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Basic Occupational Safety and Health (BOSH) Training

BOSH Framework
Unit 1 – Introduction to OSH

Module 1: OSH and the BOSH Framework

This is a very short module which aims to prepare you for the technical discussions that will follow in the next modules. This will also explain how the discussions will flow and give you basic directions on where we are going.

Objectives:
Working on this module should help you to:

- have an overview of the BOSH Course and the importance of safety and health
- define OSH and its three major fields – Occupational Safety, Occupational Health and Industrial Hygiene
- identify work hazards and risks and recommend control measures to reduce or eliminate work-related accidents and illness
- acquire basic knowledge & skills on OSH, such as safe work practices, that will enable you to plan/develop your company’s Safety and Health program.

Overview of the BOSH Course

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

- Understand the National Laws and Regulations on OSH
- Be aware of the Philippine Statistics on accidents/injuries and illnesses and the reporting requirements of the Department of Labor and Employment
- Understand the causes of accidents, identify existing/potential safety and health hazards and risks at work, and the mechanisms to prevent these hazards and risks
- Describe the effects of OSH hazards on the worker
- Enumerate the effects of occupational illnesses/accidents to the workers, workplace, community, and society
- Determine the appropriate control measures to prevent hazards and risks
- Conduct a simulated safety and health audit through a site/plant visit
- Describe the roles/functions of the supervisor in promoting an OSH-friendly environment in his/her organization
- Describe the components of a health and safety program
- List and describe the benefits of an OSH-friendly environment, the different government organizations and non-governmental organizations, private and academic institutions that promote, regulate OSH and how they can network with partners
- Develop a personal re-entry plan

These objectives can be attained by understanding OSH, why we need to learn key concepts in prevention and how we can respond to existing and potential hazards that affect the human body, personal lives, families and communities.
What is Occupational Safety and Health (OSH)?

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

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

“In its broadest sense, OSH aims at:

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

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

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

Occupational health issues are often given less attention than occupational safety issues because the former are generally more difficult to confront. However, when health is addressed, so is safety - a healthy workplace is by definition also a safe workplace. The reverse, though, may not be true - a so-called safe workplace is not necessarily also a healthy workplace. The important point is that both health and safety issues must be addressed in every workplace.” (Your health and safety at work: INTRODUCTION TO OCCUPATIONAL HEALTH AND SAFETY, International Labour Organization, accessed 25 April 2005 [http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm](http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm))
The terms hazard and risk are often interchanged. Because you will be encountering these throughout the course it is a must that you understand the difference between them.

**Hazard** – a source or situation with a potential to cause harm in terms of injury, ill health, damage to property, damage to the environment or a combination of these.

**Risk** – a combination of the likelihood of an occurrence of a hazardous event with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.

The hazards affecting the workplace under each major area should be detected, identified, controlled and, at best, prevented from occurring by the safety and health officer of the company. Occupational safety and health should be integrated in every step of the work process, starting from storage and use of raw materials, the manufacture of products, release of by-products, use of various equipment and ensuring a non-hazardous or risk-free work environment.

Our discussions will therefore flow from the three major areas of OSH and then on to the part where you will prepare a re-entry plan to apply what you have learned in your specific workplace. If you are not working yet, we can simulate a company, a household or a community that will benefit from your re-entry plan.
Basic Occupational Safety and Health (BOSH) Training

OSH Situationer
Unit 1 – Introduction to OSH

Module 2: OSH Situation in the Global and Local Levels

Module 2, aims to provide a background on both the local and international OSH situation. We hope that by being aware and focusing on the magnitude of work-related accidents, injuries and illness, you will understand the prevalent conditions that exist which contribute to the accidents and illness at work.

Let us share with you a historical event which led to OSH improvements in the early 19th century. During the industrial revolution of 1800 – 1900s, the use of machines, equipment and chemicals were intensive as manufacturing processes, agriculture and train/steam engine transport were the driving force of the economy. However, numerous work-related accidents and deaths occurred arising from hazards in these industries. Statistics, at that time, showed that safety hazards, chemical exposures and injuries from manufacturing work were very high. This led to the development of guidelines and standards to protect workers from work-related hazards and risks in the above-mentioned industries.

As work patterns change, trends on accidents and diseases may also reflect how workers are affected. In the late 20th century and until the present, we see that predominance of the service sector (wholesale and retail trade, education, hotels and restaurants, banks, health-care etc.), and we are now confronted with data that reveal work-related muscle and joint injuries experienced by the service sector workers and the emergence of the science of ergonomics which will be discussed at length in the Occupational Health module.

Objectives:

Working on this module should help you:
- articulate a heightened awareness of the OSH situation, both local and international
- identify the problems, issues and challenges associated with OSH conditions in the country

Global OSH figures

The International Labour Organization (ILO) Safework Introductory Report in 2008 showed that close to 50% of work-related deaths occur in Asia. In developing countries, fatality rates are five to six times higher than in industrialized nations and in developing countries where, every year, around 170,000 agricultural workers and 320,000 people die from exposures to biological risks such as viral, bacterial, insect or animal related risks.
The latest ILO figures reveal that,

“Every 15 seconds, 160 workers have a work-related accident. Every 15 seconds, a worker dies from a work-related accident or disease.

Everyday, 6,300 people die as a result of occupational accidents or work-related diseases – more than 2.3 million deaths per year. Over 337 million accidents occur on the job annually; many of these resulting in extended absences from work. The human cost of this daily adversity is vast and the economic burden of poor occupational safety and health practices is estimated at 4% of global Gross Domestic product each year.

The safety and health conditions at work are very different between countries, economic sectors and social groups. Deaths and injuries take a heavy toll in developing countries, where a large part of the population is engaged in hazardous activities such as agriculture, fishing and mining. Throughout the world, the poorest and least protected – often women, children and migrants – are among the most affected.”


To see figures in other countries, you may refer to these websites

United States of America
http://www.bls.gov/iif#tables
http://www.bls.gov/data/home.htm

Canada
http://www.ccohs.ca/oshanswers/information/information/injury_statistics.html

Japan

Philippines
http://www.oshc.dole.gov.ph
http://www.bles.dole.gov.ph

International Labour Organization
http://laborsta.ilo.org

Philippine Labor and OSH statistics
According to the latest Labor Force Survey (LFS) of the National Statistics Office (NSO), the Philippine labor force/ economically active population, which refers to persons 15 years old and above who are employed or underemployed, totals 38.905M in October 2010.

“Of the estimated 36.0 million employed persons in 2010, more than half (51.8%) were engaged in services and about one-third (33.2%) were in agriculture. Most of those who worked in the services sector were into wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (19.5% of the total employed).
Of the total employed persons, the laborers and unskilled workers comprised the largest group (32.3%). This was followed by farmers, forestry workers and fishermen (16.0%); officials of government and special interest organizations, corporate executives, managers, managing proprietors and supervisors (13.8%); and service workers, shop and market sales workers (10.6%). The rest of the major occupation groups each comprised less than 10 percent ranging from 0.4 percent to 7.7 percent. The majority (54.4%) of the employed were wage and salary workers, most of whom were in private establishments (40.4% of the total employed). Thirty percent were self-employed without any paid employee, four percent were employer in own family-operated business or farm while nearly 12 percent worked without pay in own family-operated farm or business.

More than half (63.5%) of the total employed were full time workers or have worked for at least 40 hours per week. On the average, employed persons worked 41.7 hours a week in 2010.

The number of underemployed workers in 2010 was 6.8 million, representing an annual underemployment rate of 18.7 percent. Underemployed workers are persons who express the desire to have additional hours of work in the present job, or to have an additional job, or to have a new job with longer working hours. The lowest underemployment rate was observed in Central Luzon (9.1%) while the highest was noted in Bicol Region (36.8%).

About 2.9 million Filipinos were unemployed in 2010 representing an unemployment rate of 7.3 percent for the year. The unemployed persons who have attained high school accounted for 45.2 percent of all unemployed. The proportion of unemployed males was greater than that of their female counterparts (63.3% compared to 36.7%).”

According to the July 2011 Current Labor Statistics of the DOLE Bureau of Labor and Employment Statistics (BLES), there are 8M OFWs with 1.47M deployed in 2010. Of the OFWs deployed in 2010, 1,123,676 are land based and 347,150 are sea-based. After knowing these statistics, the question that comes to mind is “how many Filipino workers are protected from accidents and illnesses while they work?”
Taken in 2007-2008 and released in 2010, the latest Bureau of Labor and Employment Statistics (BLES) Integrated Survey (BITS) on cases of occupational injuries and diseases that affected private sector establishments covered 6,460 sample non-agricultural establishments with 20 or more workers. It has expanded its coverage 65 industries including building and repairing of ships and boats (manufacturing industry); bus line operation (transport, storage and communications); accounting, bookkeeping and auditing activities; tax consultancy, architectural, engineering and related technical consultancy; call center activities, medical transcription and related outsourcing activities (real estate, renting and business activities); and animated films and cartoons production (other community, social and personal service activities) industries.

The BITS results reveal that a total of 44,800 occupational accidents occurred in 4,600 non-agricultural establishments employing 20 or more workers in 2007, a figure lower by 14.7% than the 52,515 accidents that affected 4,824 establishments in 2003. Occupational injuries resulting from workplace accidents declined by 20.7% from 58,720 in 2003 to 46,570 in 2007.

Cases that required absence/s from work stood at 23,265 in 2003 and 20,386 in 2007 or a reduction of 12.4%. Almost all cases with workdays lost in 2007 were temporary disabilities (20,109). This is 12.4% lower than the caseload of 22,964 in 2003.

Fatalities decreased by 31.8% (from 170 in 2003 to 116 in 2007. However those permanently incapacitated increased by 23.7 % (from 131 in 2003 to 162 in 2007).

Contributing factors to occupational accidents and injuries include machines, equipment, hand tools, materials, buildings, structures and chemical substances.
On the other hand, training on the proper handling and correct operation of machines, use of personal protective equipment (PPE) precautions and carefulness in work prevent accidents and promote safety in establishments.

The largest caseload of injuries with workdays lost in 2007 was recorded in manufacturing establishments at 61.0% (12,427). This industry also posted the biggest share at 61.9% four years earlier. The rest of the industries had lower shares ranging from 0.2% (financial intermediation) to 9.2% (hotels and restaurants) in 2007 and from 0.3% (mining and quarrying) to 11.6% (wholesale and retail trade) in 2003. (Table 1).

Relative to their specific industry totals, private education injury cases with workdays lost had multiplied by as much as three times its 2003 level (from 132 in 2003 to 436 in 2007). Other noticeable percentage increases were recorded in mining and quarrying at 58.3% (from 60 in 2003 to 95 in 2007) and in hotels and restaurants at 57.1% (from 1,195 in 2003 to 1,877 in 2007). On the other hand, remarkable decreases were noted in other community, social and personal service entities at 66.1% (from 546 in 2003 to 185 in 2007) and in financial intermediation activities at 52.0% (from 100 in 2003 to 48 in 2007).

### TABLE 1 - Cases of Occupational Injuries With and Without Workdays Lost by Major Industry Group, Philippines: 2003 and 2007

<table>
<thead>
<tr>
<th>Major Industry Group</th>
<th>2003 Total</th>
<th>With Workdays Lost</th>
<th>Without Workdays Lost</th>
<th>2007 Total</th>
<th>With Workdays Lost</th>
<th>Without Workdays Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>59,728</td>
<td>23,265</td>
<td>35,454</td>
<td>46,570</td>
<td>20,386</td>
<td>26,184</td>
</tr>
<tr>
<td>Mining and Quarrying</td>
<td>166</td>
<td>60</td>
<td>96</td>
<td>181</td>
<td>95</td>
<td>86</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>43,498</td>
<td>14,403</td>
<td>29,094</td>
<td>30,790</td>
<td>12,427</td>
<td>18,364</td>
</tr>
<tr>
<td>Electricity, Gas and Water Supply</td>
<td>1,028</td>
<td>605</td>
<td>424</td>
<td>1,073</td>
<td>731</td>
<td>347</td>
</tr>
<tr>
<td>Construction</td>
<td>1,768</td>
<td>1,114</td>
<td>654</td>
<td>2,076</td>
<td>697</td>
<td>1,326</td>
</tr>
<tr>
<td>Wholesale and Retail Trade, Repair of Motor Vehicles, Motorcycles and Personal and Household Goods</td>
<td>6,637</td>
<td>3,690</td>
<td>2,947</td>
<td>7,785</td>
<td>1,658</td>
<td>6,127</td>
</tr>
<tr>
<td>Hotels and Restaurants</td>
<td>2,757</td>
<td>1,165</td>
<td>1,592</td>
<td>4,069</td>
<td>1,077</td>
<td>3,091</td>
</tr>
<tr>
<td>Transport, Storage and Communications</td>
<td>2,335</td>
<td>1,666</td>
<td>669</td>
<td>2,220</td>
<td>1,701</td>
<td>519</td>
</tr>
<tr>
<td>Financial Intermediation</td>
<td>109</td>
<td>100</td>
<td>9</td>
<td>131</td>
<td>48</td>
<td>84</td>
</tr>
<tr>
<td>Real Estate, Renting and Business Activities</td>
<td>1,022</td>
<td>606</td>
<td>416</td>
<td>1,033</td>
<td>325</td>
<td>778</td>
</tr>
<tr>
<td>Private Education Services</td>
<td>699</td>
<td>132</td>
<td>567</td>
<td>1,234</td>
<td>436</td>
<td>798</td>
</tr>
<tr>
<td>Health and Social Work except Public Medical, Dental and Other Health Activities</td>
<td>169</td>
<td>96</td>
<td>73</td>
<td>197</td>
<td>67</td>
<td>130</td>
</tr>
<tr>
<td>Other Community, Social and Personal Service Activities</td>
<td>1,243</td>
<td>546</td>
<td>697</td>
<td>1,018</td>
<td>185</td>
<td>833</td>
</tr>
</tbody>
</table>

Note: Data may not add up to totals due to rounding off.

