 3.2 Vitalization of Safety Management Activities
 - 3.2.1 Safety Management Activities Involving Subcontractors' Workplaces
 - 3.2.2 Safety Management Activities in the Construction Industry
- 4.0 Conclusion
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1.0 INTRODUCTION

A safety management system (SMS) can be created to fit any business type and/or industry sector. SMS is a management system designed to manage safety elements in the workplace. It includes policy, objectives, plans, procedures, organisation, responsibilities and other measures. The SMS is used in industries that manage significant safety risks, including aviation, petroleum, chemical, electricity generation and others. It is a systematic, explicit and comprehensive process for managing safety risks. As with all management systems, a safety management system provides for goal setting, planning, and measuring performance. SMS is woven into the fabric of an organization. It becomes part of the culture, the way people do their jobs.

There are three imperatives for adopting a safety management system for a business; these are ethical, legal and financial. There is an implied moral obligation placed on an employer to ensure that work activities and the place of work to be safe (ethical), there are legislative requirements defined in just about every jurisdiction on how this is to be achieved (legal) and there is a substantial body of research which shows that

effective safety management (which is the reduction of risk in the workplace) can reduce the financial exposure of an organisation by reducing direct and indirect costs associated with accident and incidents (financial).

To address these three important elements, an effective SMS should: Define how the organisation is set up to manage risk; Identify workplace risk and implement suitable controls; Implement effective communications across all levels of the organisation; Implement a process to identify and correct non conformities; and Implement a continual improvement process.

2.0 OBJECTIVES

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

- Understand establishment of safety management systems
- Understand vitalization of safety management activities

3.0 MAIN CONTENT

3.1 Safety Management Systems

In order to proceed appropriately with safety management and prevent occupational accidents, it is necessary to establish appropriate safety management systems and to promote voluntary safety management activities in the workplace. There are different types of desirable safety management systems by industry, scale, production methods, and other factors. It is important that the system should effectively bring out the strength of each enterprise as a whole through the following:

3.1.1 Clarification of the Management's Basic Policy on Safety

The responsibility for safety management in any workplace rests with the top managers, it is important for top managers to be fully aware of safety management and to lead safety management activities themselves in order to maintain active safety and health activities in the workplace. For that purpose, it is important for the top managers to show to all the workers in the workplace a positive stance in dealing with safety management by expressing basic thinking on safety and ideals of safety as the basic policy.

3.1.2 Establishment of a Safety Goal and Formulation of a Safety Management Plan

In order to proceed effectively with safety management, it is necessary to set a safety goal to be reached within a certain period, based on the basic policy on safety

management expressed by top managers as well as to formulate a specific safety management plan to achieve a goal. In establishing a goal and formulating a safety management plan, it is necessary to analyse in detail risk factors in the workplace, past records of safety management plans, the status of attainment of the goal as well as the situations which caused occupational accidents. Problems could be elucidated from such analyses, based on which medium and long term plans and specific annual plans should be formulated.

The basic items to be incorporated into the safety management plan include, improving the safety management systems, safety activities, improving the safety of machines and equipment, improving the safety of working environments, promotion of safety education and improving work process. It is necessary to indicate as specifically and feasibly possible on each item on when, who and how these are to be implemented.

3.1.3 Clarification of Responsibility and Authority for Safety

It is needless to say that the responsibility for safety management in the workplace rests with the top managers. However, in order to implement safety management effectively, it is necessary to establish a system which assigns managers and supervisors at each level concerning the safety of workplaces, and to clarify the role, responsibility and authority of each person. This should also necessitate the involvement of the workplace as a whole in the systematic and continuous safety management activities in business or production activities.

When expressing the basic policy, it is important to analyse the current status of industrial accidents in the workplace, the actual circumstances of safety management activities, and the present situation relating to personnel in charge of safety management and expenses as well as examining whether implementing further strategies to achieve the basic policy is justified or not. Moreover, it is essential to adequately take up the views of managers, supervisors, and workers at all levels as well as safety staff and to reflect these views in the basic policy.

Moreover, while safety management activities should be carried out in unison with production activities, it is desirable to set up a system in which the production line departments can closely collaborate with the safety staff department. Collaboration includes, for example, that the safety staff department formulate a safety management plan with the cooperation of the production or business line departments, as well as inspections and evaluation of activity to be undertaken by the safety staff department.

3.1.4 Implementation of Safety Management Activities

In order to smoothly implement safety management activities based on a safety management plan, it is necessary to set details and points to be noted in implementing and managing a safety management plan. Moreover, for safety management activity to become effective, it is indispensable to obtain the understanding and cooperation of the frontline workers. That requires views and opinions of workers to be reflected in safety management activities. That should ensure all the workers to develop a consciousness that they are participating in safety management activities. Furthermore, in order to raise and stabilize workers' interest in safety management activities, the role to be played by the manager and supervisor in the workplace is important. It is important for these managers and supervisors to select hazard prediction activity, tool box meetings, safety monitor rotation system and other activities that are suitable for the workplace.

SELF-ASSESSMENT EXERCISE

- i. Define safety management system.
- ii. Identify and explain the industrial desirable safety management systems needed for bringing out the strength of an enterprise.

3.2 Vitalization of Safety Management Activities

To make Safety Management Activities lively, you may need to look in the following better comprehension.

3.2.1 Safety Management Activities Involving Subcontractors' Workplaces

Promotion of safety management activities involving subcontractors' workplaces on and off the premises involved shipping industry, steel industry, and chemical industry and the like have a large number of collaborative workplaces within their own premises. In this regard, the automobile industry and electric machinery and equipment makers have many collaborative workplaces outside their premises. Such subcontracted workplaces are generally small in scale and often do not implement sufficient safety management activities. For vitalization of safety management activities, it is important for them to make efforts of their own accord and for parent firms to take the lead in establishing a cooperative organization for the prevention of accidents. This organization serving as the core will help in giving support through:

- Establishing a consultative group for the prevention of occupational accidents, in which responsible chiefs of both the parent company and the subcontractors participate.

- Compiling a basic plan concerning safety management activities involving the subcontractors.
- Formulating a safety management plan for work in which workers of different subcontractors mix with each other and liaising and coordinating between the works thoroughly.
- Assisting in guidance to safety management activities, such as safety education and ensuring the safety of machines and equipment at the subcontractors.
- Establishing mutual discussion on cases of occupational accidents to prevent occupational accidents that have occurred in workplaces from recurring as well as to offer a variety of information concerning safety.

3.2.2 Safety Management Activities in the Construction Industry

Normally in the construction industry, the workers of a prime contractor and its related subcontractors (specific contractors) intermingle with one another at one and the same construction site to do construction work. This practice is considered one of the factors for the outbreak of many occupational accidents in the construction industry. In order to prevent occupational accidents at such construction sites, there is a need for the prime contractor, which is in a position to manage and supervise the construction site as a whole, to step up integrated safety management activities, such as the coordination of one job with another, and to promote instructions to the specific contractors.

It is also necessary that the specific subcontractors, who directly engaged in lines of construction work, carry out safety management activities to appropriately fulfil their responsibility under the overall safety management of the prime contractor. Particularly in the construction industry, it is its characteristic feature that its construction projects are terminable. In order to strive to raise the safety level under this condition, it is important for construction sites, branch and business offices, among others, to closely collaborate with one another in stepping up safety management activities.

SELF-ASSESSMENT EXERCISE

- i. Compare and contrast safety management activities involving 'subcontractors' workplaces and construction industry'.
- ii. An effective safety management system is a key component of any business, discuss.

4.0 CONCLUSION

Safety is the state in which the possibility of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management. A Safety Management System (SMS) is a systematic approach put in place by an employer to minimize the risk of injury and illness. It involves identifying, assessing, and controlling risks to workers in all work place operations. An effective SMS is a key component of any business; its scope and complexity will vary according to the type of work place and the nature of its operations. For both development and implementation of SMS to be successful, effective and efficient, it needs to be based on a formal structure of defined elements, including; management involvement and commitment, hazard identification and assessment, hazard control, training, emergency response, incident reporting and investigation and communications.

5.0 SUMMARY

You have been successfully guided toward understanding establishment of safety management systems with respect to; clarification of the management's basic policy on safety, establishment of a safety goal and formulation of a safety management plan, clarification of responsibility and authority for safety, and implementation of safety management activities. Further to that, you have also been guided for the understanding of vitalization of safety management activities as regards safety management activities involving subcontractors' workplaces and safety management activities in the construction industry. These points simply make concrete your understanding of the subject matter as a whole.

6.0 TUTOR MARKED ASSESSMENT

1. An effective safety management system is a key component of any business, discuss.
2. Identify and explain the industrial desirable safety management systems needed for bringing out the strength of an enterprise.
3. Compare and contrast safety management activities involving 'subcontractors' workplaces and construction industry'.

7.0 REFERENCES/FURTHER READINGS

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