Definition of Terms:

**Occupational accident** - an unexpected and unplanned occurrence, including acts of violence arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death. It can occur outside the usual workplace/premises of the establishment while the worker is on business on behalf of his/her employer, i.e., in another establishment or while on travel, transport or in road traffic.

**Occupational injury** - an injury which results from a work-related event or a single instantaneous exposure in the work environment (occupational accident). Where more than one person is injured in a single accident, each case of occupational injury should be counted separately. If one person is injured in more than one occupational accident during the reference period, each case of injury to that person should be counted separately. Recurrent absences due to an injury resulting from a single occupational accident should be treated as the continuation of the same case of occupational injury not as a new case.

**Temporary incapacity** - case where an injured person was absent from work for at least one day, excluding the day of the accident, and 1) was able to perform again the normal duties of the job or position occupied at the time of the occupational accident or 2) will be able to perform the same job but his/her total absence from work is expected not to exceed a year starting the day after the accident, or 3) did not return to the same job but the reason for changing the job is not related to his/her inability to perform the job at the time of the occupational accident.

**Permanent incapacity** - case where an injured person was absent from work for at least one day, excluding the day of the accident, and 1) was never able to perform again the normal duties of the job or position occupied at the time of the occupational accident, or 2) will be able to perform the same job but his/her total absence from work is expected to exceed a year starting the day after the accident.

**Fatal case** - case where a person is fatally injured as a result of occupational accident whether death occurs immediately after the accident or within the same reference year as the accident.

Injuries incurring days away from work recorded a Frequency Rate (FR) of 2.79 in 2007. This was 1.28 percentage points lower than the FR of 4.07 in 2003. Expectedly, this was coherent to the 12.4% reduction in the number of cases of occupational injuries to 20,386 in 2007 from 23,265 in 2003.

Categories by incapacity for work on cases with workdays lost recorded frequency rates as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>2003</th>
<th>2007</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>4.07</td>
<td>2.79</td>
<td>-1.28</td>
</tr>
<tr>
<td>Fatal</td>
<td>0.03</td>
<td>0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>Non-Fatal</td>
<td>4.04</td>
<td>2.77</td>
<td>-1.27</td>
</tr>
<tr>
<td>Permanent</td>
<td>0.02</td>
<td>0.02</td>
<td>-</td>
</tr>
<tr>
<td>Temporary</td>
<td>4.02</td>
<td>2.75</td>
<td>-1.27</td>
</tr>
</tbody>
</table>
Definition of Terms:

**Frequency Rate (FR)** – refers to cases of occupational injuries with workdays lost per 1,000,000 employee-hours of exposure.

**Incidence Rate (IR)** – refers to cases of occupational injuries with workdays lost per 1,000 workers.

**Severity Rate (SR)** – refers to workdays lost of cases of occupational injuries resulting to temporary incapacity per 1,000,000 employee-hours of exposure.

**Average Workdays Lost** – refer to workdays lost for every case of occupational injury resulting to temporary incapacity.

Cases of occupational diseases in non-agricultural establishments employing 20 or more workers decreased by 14.8% from 55,413 in 2003 to 47,235 in 2007. Incidences of occupational diseases decreased in almost all types of diseases in 2007 except in bronchial asthma (+29.9%), occupational dermatitis (+18.6%) and essential hypertension (+7.8). Work-related musculoskeletal diseases were most prevalent in non-agricultural establishments employing 20 or more workers both in 2003 and 2007. This type of disease accounted for 37.2% (2003) and 28.1% (2007) of the totals. Other types which made up more than 10% of the total diseases in 2007 were bronchial asthma (18.5%), infections (13.8%), essential hypertension (13.0%) and occupational dermatitis (12.6%).


The present local data does not present a total picture of OSH situation in the Philippines. As you can see, the BITS survey is limited only to the 6,460 companies covered out of the estimated 780,500 existing establishments in the country. Many companies do not report accidents and injuries. Data gathering has been problematic because of the following conditions:

- Under reporting of work-related accidents and illnesses. Rule 1050 of the Philippine Occupational Safety and Health Standards (OSHS) requires all employers to report all work accidents or occupational illnesses resulting to disabling conditions to the DOLE Regional Office in their area. However, very few companies submit reports.
• Limited coverage of the OSH information and education and OSHS implementation. Vulnerable groups such as the informal sector (which amounts to 28M or 80% of the Filipino workforce) are often left out in the OSH education, information and program implementation because they are do not have the capacity to pay for trainings and most of the time are not even aware that they can protect themselves from accidents and illnesses. Many of them think that the diseases and accidents they experience is part of the nature of their work and cannot be prevented. On a positive note, OSHC has been doing a lot of OSH awareness campaigns for informal workers.

• Inadequate number of trained OSH personnel. There has been an upsurge of OSH awareness worldwide and companies both here and abroad require companies to hire trained OSH personnel. This has caused an exponential increase in the number of workers who have undergone and are wanting to avail of OSH trainings but because accidents continue to happen, more dedicated and trained personnel are needed.

• Absence of strict penalties. There is no system of fines for violations of the different provisions of the OSHS.

• Weak enforcement of OSH laws – problem is traceable also to the absence of strict penalties on violations of OSH standards.

• Fragmented OSH administration. There is no central authority to coordinate all OSH efforts.

• Public apathy on OSH concerns. Most people do not generally pay attention to OSH concerns.

• Low priority on OSH concerns by both management and labor. The former is more concerned about profit while the latter is with wages and other monetary benefits.

Emerging issues in OSH

• Aside from the problems already identified, participants should also be aware that there are emerging OSH issues – such as women workers’ issues, OSH and child labor, OSH in the informal sector, agriculture, in schools and lifestyle diseases such as AIDS and diabetes, and many others.

• Women are often faced with multiple burdens. They have take on the burden of the home they perform the role of a wife and a mother. These may also affect her performance at the workplace and add to the stresses that come with the job. The hazards that a women worker is exposed to while at work to can affect her reproductive health and for a pregnant worker, her unborn child.
• There are 250 million child laborers around the world of which 3.7 million are found in the Philippines. Of these, 2.2M are in hazardous jobs. Employing children in these types of work greatly affects the quality of their life and in serious cases, may even cause serious disabilities or death. The OSHC researches on the footwear industry, fishing, mining, and agriculture, helped in the formulation of policies, in advocacy campaigns to take children out of hazardous work.

• The use of pesticides in farms is also another issue. Farmers or farm workers who handle pesticides may be unaware of the hazards that they are exposed to. Constant exposure of a worker, has enormous adverse effects his or her health. Workers handling pesticides may even bring home residues of the chemicals and, affecting their families and the community.

• There is also little mechanism on OSH for the informal sector considering that they represent more than half of the total workforce and is the sector badly in need of OSH information since they have the tendency to ignore such concerns just to get their daily incomes.

• In schools, students are also exposed to hazards such as chemicals and electricity, while bullying and hazing (both psycho-social issues) are becoming more common. Many school buildings are also risks themselves.

Although the number of work-related accidents and illnesses has decreased in the recent years here in the Philippines, cases of occupational injuries and diseases continue to occur. We at the OSHC subscribe to the principle that “one life lost is one too many.” Everyone must therefore be involved in the effort to contain OSH concerns to enhance one’s working life. After all, most of us work mainly for economic purposes - “ang hanap-buhay ay para ikabuhay, hindi para ikamatay.”
Unsafe/Unhealthy Acts and Conditions
Module 3: Unsafe / Unhealthy Acts and Conditions

Objectives

Working on this module should help you to:
- identify the different unsafe and unhealthy acts and conditions in your workplace
- differentiate unsafe/unhealthy acts from unsafe/unhealthy conditions
- explain the relationship between unsafe/unhealthy acts and unsafe/unhealthy conditions
- identify Filipino traits and characteristics in the workplace which result in unsafe/unhealthy acts and conditions
- define accident and its causes
- enumerate ways to promote safety consciousness

What are unsafe/unhealthy acts and conditions?

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

Accidents

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

Common types of accidents:

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

Costs of accidents

Corollary to accidents are costs that companies have to bear whether directly or indirectly. The cost of accidents can be best explained by the Iceberg Theory. Once an accident happens, money has to be spent for medical expenses of the injured worker/workers, insurance premiums and, in some cases, for penalty and litigation expenses. Companies also spend huge amounts to replace damaged equipment and wasted raw materials. These are what we consider as the direct costs of accidents. But these are just the tip of the iceberg.
The larger and more dangerous part of the iceberg however is the part that lies beneath the water. This represents the **indirect costs** of an accident which have a more damaging impact to the worker, their families, the company and the community in general. Indirect costs include:

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

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

**Accident causation**

After knowing what accidents are and the costs that will be incurred when these happen, we will now look at the primary causes of accidents. Understanding this topic will help you identify appropriate measures to prevent accidents from happening.

Are these phrases familiar to you?

- "Oras na niya"
- "Malas niya lang"
- “Tanga kasi”
- “Kasama sa trabaho”

People usually utter the abovementioned phrases or statements when someone gets injured or dies in an accident. However, these are not the real causes of accidents but mere excuses of people who do not understand the concepts of occupational safety and health. Accidents are primarily caused by unsafe and unhealthy acts and conditions.

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

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

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

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

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

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

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

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

It is important to raise everybody’s consciousness to such a degree that we all begin to realize that our actions affect other people in the workplace, even if these appear to have nothing to do with them. If you agree that we are part of the problem, then, probably we can be part of the solution, too. OSHC believes that Filipinos are inherently responsible workers. Given the proper education, training, and the right motivation, we can do our part in making a safe and a healthy workplace. That is why we are conducting this BOSH Training Course.

Below are additional references you can check out to learn more about this module

http://www.oshc.dole.gov.ph/
http://www.itcilo.it/actrav/actrav-english/telearn/osh/intro/introduc.htm
http://training.itcilo.it/actrav_cdrom2/es/osh/add/sechyg.htm
Housekeeping
Unit 2 – Occupational Safety

Module 4: Housekeeping

This module aims to introduce you to the importance of good housekeeping in preventing most common accidents in the workplace (we also think it will be good to implement in your homes and schools).

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

Objectives

Working on this module should help you to

- explain the value of practicing good housekeeping
- recall and explain the role of management, supervisor and employees in good housekeeping activities
- identify and discuss good housekeeping practices

Defining Housekeeping

Let us begin by showing you what housekeeping is not: It is shown when your surroundings have:

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

Do you agree with this? Housekeeping is avoiding all of the above and many more. Now instead of just being crabby and complaining about poor housekeeping, why don’t we see how we can instill and implement good housekeeping in our workplace? Look at the two pictures below. Do you know about with these seven wastes and how we can eliminate them? You got it! Through good housekeeping!
SEVEN (7) WASTES

1. Scrap and Rework
2. Overproduction
3. Non-effective work
4. Transportation
5. Inventory
6. Non-effective motion
7. Waiting

What is 5S?

5S is a systematized approach to:
- organizing work areas
- keeping rules and standards
- maintaining discipline

5S utilizes:
- workplace organization
- work simplification techniques

5S practice...
- develops positive attitude among workers
- cultivates an environment of efficiency, effectiveness and economy

5S Philosophy

- Productivity comes from the elimination of waste
- It is necessary to attack the root cause of a problem, not just symptoms
- Participation of everybody is required
- To acknowledge that the human being is not infallible
5S Terms:

1. **Seiri/Sort/Suriin** – is the first S which means sorting out unnecessary items and discarding them.

   - Make the work easy by eliminating obstacles
   - Eliminate the need to take care of unnecessary items
   - Provide no chance of being disturbed with unnecessary items
   - Prevent faulty operation caused by unnecessary items.

2. **Seiton/Systematize/ Sinupin** – is the second S which means we need to organize things

   ![Diagram of 5S Terms](image)

   **How to SEITON Your Workplace**

   - **SEITON**
     - Items frequently used
     - Must be placed near the point of use
   - **SEIRI**
     - Items not used at all
     - Must be stored separately with clear identification
   - **Systematize**
     - Items sometimes used
     - Can be placed farther away

7 Seiton Principles:

- Follow the first-in-first-out (FIFO) method for storing items
- Assign each item a dedicated location.
- All items and their locations should be indicated by a systematic labeling
- Place items so that they are visible to minimize search time
- Place items so they can be reached or handled easily.
- Separate exclusive tools from common ones.
- Place frequently used tools near the user.
3. **Seiso/Sweep/Simutin** – is the third S which means we have to sanitize or clean our workplace.

- Keep environmental condition as clean as the level necessary for the products
- Prevent deterioration of machinery and equipment and make checking of abnormalities easy
- Keep workplace safe and work easy

4. **Seiketsu/Standardize/Siguruhin** – is the fourth S which means we have to standardize what we are doing.

5. **Shitsuke/Self-Discipline/Sariling kusa** – is the fifth and last S which means we have to do this process without prodding.

### Some Suggested Good Shitsuke Practices

- Contact people with a big smile.
- Be a good listener.
- Be devoted and kaizen-oriented.
- Demonstrate team spirit.
- Conduct yourself as the member of a reputable organization.
- Be punctual.
- Always keep your workplace clean and tidy.
- Observe safety rules strictly.

**Good housekeeping is needed for quality improvement.** By this we lessen rejects/losses. If the workplace is in order, it is easy to do the job. An easier job, having no defects, continuous production and an orderly workplace is akin to work improvement. And now that ISO Certification is the trend, the impression of a company to the community is very important. A company that follows good housekeeping principles will surely be recognized as a provider of quality service and products.
Steps in implementing 5S

Step 1: Preparations

a. Understanding 5S concepts and benefits by the CEO
b. CEO’s visit to the 5S model companies
c. CEO’s commitment to 5S implementation
d. Organize 5S working Committee
e. 5S facilitators
f. Train facilitators and practitioners

Step 2: Management’s official announcement

a. CEO officially announces implementation of 5S program
b. CEO explains the objectives of 5S to all colleagues
c. Publicize 5S organizational chart and lay-out
d. Work out various promotional tools

5S CORE GROUP
ROLES AND RESPONSIBILITIES

- PLAN
  - Situation Appraisal
  - Setting Benchmarks or Targets
  - Implementation Plan
- DO
  - Announcements
  - Education
  - Akafuda
  - Big Seiso
  - Seiso Inspection
  - Seiton Campaign
  - Special 5S Projects
- CHECK
  - 5S Audit
  - Documentation of Targets
  - Review Targets
- ACT
  - Corrective Measures
  - Revise Plans
  - Difficulties Encountered

Organizing to Implement 5S
Management’s Role

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

Supervisor’s Role

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

Worker’s Role

- Follow housekeeping procedures
- Maintain an orderly workplace
- Report to supervisors any unsafe condition
Step 3:  Big clean-up day

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

Step 4:  Initial seiri

a. Establish disposal standards for unnecessary items
b. Apply “Disposal Notices” to all questionable items
c. Carefully examine responses to disposal notices
d. Dispose unnecessary items according to disposal standards
e. A company-wide seiri should be planned and practiced annually

Daily Seiso and Seiton activities

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

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

a. Furniture – tables, shelves, drawers
b. Equipment – computers, projector, fax, copier
c. Lay-out of desk and equipment

Soft 5S

a. Office policies and procedures
b. Dress code
c. Sharing of responsibilities, telephone etiquette
5S Office guidelines

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

Office machines
- Clean office machines and equipment regularly (Seiso)
- Set electric cables neatly for safety and good appearance (Seiton)
- inspect machines regularly and take action for required servicing (Shitsuke)

Toilets
- Flush after use (Seiketsu)
- Wash hands after using the toilet (Seiketsu)
- Clean up toilet and wash basin everyday (Seiso/Seiketsu)
- Replenish toilet paper, soaps and paper towels (Seiton/Seiketsu)
- All users should always try to keep toilets clean and tidy (Shitsuke)
- Check exhaust fans regularly for effective function (Seiso)

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

Hallways
- Do not smoke while walking in the hallways (Shitsuke)
- Do not place anything in the hallways without permission (Seiri/Seiton/Shitsuke)
- Pick-up and dispose any waste in the hallway (Seiketsu/Shitsuke)
- Avoid talking loudly along hallways (Shitsuke)

Notice Boards
- Ensure that outdates notices are removed (Seiketsu)
- Ensure that all information are updated regularly (Seiri)
- Items should be neatly aligned and properly secured (Seiton)
- Pins must be readily available (Seiton)
- Check that the location of notice boards are appropriate (Seiton)
Visual Control - a technique that enables people to make the rules easy to follow, differentiate normal and abnormal situations and act accordingly, with the use of visual aids.

**Pointers in making visual control**
- Should be easy to see from a distance
- Should be properly and strategically located
- Should be easy to follow
- Should facilitate distinction of what is right and what is wrong

**Step 5: Periodic 5S audits**

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

**Purpose of 5S audit**

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

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

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

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

RECORD IMPROVEMENTS WITH PHOTOGRAPHS

5S IMPROVEMENT RECORDS

<table>
<thead>
<tr>
<th>WORKPLACE</th>
<th>SPARE PARTS STORAGE</th>
<th>LOCATION NO.</th>
<th>5S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 1</th>
<th>STEP 2</th>
<th>STEP 3</th>
<th>STEP 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>DATE</td>
<td>DATE</td>
<td>DATE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMMENTS</td>
<td>COMMENTS</td>
<td>COMMENTS</td>
<td>COMMENTS</td>
</tr>
<tr>
<td>RATING</td>
<td>RATING</td>
<td>RATING</td>
<td>RATING</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Very messy.
- Needs Seiri, Seiton and Seiso
- Much improved, but...
- needs further study

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## 5S Evaluation Form

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FOCUS</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desks / tables / chairs</td>
<td>Are they tidy and conveniently organized?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Cabinets/shelves</td>
<td>Are they clean and labeled for the easy retrieval of things needed?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Documents/files</td>
<td>Are they clean and systematically organized?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Forms/office supplies</td>
<td>Are they tidy and conveniently stored for retrieval?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Telephones</td>
<td>Are they clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Facsimiles</td>
<td>Are they clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Typewriters/word-processors</td>
<td>Are they clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Computers/monitors</td>
<td>Are they clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Printers</td>
<td>Are they clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Copying machines</td>
<td>Are they clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Electric wiring</td>
<td>Is it tidy, safe and conveniently laid out for operation?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Lighting/ventilation</td>
<td>Are they adequate for efficient operation?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Floors/walls/windows/ceiling</td>
<td>Are they dust-free and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Fire extinguishers</td>
<td>Are they adequate and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Emergency exits</td>
<td>Are they adequate and clear of obstacles in case of emergencies?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Safety devices</td>
<td>Are they adequate and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Working clothes/shoes</td>
<td>Are they clean and do they present a good image?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Waste baskets</td>
<td>Are clean and well-maintained?</td>
<td>10 8 6 4 2</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>10 8 6 4 2</td>
</tr>
</tbody>
</table>
Factors leading to the success of 5S

a. Strong sponsorship and leadership of CEO
b. Active promoter/5S committee
c. Good launching activity
d. Regular audits
e. Good documentation
f. Visits by external consultants
g. Competition

Factors that hinder the success of 5S

a. Project sponsor is not the decision maker
b. Organizational policies
c. Lack of experience in undertaking cross-functional activities
d. Lack of top management support
e. Implementation carried out through orders from the management
f. Implementation done by task forces
g. 5S treated as a project
h. Emphasis on immediate results

Notes:
Here are additional notes on good housekeeping in the workplace as well as inspection checklists from the Canadian Center of Occupational Health and Safety (CCOHS)

Why should we pay attention to housekeeping at work?

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

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

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

Poor housekeeping can be a cause of accidents, such as:
- tripping over loose objects on floors, stairs and platforms
- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

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

What are some benefits of good housekeeping practices?

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

How do I plan a good housekeeping program?

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

The costs of this investment could be offset by the elimination of repeated handling of the same material and more effective use of the workers' time. Often, ineffective or insufficient storage planning results in materials being handled and stored in hazardous ways. Knowing the plant layout and the movement of materials throughout the workplace can help plan work procedures.
Worker training is an essential part of any good housekeeping program. Workers need to know how to work safely with the products they use. They also need to know how to protect other workers such as by posting signs (e.g., "Wet - Slippery Floor") and reporting any unusual conditions.

Housekeeping order is "maintained" not "achieved." Cleaning and organization must be done regularly, not just at the end of the shift. Integrating housekeeping into jobs can help ensure this is done. A good housekeeping program identifies and assigns responsibilities for the following:
- clean up during the shift
- day-to-day cleanup
- waste disposal
- removal of unused materials
- inspection to ensure cleanup is complete

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

What are the elements of an effective housekeeping program?

Dust and Dirt Removal
In some jobs, enclosures and exhaust ventilation systems may fail to collect dust, dirt and chips adequately. Vacuum cleaners are suitable for removing light dust and dirt. Industrial models have special fittings for cleaning walls, ceilings, ledges, machinery, and other hard-to-reach places where dust and dirt may accumulate.

Special-purpose vacuums are useful for removing hazardous substances. For example, vacuum cleaners fitted with HEPA (high efficiency particulate air) filters may be used to capture fine particles of asbestos or fiberglass.

Dampening (wetting) floors or using sweeping compounds before sweeping reduces the amount of airborne dust. The dust and grime that collect in places like shelves, piping, conduits, light fixtures, reflectors, windows, cupboards and lockers may require manual cleaning.

Compressed air should not be used for removing dust, dirt or chips from equipment or work surfaces.
Employee Facilities
Employee facilities need to be adequate, clean and well maintained. Lockers are necessary for storing employees' personal belongings. Washroom facilities require cleaning once or more each shift. They also need to have a good supply of soap, towels plus disinfectants, if needed.

If workers are using hazardous materials, employee facilities should provide special precautions such as showers, washing facilities and change rooms. Some facilities may require two locker rooms with showers between. Using such double locker rooms allows workers to shower off workplace contaminants and prevents them from contaminating their "street clothes" by keeping their work clothes separated from the clothing that they wear home.

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

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

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

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

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

Keeping aisles and stairways clear is important. They should not be used for temporary "overflow" or "bottleneck" storage. Stairways and aisles also require adequate lighting.
Spill Control
The best way to control spills is to stop them before they happen. Regularly cleaning and maintaining machines and equipment is one way. Another is to use drip pans and guards where possible spills might occur. When spills do occur, it is important to clean them up immediately. Absorbent materials are useful for wiping up greasy, oily or other liquid spills. Used absorbents must be disposed of properly and safely.

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

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

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

Storage
Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere with work but they should still be readily available when required. Stored materials should allow at least one meter (or about three feet) of clear space under sprinkler heads. Stacking cartons and drums on a firm foundation and cross tying them, where necessary, reduces the chance of their movement. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations. All storage areas should be clearly marked.
Flammable, combustible, toxic and other hazardous materials should be stored in approved containers in designated areas that are appropriate for the different hazards that they pose. Storage of materials should meet all requirements specified in the fire codes and the regulations of environmental and occupational health and safety agencies in your jurisdiction.

http://www.ccohs.ca/oshanswers/hsprograms/house.html

What is an example of a workplace housekeeping checklist for construction sites?

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

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

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

http://www.ccohs.ca/oshanswers/hsprograms/cklstcon.html

What is an example of a Housekeeping Inspection Checklist?
Use the following checklist as a general workplace guide.

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

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

Spill Control
• Are all spills wiped up quickly?
• Are procedures followed as indicated on the material safety data sheet?
• Are spill absorbents used for greasy, oily, flammable or toxic materials?
• Are used rags and absorbents disposed of promptly and safely?
• Is a spill area surrounded by a barrier to prevent a spill from spreading?
Equipment and Machinery Maintenance
- Is equipment in good working order, with all necessary guards or safety features operational or in place?
- Is equipment damaged or outdated?
- Are tools and machinery inspected regularly for wear or leaks?
- Is equipment repaired promptly?
- Are drip pans or absorbent materials used if leaks cannot be stopped at the source?
- Is a machine that splashes oil fitted with a screen or splash guard?
- Are machines and tools cleaned regularly?

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

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

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

http://www.ccohs.ca/oshanswers/hsprograms/cklstgen.html
What is an example of a workplace housekeeping checklist for stockpiling?

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

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

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

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

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

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

[http://www.ccohs.ca/oshanswers/hsprograms/cklststk.html](http://www.ccohs.ca/oshanswers/hsprograms/cklststk.html)
What is an example of a Workplace Housekeeping Checklist?

**DO:**

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

**DO NOT:**

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

[http://www.ccohs.ca/oshanswers/hsprograms/cklstwrk.html](http://www.ccohs.ca/oshanswers/hsprograms/cklstwrk.html)
Conclusion

As an individual, you can make your work area more pleasant and conducive to working, thus creating and improving work efficiency, safety and quality of work and products. As a company, 5S is an integrated approach for production, quality, lower costs, on time delivery, safety, and morale.

In conclusion, it is not a matter of memorizing Japanese words pertaining to a system of housekeeping. Wholehearted practice and observance of good housekeeping is what is important. Surely after reading about this, you will realize the value of good housekeeping as the most basic step in preventing accidents and avoiding various degrees of losses to productivity, property, materials and equipment, notwithstanding its human elements.
Materials Handling and Storage
Module 5: Materials Handling and Storage

Objectives

Working on this module should help you to:

- demonstrate methods of safe manual handling;
- discuss safe procedures in mechanical handling; and,
- enumerate standard requirements on materials storage.

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

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

I. Manual Materials Handling

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

Remember to stop and think before lifting any load and ask yourself whether there is an even safer way to do the job.

**What makes manual materials handling hazardous?**

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

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

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

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

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

Source: [http://www.ccohs.ca/oshanswers/ergonomics/push1.html](http://www.ccohs.ca/oshanswers/ergonomics/push1.html)

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

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

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

Most common are overexertion injuries (e.g., back strain). Injuries due to slips and falls are also often associated with pushing and pulling. Additionally, injuries to fingers and hands can result when caught in, on, or between objects (e.g., between a cart and the wall) and to lower legs when bumped by carts. Therefore, existing statistics do not reflect the importance of pushing and pulling as work factors causing injury because the injuries fall into different categories making them difficult to analyze.
Because of the complex nature of body motion during pushing and pulling, no numerical standard has yet been developed that can be directly applied in industry.

Many factors affect the amount of force that you exert in a horizontal push and pull:

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

Tables 1 and 2 contain the upper force limits for horizontal and vertical pushing and pulling. They indicate the amount of force that you can exert safely. It is important to be aware that the forces in the tables are not the same as the weight of objects being pushed and pulled. This means that you cannot use these upper force limits as recommendations for weight limits that can be pushed or pulled in the workplace. Only trained personnel using special equipment can measure the forces exerted by a worker.

The values in Table 1 show the upper limits of forces for horizontal pushing and pulling. These limits should not be exceeded in work situations. In fact, it is better and safer if pushing and pulling tasks require lower forces, particularly, where the task requires:

- pushing or pulling an object when the hands must be above the shoulder or below the waist level
- exerting a force for longer than 5 seconds
- exerting a force at an angle not directly in front of the body, e.g., not "straight on"
- where a worker can support his body (or feet) against a firm structure higher forces (up to 675N or about 165 lbf or 75 kgf) can be developed
<table>
<thead>
<tr>
<th>Condition</th>
<th>Forces that should not be exceeded, in newtons (Kgf, lbf)**</th>
<th>Examples of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Standing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Whole body involved</td>
<td>225 N (50 lbf or 23 kgf)</td>
<td>Truck and cart handling. Moving equipment on wheels or casters. Sliding rolls on shafts.</td>
</tr>
<tr>
<td>2. Primary arm and shoulder muscles, arms fully extended</td>
<td>110 N (24 lbf or 11 kgf)</td>
<td>Leaning over an obstacle to move an object. Pushing an object at or above shoulder height.</td>
</tr>
<tr>
<td>B. Kneeling</td>
<td>188 N (42 lbf or 19 kgf)</td>
<td>Removing or replacing a component from equipment as in maintenance work. Handling in confined work areas such as tunnels or large conduits.</td>
</tr>
<tr>
<td>C. Seated</td>
<td>130 N (29 lbf or 13 kgf)</td>
<td>Operating a vertical lever, such as a floor shift on heavy equipment. Moving trays or a product on and off conveyors.</td>
</tr>
</tbody>
</table>


** Units of force are: newton (N), kilogram force (Kgf), pound force (lbf); 10N is about the same as 1 Kgf or 2 lbf. The values in each unit system - newtons, kilogram force and pound force, respectively - are provided in the table because all are used in the literature and on instruments, depending on the country of origin.
The values in Table 2 show the upper limits of forces for vertical pushing and pulling. Examples of the use of vertical force are operating controls and hand tools. Such activities tend to be of a repetitive nature and physically more demanding than occasional pushing or pulling. Therefore, these tasks should be designed for considerably lower force requirements than those shown in Table 2.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Upper Limit of Force in newtons, (lbf, kgf)**</th>
<th>Examples of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pull down, above head height</td>
<td>540 N (120 lbf or 55 kgf)</td>
<td>Activating a control, hook grip; such as a safety shower handle or manual control</td>
</tr>
<tr>
<td></td>
<td>200 N (45 lbf or 20 kgf)</td>
<td>Operating a chain hoist, power grips; less than 5 cm (2 in) diameter grip surface</td>
</tr>
<tr>
<td>Pull down, shoulder level</td>
<td>315 N (70 lbf or 32 kgf)</td>
<td>Activating a control, hook grip. Threading up operations as in paper manufacturing and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>stringing cable.</td>
</tr>
<tr>
<td>Pull up, -25 cm (10 in) above</td>
<td>315 N (70 lbf or 32 kgf)</td>
<td>Lifting an object with one hand</td>
</tr>
<tr>
<td>the floor</td>
<td>148 N (33 lbf or 15 kgf)</td>
<td>Raising a lid or access port cover, palm up</td>
</tr>
<tr>
<td>-Elbow height</td>
<td>75 N (17 lbf or 7.5 kgf)</td>
<td></td>
</tr>
<tr>
<td>-Shoulder height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push down, elbow height</td>
<td>287 N (64 lbf or 29 kgf)</td>
<td>Wrapping, packing; Sealing cases</td>
</tr>
<tr>
<td>Push up, shoulder height (boosting)</td>
<td>202 N (45 lbf or kgf)</td>
<td>Raising a corner or end of an object, like a pipe or beam. Lifting an object to a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>high shelf.</td>
</tr>
</tbody>
</table>


** Units of force are: newton (N), kilogram force (Kgf), pound force (lbf); 10N is about the same as 1 Kgf or 2 lbf. The values in each unit system - newtons, kilogram force and pound force, respectively - are provided in the table because all are used in the literature and on instruments, depending on the country of origin.
What types of protective clothing should be worn?

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

DO NOT WEAR
- aprons, coats,
- clothing with exposed buttons, zippers or loose flaps, or
- heavy duty mitts.

Manual handling guides

1. Shoveling guidelines

Put weight on front foot. Use leg to push shovel.

Keep feet wide apart. Place front foot close to shovel.

Shift weight to rear foot. Keep load close to body.

Turn feet in direction of throw

Source: http://www.ccohs.ca/oshanswers/ergonomics/shovel.html#_1_1
2. Digging guidelines

Push spade down using leg muscle. Slide load close to body. Ensure load is loose from ground before lifting.

Source: http://www.ccohs.ca/oshanswers/ergonomics/mmh/generalpractice.html?print#_1_1

3. Lifting guidelines

Before lifting...
- Always check to see if mechanical aids such as hoists, lift trucks, dollies, or wheelbarrows are available.
- Get help with heavy or awkward loads.
- Assess and identify the weight of the load.
- Be sure that you can lift the load without over-exertion.
- Be sure that the load is "free" to move.
- Check if the planned location of the load is free of obstacles and debris.
- Be sure that the path to the planned location of the load is clear. Grease, oil, water, litter and debris can cause slips and falls.
- Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, sheet materials like metal or glass).
- Do not lift if you are not sure that you can handle the load safely.

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

A compact load can be lifted between the knees.

Examples of a compact load

Source: http://www.ccohs.ca/oshanswers/ergonomics/mmh/compactloads.html?print#_1_2
Remember to:
- Stand close behind the load.
- Straddle the load:
  - Place the leading foot flat beside the load in the direction of travel.
  - Place the rear in the direction of travel.
- Bend the hips and knees.
- Keep your back straight.

When lifting...
- Grasp the load with elbows inside the thighs:
  - Use a power grasp for loads with handles.
  - Use slings or hooks to improve grasp when loads do not have handles.
  - Use blocks under loads without handles to make lifting them up easier and safer.
  - Use a ledge grasp for loads without handles.
- Grasp with one hand at the outer, upper corner, over the leading foot and the other hand on the lower, opposite corner.
- Lean forward with the rear arm straight. This position gets the load moving.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Keep the load close to the body.
- Keep the rear arm straight.
- Move off without twisting the body.

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

Source: http://www.ccohs.ca/oshanswers/ergonomics/mmh/compactbags.html
B. Lifting compact bags

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

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

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

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

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

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

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

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight.
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.
C.3. "Two-person lift and stack"

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

On one person's command:

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


D. Lifting drums and barrels

Handling drums and barrels can be dangerous. Do not handle drums and barrels without training.

**Raising drums from the ground**

- Use mechanical aids whenever possible. Do not attempt to raise a full drum alone.
- Make sure that the drum is empty before raising it.
- Stand at the end of the drum.
- Place one foot forward at the side of the drum, the other behind.
- Bend your hips and knees.
- Keep the back straight.
- Grasp the rim about 15 cm from the ground with the elbows inside thighs.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Bring the back leg forward as if you are walking. Keep close to the drum.
• Stop at the balance point to change hand grip.
• Set the drum on its base by moving back leg forward. Use the body weight as a counter balance.

Two-person lift

• Use two people to lift a full drum.
• Use the same technique as with one person, but have two people squatting at either side of the drum.

Moving a standing drum

• Stand close to the drum with feet apart. One foot at the front and the other behind.
• Keep knees slightly flexed.
• Put your hands firmly against upper rim of the drum.
• Keep arms straight with the elbows "locked".
• Rock the drum gently to get the feel of its contents before you move it.
• Push the top of the drum away by extending the back leg and shifting your body weight onto your front leg.
• Stop tilting the drum at the balance point. Use back leg as a counter balance.
Should drums be lifted manually when they are stacked?

No. Always use cranes or lift trucks to stack drums.

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

E. Lifting sheet materials

Handling sheet material single-handed is always difficult and hazardous.

A. Store the sheet materials at a convenient height above ground.
B. Do not lift and carry sheets without training.

What should be done when lifting sheet material?

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the mid-point of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.
- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending and twisting body.
What should be done when carrying the load?
- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.
- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.

II. Mechanical materials handling

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


A. Manually powered materials handling equipment reduce physical effort, making materials handling easier and safer. Here are some tips when using mechanical aids:

- Check for the availability of mechanical aids before lifting or moving loads.
- Do not operate any equipment if you are not trained to use it.
- Keep the equipment in good operating condition. It saves effort while transporting loads.
- Select the right equipment to complete the task.
- Specific tasks or objects require specialized equipment.
- Do not operate any equipment if you are not trained to use that equipment.
- Keep the equipment in good operating condition. It saves effort while transporting loads.
Here are some manually powered materials handling equipment:

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

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

- **Use a shelf truck** to move a variety of objects.
• Use a **platform truck** to move heavy, irregularly shaped objects.

![Platform truck](image1)

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

![Semi-live skid](image2)

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

![Rack and bin](image3)

*Source: [http://www.ccohs.ca/oshanswers/ergonomics/mmh/mechanicalaids_transport2.html](http://www.ccohs.ca/oshanswers/ergonomics/mmh/mechanicalaids_transport2.html)*
• Select a **stair climbing truck** when moving load on stairs.

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

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

• Move and dump waste materials with **dump trucks**.
• Move and empty drums with *tilting drum cradles* and *drum dollies*.

![Tilting Drum Cradle and Drum Dolly](image1)

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

![A Frame Hand Truck and Dolly](image2)

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

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

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

In both manually-powered and mechanically-powered materials handling equipment, you can use *accessories* such as ropes, chains or steel/plastic straps to secure loads and prevent them from sliding or falling from the equipment.
Ropes
- You should know what particular rope can handle particular tasks/loads.
- Keep rope in good condition all the time.

Chains
- Do not let chains get kinked, knotted or twisted.

Steel and plastic straps
- Make sure straps are not too loose or tight.
- Do not lift by the strap unless the same is designed for that purpose.

III. Workspace lay-out

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

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

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

Source: http://www.ccohs.ca/oshanswers/ergonomics/mmh/workspacelayout.html?print

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

- Have all materials at work level.
- Use adjustable elements at the workplace.
- Workbench with adjustable height and tilt improves working position.

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

- Ensure that there is enough room to turn around to prevent twisting.
• Use adjustable supports or suspenders to operate heavy tools.
• Tool suspender reduces muscular effort and compression on the back.

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

IV. Materials Storage

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

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

Firstly, materials should be housed in a storage room with the following features:
• at least two exits
• properly illuminated
• properly ventilated
• restricted access

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

Also, materials that you need more frequently and use must be placed closer to you.
Furthermore, materials must not obstruct alarm boxes, sprinkler system control, first-aid equipment, fuse boxes and importantly, aisles and exits.

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

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

Source: http://www.ccohs.ca/oshanswers/ergonomics/mmh/layoutstoring.html?print

What should be remembered when setting up a storage area?
- Store materials at a convenient height.
- Leave the lowest shelf unused if necessary.
- Use vertically mobile shelves to avoid bending and overhead reaching.

- Use bin racks for storing small items.
• Store heavy and frequently used materials at waist height.

• Do not store materials at floor level.

• Use hand trucks with elevating devices in storage and loading areas.
• Use trucks with a tilting device to avoid bending.

• Use elevating platforms to avoid overhead reaching.

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

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

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

- Eliminate extra loading or unloading steps where possible.
- Unload as close as possible to the place where material will be needed.
- Use ramps to avoid lifting and dragging over edges.

- Use containers that allow fluids to pour or empty without lifting the container.
Solving materials handling problems

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

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

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

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

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

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

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

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

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

In summary, it is you who can prevent materials handling accidents and injuries. You can achieve this by remembering the following:

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

- The capacity to perform MMH varies considerably among individuals. In general, the lifting strength of women as a group is less than that of men. However the individual ranges of strength are wide. This means that some women can safely handle greater loads than some men. Therefore, discrimination against women for MMH is not justified. In a situation where selection is the only way to minimize the possibility of injury, women and men should be given an equal opportunity of being selected for the job. However there are certain working conditions that even alone and more particularly when combined with MMH create greater health hazards for women. Owing to body composition and structure, women are less tolerant of heat and whole body vibration. Such hazardous conditions should be fully controlled and not serve as an excuse for gender discrimination.

- Ageing diminishes strength. Since the rate of decline varies greatly with the individual, discrimination against older workers solely on this basis is unjustified. Statistics show that back injuries among workers over 45 years of age are less frequent than among those between 20-45 years of age. Experience seems to counterbalance decreasing physical capacity. With experience comes skills, dexterity and practical know-how for completing tasks, all of which are very important factors contributing to safe MMH. The unskilled, inexperienced worker is at greater risk in tasks that require skills in handling. On the other hand, the older, experienced worker is at risk in tasks requiring sheer physical strength.

We hope this module clarified many things about materials handling in the workplace. In fact, we believe some of the points we have made here are also applicable at home and in school. It would be good to keep these points in mind wherever you may be.
Fire Safety
Module 6: Fire Safety

In this Module, we will talk about fire safety. Having a fire in the workplace is one of the most highly preventable situations IF and only IF we follow all the safety regulations and use our common sense as well as our awareness in looking out for possible fire hazards. It may seem too common for some thus, we often overlook these fire safety tips, and before we know it, everything will have gone up in smoke. To prevent all this from happening, do take this module seriously for your sake as well as that of your loved ones.

This module aims to introduce you to the chemistry and behavior of fire and principles of fire prevention and control. The triangle of fire demonstrates how fire occurs and the principles of extinguishing fire. Fire is caused by variety of factors, all of which can be prevented and controlled. Most fires start small and can be controlled through immediate response and knowledge of extinguishing medium.

Prevention and control of the hazards from fire should be a part of the safety program in each workplace, and even in your own home.

Objectives

Working on this module should help you to

- describe principles of fire occurrence and extinguishment using the fire triangle model
- enumerate the five principles of fire prevention and control

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

The Fire Triangle and the Fire Tetrahedron

The fire triangle and the pyramid of fire illustrate the elements necessary for fire to start and the methods of extinguishment. Each side represents an essential ingredient for fire. The three elements are Fuel, Oxygen and Heat. When a fire starts, a fourth element, which is the chemical reaction itself, is necessary for flame propagation. The four-sided figure is called the Fire Tetrahedron.
• **Fuel**: Any material that will burn is classified as fuel. Identify examples of fuel you can find in your workplace. Do you know the difference between a flammable or combustible substance?

**Flammable substance** – is a substance having a flashpoint below 100 °F (37.8 °C) and vapor pressure not exceeding 20 psia at 100 °F. Examples of flammable substances with their flashpoint are shown below:

<table>
<thead>
<tr>
<th>Flammable substances</th>
<th>°F</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>-45</td>
<td>-42.8</td>
</tr>
<tr>
<td>Ether</td>
<td>-49</td>
<td>-45</td>
</tr>
<tr>
<td>Acetone</td>
<td>0</td>
<td>-17.8</td>
</tr>
<tr>
<td>Alcohol</td>
<td>55</td>
<td>12.8</td>
</tr>
</tbody>
</table>

**Combustible substance** – is a substance having a flashpoint at or above 100 °F (37.8 °C).

<table>
<thead>
<tr>
<th>Combustible substances</th>
<th>°F</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Oil</td>
<td>100</td>
<td>37.8</td>
</tr>
<tr>
<td>Kerosene</td>
<td>100</td>
<td>37.8</td>
</tr>
<tr>
<td>Quenching Oil</td>
<td>365</td>
<td>185.0</td>
</tr>
<tr>
<td>Mineral Oil</td>
<td>380</td>
<td>193.3</td>
</tr>
</tbody>
</table>

**Flashpoint** - the lowest temperature at which fuel begins to give off flammable vapors and form an ignitable mixture in air.

Which is more dangerous: a substance with low flashpoint or a substance with a high flashpoint?

**Answer**: *The lower the flashpoint, the more dangerous a substance is.*

• **Oxygen**
  From our definition of FIRE, we need oxygen which combines with fuel while burning. Normally, the air has 21% oxygen and 78% while nitrogen.

• **Heat – completes the chemistry of fire**
  Even if found together, fuel and oxygen will not burn. An example is a piece of paper. This fuel is exposed to oxygen in the air but will not burn. Why? Because we need to introduce the third element which is **Heat**.
It is when we heat up the piece of paper sufficiently that it will start to burn.

What we form with these three elements is called the **Fire Triangle**. This model shows us that to have fire we need three elements. And if these elements are combined at the right proportion, we will have fire.

### I. How to extinguish a fire?

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

#### A. Removing fuel

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

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

#### B. Removing oxygen

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

1. Separate it from the fire through smothering the burning area with a non-combustible material – this is called “suffocating the fire.”
   
   **Examples:**
   - If there are oil spills, you can cover it with wet blanket or you can throw sand or soil on it.
   - Covering with foam
   - Smothering it with inert gas

2. Reduce the concentration of oxygen below the concentration necessary to support combustion. This is accomplished by discharging carbon dioxide or other inert gases into the fire.
Example:
Light candle and cover with glass until the candle dies

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

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

C. Removing heat

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

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

D. Interrupting the chain reaction

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

Interrupt the chain reaction by inhibiting the oxidation process and the production of flammable vapors that react with oxygen, then we extinguish the fire.
Example:
- Use of dry chemicals extinguishes fire with this principle.

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

II. Classification of fires

There are four classes of fires, categorized according to the kind of material that is burning. For the first three classes of fires, there are two sets of color-coded icons commonly used. One or both kinds of icons appear on most fire extinguishers to indicate the kinds of fire against which the unit is intended to be used.

There is only one icon used to indicate the fourth (class D) kind of fire. Class D fires involve uncommon materials and occur in fairly specialized situations. Note that any given fire can fall into more than one class; a fire that involves both burning paper and kitchen grease would be a Class AB fire.

Knowing the classification of fires is important for the speedy extinguishment and safety of the fire fighters. Using the wrong extinguishing medium may cause the fire to spread and endanger the fire fighters.

Class A fires are those fueled by materials that, when they burn, leave a residue in the form of ash, such as paper, wood, cloth, rubber, and certain plastics.

Class B fires involve flammable liquids and gasses, such as gasoline, paint thinner, kitchen grease, propane, and acetylene.

Fires that involve energized electrical wiring or equipment (motors, computers, panel boxes) are Class C fires. Note that if the electricity to the equipment is cut, a Class C fire becomes one of the other three types of fires.

Class D fires involve combustible metals such as magnesium, sodium, titanium, and certain organometallic compounds such as alkyl lithium and Grignard reagents.
Fire that involves combustible cooking fuels such as vegetable or animal oils and fats.

III. Principles of fire prevention and control

A. Prevent the outbreak of fire

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

It will be good to examine the hazards from which most fires originate. These are sometimes described as causes of fire.

<table>
<thead>
<tr>
<th>Causes of Fire</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>(28.9%)</td>
</tr>
<tr>
<td>Open flames (torch)</td>
<td>(10.5%)</td>
</tr>
<tr>
<td>Unattended cooking</td>
<td>(5.3%)</td>
</tr>
<tr>
<td>Lighted candles or oil lamp</td>
<td>(4.3%)</td>
</tr>
<tr>
<td>Cigarette butts/smoking</td>
<td>(3.1%)</td>
</tr>
<tr>
<td>Spontaneous combustion</td>
<td>(2.4%)</td>
</tr>
<tr>
<td>Lighted matchstick or lighter</td>
<td>(2.1%)</td>
</tr>
<tr>
<td>LPG explosion</td>
<td>(1.2%)</td>
</tr>
<tr>
<td>Static electricity</td>
<td>(1.0%)</td>
</tr>
<tr>
<td>Electrical machines</td>
<td>(1.0%)</td>
</tr>
<tr>
<td>Fireworks</td>
<td>(0.7%)</td>
</tr>
<tr>
<td>Chemicals</td>
<td>(0.5%)</td>
</tr>
<tr>
<td>Bomb Explosion</td>
<td>(0.1%)</td>
</tr>
<tr>
<td>Lightning</td>
<td>(0.1%)</td>
</tr>
<tr>
<td>Unknown, others</td>
<td>(40.0%)</td>
</tr>
</tbody>
</table>

Common causes of fires:

- **Electricity**

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

  Overheating happens when there is overloading of system, short circuit and poor insulation. These are caused by improper wiring connection/practice, tampering with safety devices such as fuse and circuit breakers, and old and poorly maintained electrical installation.
• **Control**
  - conduct regular inspection and maintenance of electrical installation
  - employ trained and licensed electrician
  - follow Philippine Electrical Code and Occupational Safety and Health Standards

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

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

- **Mechanical heat**

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

- **Friction sparks**

  Friction generates heat. Excessive heat generated by friction causes a very high percentage of industrial fires. Fire usually results from:
  - overheated power-transmission bearings and shafting from poor lubrication and excessive dust
  - jamming of work material during production
  - incorrect tension adjustment of belt-driven machinery. If the belt is too tight or too loose, excessive friction could develop

- **Control**
  - Preventive maintenance program to keep bearings well oiled and do not run hot. And keep accumulation of flammable dust or lint on them to a minimum.
  - Keep oil holes of bearings covered to prevent dust and gritty substances from entering the bearings.

- **Open flames**

  Carelessly discarded cigarettes, pipe embers, and cigars are a major source of fire. Prohibit smoking, especially in woodworking shops, textile mills, four mills, grain elevators, and places where flammable liquids or combustible products are manufactured, stored or used.
• **Control**
  - providing a "No Smoking Area" at specified times where supervision can be maintained.
  - marking areas where exposure is severe with conspicuous “No Smoking” signs, prohibiting employees from even carrying matches, lighters and smoking material of any kind

**Spontaneous heat (auto-ignition)**

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

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

**Welding and cutting sparks**

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

**Control time for welding and cutting:**

- Move combustibles a safe distance away - 35 ft. horizontally or
- Move work to a safe distance
- Protect the exposed combustibles with suitable fire resistant guards and provide a trained fire watcher with extinguishing equipment readily available
- Cover openings in walls, floors or ducts should be if within 35 ft of the work.
- Implement "Hot Work Permit System"

**Generation of static charge**

*Static Electricity* is electricity at rest. It is formed by the contact and separation of dissimilar materials. Examples that produce static electricity:
- flow of fluid through a pipe
- agitation and mixing
- splash filing
Static spark created may cause ignition of flammable vapors, dust and fibers. Also, a worker could be injured through accidental reaction caused by static spark shock.

- Control

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

Highly flammable or combustible materials – Take care that the following materials are not stored with machinery or near any type of electrical or heat source.

Highly flammable materials may include:
- Hay and straw
- Bedding material (especially sawdust and shredded newspaper)
- Cobwebs, dust, and grain dust
- Horse blankets
- Paint
- Fertilizer
- Pesticides and herbicides

Accelerants - Accelerants are substances that increase the speed at which a fire spreads. All accelerants are highly flammable or combustible, but not all highly flammable or combustible materials are accelerants. Accelerants must be stored in approved containers and properly labeled as such (plastic milk bottles do not qualify as approved containers for storing chemicals). An updated list of all chemicals in the workplace should be maintained. The list should include the name of the chemical, date purchased, the quantity of the chemical, and the place of storage on the farm. This list should be kept in a safe, handy place such as an office (not in the building where the products are stored). In case of a fire, the list should be given to the fireperson in charge to...
aid the fire department in knowing what potential toxic fumes or explosions may result and how best to contain the situation.

Common accelerants include:
- Gasoline
- Kerosene
- Oil
- Aerosol cans

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

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

**B. Provide for early detection of fire**

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

Detection serves to:
- warn the fire brigade to start extinguishing procedure
- warn occupants to escape

**Means of detection include:**
- human observer
- automatic sprinklers
- smoke, flame and heat detectors

**a. Smoke detectors**
- Monitor changes within the area
- Provide early warning
- Changing stages in the development of fire
- When smoke is produced
b. Heat detectors

- **Fixed temperature types** – which responds when the detection element reaches a predetermined temperature
- **Rate-of-rise temperature** – which respond to an increase in heat at a rate greater than some predetermined value.

c. Flame detectors

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

C. Prevent the spread of fire

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

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

- **Conduction** is the transfer of heat from molecule to molecule. Thermal conductivity is important in terms of fire spread. A steel girder passing through an otherwise fireproof wall may cause fire spread by conducted heat.

- **Convection** is caused by movement of heated gasses produced by any burning material or by heated air rising to the upper limits of the space in which it is contained. During a fire in a building convection currents convey combustion gases up through stairways or lift shafts, spreading the fire to other parts of the building.

- **Radiation** is the transfer of heat in straight rays.

**Control**

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

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

- **Permanent or "built-in" fire extinguishers**
  Examples include:
  - standpipe and hose
  - automatic sprinkler system
  - fire hydrant
  - fire pump
  - fire truck
  - automatic extinguishing system

- **Portable extinguishers**

  These are used extensively to lessen the danger from fire. After such a system is installed, its proper maintenance and regular inspection is suggested to ensure its usefulness when needed.

  Portable fire extinguishers are also called **first-aid fire extinguishers** since they are intended to be used for incipient fires. They contain a limited supply of an extinguishing medium. These appliances are designed for use on fires of specific classes.

- **Requirements for effective use of fire extinguishers:**
  1. **Of the approved type**
     - must have a seal of PS mark for locally made, and UL mark for imported ones
  2. **The right type for each class of fire that may occur in the area**
  3. **In sufficient quantity**
     - The number of fire extinguishers must be computed according to the floor area, the degree of hazard of fire that may occur and the class of fire.
  4. **Located where they are easily accessible for immediate use and the location is kept accessible and clearly identified.**
5. **Mounting of fire extinguishers (Rule 1944.05 Portable Extinguisher)**

   a. Extinguishers with a gross weight not exceeding 18 kg (40 lbs.) should be installed not more than 5 ft (1.5 m) above the floor.
   b. Extinguishers with a gross weight greater than 18 kg (40 lbs.) except wheeled type extinguishers, should be installed not more than 3.5 ft (1 m) above the floor.
   c. In no case must the clearance between the bottom of the extinguishers and the floor be less than 4 inches.

6. **Maintained in operating condition**

   - **Inspection** - a "quick check" that visually determines whether the fire extinguisher is properly placed and will operate. Inspection must be done at least monthly or more to be effective.

     Checkpoints during inspection should include:
     - location
     - free of obstruction
     - opening instructions
     - seal and tamper indications
     - weight
     - physical appearance
     - pressure gauge
     - maintenance tag

   - **Maintenance** - as distinguished from inspection means a **complete and thorough examination** of each extinguisher.

     Extinguishers should be subjected to maintenance not more than one year apart or when specifically indicated by an inspection.

     The three basic items to be checked are:
     - mechanical parts
     - extinguishing agent
     - expelling means

7. **Operable by the area personnel who are properly trained to use them effectively and promptly.**
In the absence of modern fire extinguishers, the following can be used to stop fire in its initial stage.

- For A fire - water is the best.
- For B fire - a metal cover, wet sack, towel, cloth, or blanket will do. Sand and soil are very useful
- For C fire - the main switch is the first consideration. Pull it down to cut off the current. What is useful on A & B can also be useful here.

Remember the **PASS** - word

- P - pull the pin
- A - aim low
- S - squeeze the lever above the handle
- S - sweep from side to side

**E. Provide for prompt and orderly evacuation of personnel**

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

Exit requirements for life safety in case of fire:

- at least two ways out remote from each other
- additional exits according to number of persons and relative fire danger
- evacuation drills well planned, frequently practiced (at least twice a year)
- exits are well-marked, clear, unobstructed and well lighted
- correct exit design
- regular exit drills
- makeshift fire escapes are often dangerous

**IV. General fire safety precautions**

- Smoking should never be permitted in any storage area, tack room or lounge. “No-Smoking” signs should be posted in these areas and at all exterior entrances. Butt cans should be provided as an incentive to extinguish all cigarettes.
- Exit doors should be clearly marked.
- Aisles should be raked or swept clean at all times. Vacuum up cobwebs and dust regularly. Wipe dust/dirt off light fixtures, outlet covers, switches and panel boxes
• Weeds, twigs, and other trash should be kept mowed or picked up from around the outside of the building.
• Paper storage should not be near lights, fans, electrical boxes, heaters or outlets.
• Flammable substances should be kept elsewhere outside the building.
• Vehicles and machinery should be stored in a separate building.
• A fire hose and buckets should be available and kept for the purpose of extinguishing class A fires rapidly.
• Practice fire drills should be held so employees and boarders are familiar with their responsibilities should a real fire occur.

V. Lightning protection

• Buildings should be equipped with professionally installed lightning rods of copper or aluminum. The system should be properly grounded.
• All pipes, water systems, electrical systems and telephone lines should also be grounded.
• Contact a professional company for proper maintenance and installation.

Summary and Conclusions

Remember:
• The Fire Triangle demonstrates how fire starts and how it could be extinguished
• The principle of fire prevention and control programs involves prevention, prompt action to extinguish the fire, and safe evacuation of occupants.
• With these principles in mind you can help
  - Prevent fires in your workplace
  - Safeguard your property
  - Protect many lives
A general note on fire safety:

If your clothing catches fire, it is a natural response to panic and run to the nearest shower or fire blanket. Don’t do it! Running will just fan the flames and increase the potential for serious injury. The correct response is to Stop, Drop, and Roll on the ground to extinguish the flames. Cover your face with your hands to protect your face and lungs. If one of your colleagues catches fire, panics, and starts to run, tackle him or her and smother the flames.

The information given here is intended as an introduction to fires and fire extinguishers. It is not a comprehensive reference. Be aware that fires are dangerous, and many aspects of fire safety are not discussed here. For more in-depth information and hands-on training, contact your local Fire Marshal's office.

Combustion

Combustion is a chemical reaction in which a fuel is rapidly oxidized. Three things are required to sustain a fire:

- Oxygen (more properly, an oxidizing agent)
- Fuel (a reducing agent)
- Heat

Therefore, to kill a fire, you must deny the fire one or more of these three things. You may:

- Exclude oxygen from the fire.
- Remove the fuel on which the fire is feeding.
- Lower the temperature.

Types of Fire Extinguishers

Fire extinguishers are categorized according to the substances that they contain and by class of fire. Extinguishers are rated for use against only certain kinds of fires, and will carry an ABCD marking to indicate the classes of fire against which they may properly be used. For example, an extinguisher rated for class B and C fires is called (and marked) a type BC extinguisher.
A fire extinguisher should never be used on a class of fire for which it is not rated -- see notes following the table.

<table>
<thead>
<tr>
<th>Type</th>
<th>Mechanism</th>
<th>Effective Range</th>
<th>Discharge Duration</th>
<th>Classes of Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>reduces temperature</td>
<td>30-40 ft</td>
<td>60 sec</td>
<td>✔️ ✗ ✔️ ✗ ✔️</td>
</tr>
<tr>
<td>CO₂</td>
<td>displaces oxygen</td>
<td>3-8 ft</td>
<td>8-30 sec</td>
<td>✗ ✔️ ✔️ ✗ ✔️</td>
</tr>
<tr>
<td>dry chemical</td>
<td>binds oxygen</td>
<td>5-20 ft</td>
<td>10-40 sec</td>
<td>✔️³ ✔️ ✔️ ✗ ✔️</td>
</tr>
<tr>
<td>Met-L-X</td>
<td>smothers</td>
<td>See Note 4</td>
<td>NA</td>
<td>✗ ✗ ✗ ✔️</td>
</tr>
</tbody>
</table>

- ✔️ Extinguisher rated for this type of fire
- ✗ Extinguisher not rated for this type of fire

Notes:
1. Fire extinguishers should never be used on classes of fires for which they are not rated. In some cases (e.g. water used on a Class D fire), the extinguisher can actually make the fire worse!
2. Never use water on a class C fire -- shock hazard.
3. Some dry-chemical extinguishers are rated BC, others are rated ABC. Those rated BC contain sodium or potassium bicarbonate; those rated ABC contain ammonium phosphate.
4. Extinguishing agents for class D fires are usually applied with a scoop or shovel.

Fire Extinguisher Operation

The information given here describes how a fire extinguisher should be used to fight a fire. However, do not believe, because you have read this, that you know how to use a fire extinguisher! If you really want to learn how to use a fire extinguisher properly (and you should), you should seek out a hands-on training class in which you will have the opportunity to put out some real fires using portable extinguishers.

To remember how to use a fire extinguisher, think of putting out the fire as a test you must PASS.

Pull the locking pin.
Aim the nozzle at the base of the fire.
Squeeze the trigger all the way closed.
Sweep the extinguisher discharge side to side over the area of the fire.
When should you fight a fire?

In the event of a fire, your personal safety is your most important concern. You are not required to fight a fire. If all of the following conditions are met, then you may choose to use a fire extinguisher against the fire. If any of the conditions is not met, or you have even the slightest doubt about your personal safety, do not fight the fire.

Attempt to use a fire extinguisher if and only if...
- The fire alarm has been pulled and fire department has been called.
- The fire is small and contained.
- You know your escape route and can fight the fire with your back to the exit.
- You know what kind of extinguisher is required.
- The correct extinguisher is immediately at hand.
- You have been trained in how to use the extinguisher.

We hope you’ll be better equipped, after studying this module, to keep fires from happening in your surroundings.
Electrical Safety
Module 7: Electrical Safety

Electrical safety is closely related to fire safety, so we hope you do not mind hearing some things twice. Fires are often caused by electrical trouble, as we all know, although we also know that electrical trouble can also mean other things like electrocution and other such accidents. This module aims to introduce you to the basic terms in electricity, occurrence mechanism of electric shock accidents and preventive measures for electric shock.

We already know that electrical safety has to do with understanding voltage, current and resistance. You and all the other people in the workplace must understand electrical safety in order to prevent accidents/injuries/deaths/property damage. Unsafe practices related to electricity have adverse effects to the human body and property, and are the primary causes of fire.

There are practical measures that you can follow to ensure electrical safety.

Objectives

- define the basic terms in electricity
- describe the danger of electric shock
- identify the practical measures in preventing electric shock accidents

Electricity

Electricity is essential and considered as among the basic needs of everybody. Electricity had made our houses into homes, changed the mode of transportation from kalesas into taxis and Metro Railway Transport Systems (MRTS), and improved shops to malls and factories. It is hard to imagine if we had no electricity until now. However, it is also among the common causes of occupational accidents resulting to injuries, death and property damage.

More than a thousand workers are killed each year by electrical shock and thousands more are burned or maimed. More than 90% of the fatalities occurred when a person who was grounded made contact with live wire or an energized equipment housing. Line to line contact accounted for fewer than 10% of the deaths.

Electrical safety requires understanding of what electricity is, how electrical energy is transferred and how the path through which electrical current travels can be controlled.
Electricity can be defined as the flow of electrons along a conductor. Electrons are negatively charged particles distributed in orbits around the nuclei of atoms, which are the smallest units of an element than can exist either alone or in combination. In an atom, the negative charge of the electrons is neutralized by the positive charge of particles called protons, so that the atom is electrically neutral. If an external force is applied so that the electrons are removed from their orbit and directed to a given direction, electric current is produced in that direction.

Electric current requires a suitable circuit to provide the energy needed for lighting, heating, etc. An electrical circuit usually contains a power source and an electrical load. Suitable conducting material connects the power source to the load in order to complete the electrical circuit. These conductors are covered with a suitable insulating material to prevent the current from leaking out.

Some materials such as metals have loosely bonded electrons, and the amount of thermal energy available at room temperature is sufficient to generate free electrons. Materials that have a relatively large number of free electrons at room temperature, which are called conductors, are capable of conducting electricity (the movement of electrons in a given direction). On the other hand, materials that do not have a large number of free electrons at room temperature (such as plastics), which are called insulators, are incapable of conducting electricity. Materials that fall in between the two extremes are termed semi-conductors.

Elements of electricity

- **Voltage.** In order for electrons to move between two points, a potential difference must exist. The potential difference between two points in a circuit is measured in terms of volts. The higher the potential difference, the easier it is for the electrons to move from one point to another, and the higher the electric current.

- **Resistance.** The flow of electrons is also governed by the resistance offered by the conducting materials. It is measured in Ohms

- **Current.** The current flow in a circuit is measure in terms of amperes. One ampere, by definition, is the flow of 6.28 x 10^{18} electrons per second past a given point in a circuit. Sometimes it is necessary to use smaller units of measurement for the current flow, the most commonly-used units being the milliampere (0.001 ampere)
Electricity and water analogy

Water Flow is analogous to Electricity

Hydraulic Pressure is like Voltage. The greater the hydraulic pressure, the greater the flow of water through the pipe.

Pipe Resistance is similar Electrical Resistance. The greater the resistance, the lesser the flow of water.

Ohm’s Law

The relationship between the elements of electricity was introduced by Mr. Georg Simon Ohm. It has been known as the Ohm’s Law.

**OHM’S LAW**

The Current Flowing in a circuit is

DIRECTLY PROPORTIONAL TO THE VOLTAGE And INVERSELY PROPORTIONAL TO THE CURRENT

\[ I = \frac{V}{R} \]
Electrical resistance

<table>
<thead>
<tr>
<th>Material</th>
<th>Resistance (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most metals</td>
<td>&gt;0 to 50</td>
</tr>
<tr>
<td>Dry wood</td>
<td>100,000</td>
</tr>
<tr>
<td>Wet wood</td>
<td>1,000</td>
</tr>
<tr>
<td>Dry Concrete on Grade</td>
<td>200,000 – 1,000,000</td>
</tr>
<tr>
<td>Wet Concrete on Grade</td>
<td>1,000 – 5,000</td>
</tr>
<tr>
<td>Leather Sole, dry, including foot</td>
<td>100,000 – 500,000</td>
</tr>
<tr>
<td>Leather Sole, damp, including foot</td>
<td>5,000 – 20,000</td>
</tr>
<tr>
<td>Rubber Gloves or soles</td>
<td>&gt; 20,000,000</td>
</tr>
</tbody>
</table>

Source: Electrical Safety Handbook

<table>
<thead>
<tr>
<th>Body Area</th>
<th>Resistance (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human body, Internal (wet, ear to ear)</td>
<td>100</td>
</tr>
<tr>
<td>Human body, Internal (damp, hand to foot)</td>
<td>400 to 600</td>
</tr>
<tr>
<td>Human body (wet skin)</td>
<td>1,000</td>
</tr>
<tr>
<td>Human body (dry skin)</td>
<td>100,000 to 600,000</td>
</tr>
</tbody>
</table>

Source: Accident Prevention Manual

Hazards of electricity:
- Electric shock
- Burns
- Fire

Electric shock occurrence

Electrical shock is a common hazard encountered by people involved in the installation, maintenance, and operation of electrical equipment. Electric shock occurs once the worker’s body becomes part of an electrical circuit when it comes in contact with a live internal conductor at the point of insulator breakdown.

The more common sources of electric shock are refrigerators and electric fans. Defective and poorly maintained electrical device will generate electrical leak.
This leak passes all over the conductive materials of the device and if someone touches the device he will receive electric shock.

Below are the common causes of electrical injuries/accidents:
(a) touching of live parts
(b) short circuit
(c) inadequate guarding
(d) overloading
(e) breaking of connections

When the electric current has sufficient potential difference to overcome the body’s resistance, it results in shock burns or even death. Although potential difference determines whether the body’s resistances will be overcome, the damaging factor in electrical shock is the current flow.

Factors affecting electric shock

1. **Amount of current** that flows through the human body. The amount of current that flows to the body depends on:
   - **Voltage of the circuit.** According to Ohms Law, voltage is directly proportional to the current. A higher voltage means a higher amount of current.
   - **Insulating quality**

2. The **path the current takes** through the body affects the degree of injury. A small current that passes from one hand to the other hand through the heart is capable of causing severe injury or death. However, there have been cases where larger currents caused an arm or leg to burn off without going through the vital organs of the body. In many such cases the person was not killed; had the same current passed through the vital organs of the body, the person easily could have been electrocuted.

3. **Duration of current flow.** The longer the current flows through the body, the more devastating the result can be. That is the reason why immediate action should be taken to free co-workers when they are shocked or burned by electricity.

### Actions to Take

Shut off the electrical current if the victim is still in contact with the energized circuit. While you do this, have someone else call for help. If you cannot quickly get to the electrical disconnect to turn off the current, pry the victim from the circuit with something that does not conduct electricity such as a dry wood broom stick.

**Do not touch the victim yourself if he or she is still in contact with an electrical circuit! You will become a victim of electrical shock.**
4. Type of electric energy involved. There are two kinds of electrical energy:

- **Alternating current (AC)** - the flow of electric charge whose magnitude and direction changes periodically. This can cause a person to maintain an involuntary grip on the live metal or conductor and prolong the current flow.
- **Direct current (DC)** – the flow of electric charge that does not change direction

5. Body condition. Personal sensitivity to electric shock varies with age, sex, heart condition, etc.

An electrical current passing through the body can cause severe injury or death by:

- Contracting the chest muscles, resulting in breathing difficulty and death due to asphyxiation.
- Affecting the central nervous system, resulting in malfunction of vital body function such as respiration
- Interference with the normal rhythm of the heart beat, resulting in Ventricular Fibrillation which is defined as “very rapid uncoordinated contractions of the ventricles of the heart resulting in loss of synchronization between heartbeat and pulse beat.” Once ventricular fibrillation occurs, it will continue and death will ensue within a few minutes.
- Electricity may also affect the heart muscle, resulting in severe heart muscle contraction and cessation of heart action.
- Heat generated when current overcomes tissue resistance may cause destruction of the body tissues.

The severity of an electric shock is the product of the current value and the time it flows through the body.
Based on the research of Charles F. Dalziel, professor at the University of California, the effects of alternating current (60Hz) on the human body are generally accepted to be as follows:

### Table 8.3 Effect of current on the human body

<table>
<thead>
<tr>
<th>Current (mA)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 1mA</td>
<td>No sensation, not felt</td>
</tr>
<tr>
<td>1 mA</td>
<td>Shock perceptible, reflex action to jump away. No direct danger from shock but sudden motion may cause accident.</td>
</tr>
<tr>
<td>&gt; 3mA</td>
<td>Painful shock</td>
</tr>
<tr>
<td>6 mA</td>
<td>Let go current for women</td>
</tr>
<tr>
<td>9 mA</td>
<td>Let go current for men</td>
</tr>
<tr>
<td>&gt;10mA</td>
<td>Local muscle contractions, sufficient to cause freezing to the circuit for 2.5% of the population</td>
</tr>
<tr>
<td>&gt;15mA</td>
<td>Local muscle contractions, sufficient to cause “freezing” to the circuit for 50% of the population</td>
</tr>
<tr>
<td>&gt;30mA</td>
<td>Breathing difficulty; can cause unconsciousness</td>
</tr>
<tr>
<td>50 – 100 mA</td>
<td>Possible ventricular fibrillation of the heart</td>
</tr>
<tr>
<td>100 – 200mA</td>
<td>Certain ventricular fibrillation of the heart</td>
</tr>
<tr>
<td>&gt; 200mA</td>
<td>Severe burns and muscular contractions; heart more apt to stop than fibrillate</td>
</tr>
<tr>
<td>&gt; 1A</td>
<td>Irreparable damage to body tissue</td>
</tr>
</tbody>
</table>

*Source: Occupational and Environmental Safety Engineering and Management*

- **Let go current** – the maximum current that a person can tolerate when holding a conductor and can still free himself/herself by muscular stimulation.
- **Ventricular fibrillation** – most death by electric shock are caused by ventricular fibrillation. It is a condition wherein the heart will not pulse regularly causing the heart to cease functioning. Once this occurs, the victim will be dead in a few minutes even if the electric source is interrupted.
- Even small amounts of current can cause minor shock sensations and result to secondary accidents.

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

There are four main types of injuries caused by electric currents – electrocution (fatal), electric shock, burns, and falls. These injuries can happen in various ways:

- direct contact with the electrical energy.
- when the electricity arcs (jumps) through a gas (such as air) to a person who is grounded (that would provide an alternative route to the ground for the electricity).
- thermal burns including flash burns from heat generated by an electric arc, and flame burns from materials that catch fire from heating or ignition by electric currents. High voltage contact burns can burn internal tissues while leaving only very small injuries on the outside of the skin.
- 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.

Electric shock prevention

(a) Use of grounding system

Grounding or earthing is any means of absorbing any leakage current and making it flow directly to earth by using an electrical conductor. It is a process of connecting metal parts/casing of the electrical equipment to earth through grounding wires. The voltage exists on the metal casing and earth resistance. Grounding means safety. There are two types of grounding:

1. **System Grounding** – means grounding the neutral point iron terminal of electrical circuits on power transformer of electrical system;
2. **Equipment Grounding** – grounding of a non-charged metal part of electrical equipment.

(b) Use Double Insulating Materials

Insulating materials have extremely high resistance values, virtually to prevent flow of electric current through it. The principle of insulation is used when work must be carried out near un-insulated live parts. Work on un-insulated parts are carried out by using protective devices such as insulating stands, mats or screens, or rubber insulating gloves to protect workers from electric shock.

(c) Use Appropriate Disconnecting Means

1. **Fuse**

A fuse is essentially a strip of metal that melts at a pre-determined value of current flow, and therefore cuts off the current to that circuit. In the event of abnormal conditions such as faults or when excess current flows, the fuse would blow and protect the circuit or apparatus from further damage. In effective and safe operation, the fuse should be placed in a live conductor and never in the neutral conductor. Otherwise, even with the fuse blown or removed, parts of the circuit such as switches or terminals will be affected. **Over-fusing** means using a fuse rating higher than that of the circuit it is meant to protect. This is dangerous because in the event of a fault, a current may flow to earth without blowing the fuse, endangering workers and the circuit or equipment concerned. It could also result
in overheating of the cable carrying the excessive current, with the risk of fire.

(2) Circuit Breaker
A circuit breaker has several advantages for excess current circuit protection. The principle of the operation is that excess current flow is detected electromagnetically and the mechanism of the breaker automatically trips and cuts off electric supply to the circuit it protects.

(3) Earth Leakage Circuit Breaker
Majority of electric shock injuries occur when the body acts as conductor between line and earth. Protection against such shocks is provided by the inclusion of a current sensitive earth leakage circuit breaker (ELCB) in the supply line. ELCB may detect both over-current and earth leakage currents and thereby give very good circuit protection.

(d) Proper Maintenance of Portable Power Tools
The necessity to use flexible cables to supply electricity to the tools introduces hazards. Such cables are often misused and abused resulting in damaged insulation and broken or exposed conductors. The tool itself could also become charged with electricity due to a fault. Constant care and adequate maintenance and storage are essential to safe use.

Causes of electrical fire

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

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

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

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

1. The proportion of the flammable substance to oxygen must permit ignition and the mixture must be present in a sufficient quantity to provide an ignitable atmosphere in the vicinity of electrical equipment.

2. An electric arc, flame escaping from an ignited substance in an enclosure, heat from an electric heater, or their source, must be present at a temperature equal to or greater than the ignition point of the flammable mixture.

Classification of Hazardous Locations

Class I – locations where flammable gases or vapors are present or likely to become present.
Class II – applies to combustible dusts.
Class III – locations are those where easily ignitable dust such as textile fibers are present but not likely to be suspended in the air in sufficient concentration to produce an easily ignitable atmosphere.

Explosion Proof Apparatus - A device enclosed in a case that is capable of:
- withstanding an explosion of a specified gas or vapor that may occur within it
- preventing the ignition of a specified gas or vapor outside the enclosure that may be caused by sparks, flashes or explosion of the gas or vapor inside the apparatus.

Source: http://www.ccohs.ca/oshanswers/safety_haz/electrical.html

Safe Practices and Procedures
The following are the simple rules when working with electricity:

1. Always assume that a circuit is energized.
2. Use the appropriate instrument for testing circuits.
3. Use protective devices (ELCB, fuse, rubber mats, etc.).
4. Use personal protective equipment (rubber gloves, boots, safety devices).
5. Inspect tools, power cords, and electrical fittings for damage or wear prior to each use. Repair or replace damaged equipment immediately.
6. Use warning signs and isolate dangerous areas.
7. Observe proper maintenance schedules of electrical equipment, loads and wires.
8. Always tape cords to walls or floors when necessary. Nails and staples can damage cords causing fire and shock hazards.
9. Use cords or equipment rated for the level of amperage or wattage that you are using.
10. Always use the correct size fuse. Replacing a fuse with one of a larger size can cause excessive currents in the wiring and possibly start a fire.
11. Conduct regular electrical inspections for the electrical circuit.
12. Be aware that unusually warm or hot outlets may be a sign that unsafe wiring conditions exist. Unplug any cords to these outlets and do not use until a qualified electrician has checked the wiring.
13. Place halogen lights away from combustible materials such as cloths or curtains. Halogen lamps can become very hot and may be a fire hazard. Risk of electric shock is greater in areas that are wet or damp. Install Ground Fault Circuit Interrupters (GFCIs) as they will interrupt the electrical circuit before a current sufficient to cause death or serious injury occurs.
14. Make sure that exposed receptacle boxes are made of non-conductive materials.
15. Know where the breakers and boxes are located in case of an emergency.
16. Label all circuit breakers and fuse boxes clearly. Each switch should be positively identified as to what outlet or appliance it is for.
17. Do not use outlets or cords with exposed wiring.
18. Do not use power tools when protective guards are removed.
19. Do not block access to circuit breakers or fuse boxes.
20. Do not touch a person or electrical apparatus in the event of an electrical accident. Always disconnect the current first.
21. Ensure that only qualified personnel work on any part of an electrical circuit or equipment/apparatus.
22. Always replace a fuse with the same kind and rating. Never bridge a fuse using metal wires or nails, etc.
23. Make sure that there is someone to look after you whenever you work with any part of the electrical circuit.
24. Observe lock-out/tag-out (LOTO). Always lock safety switches and place tags before working on a circuit. Before energizing a circuit, ensure all personnel are clear of the circuit or the equipment concerned.
25. Ensure that temporary electrical installations do not create new hazards.
26. Always use ladders made of wood or other non-conductive materials when working with or near electricity or power lines.
27. Adhere to strictly established regulations of the Philippine Electrical Code.
Tips for working with power tools:
- Switch tools OFF before connecting them to a power supply.
- Disconnect power supply before making adjustments.
- Ensure tools are properly grounded or double-insulated. The grounded tool must have an approved 3-wire cord with a 3-prong plug. This plug should be plugged in a properly grounded 3-pole outlet.
- Test all tools for effective grounding with a continuity tester or a ground fault circuit interrupter (GFCI) before use.
- Do not bypass the switch and operate the tools by connecting and disconnecting the power cord.
- Do not use electrical tools in wet conditions or damp locations unless tool is connected to a GFCI.
- Do not clean tools with flammable or toxic solvents.
- Do not operate tools in an area containing explosive vapors or gases.

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

A Ground Fault Circuit Interrupter (GFCI) - works by detecting any loss of electrical current in a circuit. When a loss is detected, the GFCI turns the electricity off before severe injuries or electrocution can occur. A painful shock may occur during the time that it takes for the GFCI to cut off the electricity so it is important to use the GFCI as an extra protective measure rather than a replacement for safe work practices.

GFCI wall outlets can be installed in place of standard outlets to protect against electrocution for just that outlet, or a series of outlets in the same branch. A GFCI circuit breaker can be installed on circuit breaker electrical panels to protect an entire branch circuit. Plug-in GFCIs can be plugged into wall outlets where appliances will be used.

Test the GFCI monthly. First plug a "night light" or lamp into the GFCI-protected wall outlet (the light should be turned on), then press the "TEST" button on the GFCI. If the GFCI is working properly, the light should go out. If not, have the GFCI repaired or replaced. Reset the GFCI to restore power. If the "RESET" button pops out but the light does not go out, the GFCI has been improperly wired and does not offer shock protection at that wall outlet. Contact a qualified electrician to correct any wiring errors.
Sample checklist for basic electrical safety:

Inspect Cords and Plugs
- Check power cords and plugs daily. Discard if worn or damaged. Have any cord that feels more than comfortably warm checked by an electrician.

Eliminate Octopus Connections
- Do not plug several power cords into one outlet.
- Pull the plug, not the cord.
- Do not disconnect power supply by pulling or jerking the cord from the outlet. Pulling the cord causes wear and may cause a shock.

Never Break OFF the Third Prong on a Plug
- Replace broken 3-prong plugs and make sure the third prong is properly grounded.

Never Use Extension Cords as Permanent Wiring
- Use extension cords only to temporarily supply power to an area that does not have a power outlet.
- Keep power cords away from heat, water and oil. They can damage the insulation and cause a shock.
- Do not allow vehicles to pass over unprotected power cords. Cords should be put in conduit or protected by placing planks alongside them.

Commonly-Asked Questions and Answers

Q: How much electricity is enough to cause death?
A: It depends entirely on the amount of current flowing thru the body. At 10 milli-amperes, the body experiences involuntary grip or the person cannot let go of the conducting material. At 20 mA, the body may already experience ventricular fibrillation leading to death.

Q: Why do birds standing on high-tension wires do not get electrocuted?
A: In order for an animal or person be electrocuted, the electricity should have electric current path within the body or a closed circuit path for the electricity. The bird happens to be standing only on the wire without causing itself to create a circuit path.

Q: What can you say about the practice of replacing a busted fuse with any type of conductive material to continue the electrical supply?
A: The fuse is a protective device to prevent overload. Replacing it with other than the rated fuse with another type of conductor will defeat its purpose for protection. This practice will create the overload to the circuit that will cause damage to the electrical installation and in worst cases cause fire.
Q: What is the purpose of the third conductor of common plugs/third hole in other outlets? How come it is okay to only use the two holes or remove the third wire?

A: It is actually required for these kinds of electrical systems to have a ground wire or the third wire. This wire or conductor is for the ground electrical path. The ground electrical path is for the protection of the user or the equipment itself. Removing the wire/conductor may cause damage to the equipment or cause electrical shock to the user.

Summary
Remember these simple safety rules to follow:

(a) do not guess
(b) use proper instruments
(c) always use safety device
(d) lock out and tag out (LOTO)
(e) never work alone
(f) use danger signs
(g) keep temporary electrical wiring safe
(h) strictly observe rules of Philippine Electrical Code (PEC)
(i) work with qualified men only
(j) ensure proper maintenance
(k) never bridge a fuse
(l) conduct periodic electrical inspection

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

http://www.energyquest.ca.gov/story/chapter02.html
http://www.amasci.com/miscon/whatis.html
Machine Safety
Unit 2 - Occupational Safety

Module 8: Machine Safety

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

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

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

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

Objectives

Working on this module should help you to
• recognize the principles of machine guarding
• identify areas where machine guards are needed
• enumerate the types of machine guards
• differentiate a lock-out from tag-out

A machine is a tool used to make work easier. It is basically an assemblage of parts that transmit forces, motion and energy in a predetermined manner. Simple machines are mechanical devices that change the direction or magnitude of a force. They are the "building blocks" of which the more complicated machines or compound machines are made.
The Industrial Revolution

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

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

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

**Rotating**

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

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

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

- Parts rotating in opposite directions

- Nip points between rotating and tangentially moving parts. Some examples are: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, and a rack and pinion.

- Nip points between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are: spoked hand wheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.
Reciprocating

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

Transversing

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

Cutting

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

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

Punching

Punching action results when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where stock is inserted, held, and withdrawn by hand.

Typical machines used for punching operations are power presses
Shearing

Shearing action involves applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is actually inserted, held, and withdrawn.

Examples of machines used for shearing operations are mechanically, hydraulically, or pneumatically powered shears.

Bending

Bending action results when power is applied to a slide in order to draw or stamp metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn.

Equipment that uses bending action includes power presses, press brakes, and tubing benders.
Areas where machine guarding are necessary

Dangerous moving parts in three basic areas require safeguarding:

![Diagram of machine parts]

- **The point of operation**: that point where work is performed on the material, such as cutting, shaping, boring, or forming of stock.

- **Power transmission apparatus**: all components of the mechanical system which transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.

- **Other moving parts**: all parts of the machine which moves while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanism and auxiliary parts of the machine.

In general, any machine part, function, or process which may cause injury must be guarded.

Importance of machine safety

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

- severe accidents
- loss of trained and skilled employee/s
- loss of production
- damage to equipment
- incurring training cost for new employee/s
- overtime cost
- possible litigation
- accident investigation
Machines can also cause:
- lost time expense
- cost of machine down time
- cost of machine damage and repairs
- lost time due to time spent on accident investigation and other statutory requirements
- loss of production

Types of machine guards

Preventing access

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

Preventing dangerous motions
When frequent access is required, physical guarding at the hazard is sometimes too restrictive for part loading or adjustment. In this situation, a device is required to prevent dangerous motion while allowing unrestricted access by sensing the presence of the operator and sending a stop signal.
Movable guards with interlocking switches
If access is required in a hazardous area of a machine, an operator can be protected by an inter-lock with the power source which ensures that whenever the guard door is not closed, the power is switched off.

Two hand controls
There are other ways of preventing access while the machine is in a dangerous condition. The use of two hand controls (also referred to as bi-manual controls) is common in certain types of machinery. Two start buttons have to be operated at the same time to run the machine. This ensures that both hands of the operator are in a safe position and therefore cannot be in the hazard area.
Pullback Devices
These are mechanical devices attached to the operator's hands and connected to the moving portion of the die. If properly adjusted, it withdraws the operator's hands if they are inadvertently within the point of operation as the dies close.

Photoelectric light curtain
These devices emit a “curtain” of harmless infrared light beams in front of the hazard area. When any of the beams are blocked, the light curtain control circuit sends a stop signal to the guarded machine.
Light curtains are extremely versatile and can guard areas many meters wide. By using mirrors, light beams can be diverted all around the corners to enclose a machine.

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

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

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

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

Emergency stops

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

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

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

Telescopic trip switches

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

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

Requirements of effective safeguards (Rule 1200)

Must prevent contact

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

Must be secured and durable

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

Must provide protection against falling objects

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

Must not create new hazards

Safeguards should overcome the hazards in question without creating new ones. A safeguard with a sharp edge, unfinished surface or protruding bolts introduces new hazards while protecting against the old.
Must not create interference

Safeguards can interfere with the progress of work if they are not properly designed. Such safeguards are likely to be disregarded or disabled by workers due to the pressure of production deadlines.

Must allow safe maintenance

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

The Hierarchy of Measures

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

1. Fixed Enclosing Guards - If access to dangerous parts is not required, the solution is to protect them by some type of fixed enclosing guard.

2. Movable (interlocked) guards or protection devices (e.g., light curtains, presence sensing mats, etc.) - If access is required, things get a little more difficult. It will be necessary to ensure that access can only be permitted while the machine is safe. Protective measures such as interlocked guard doors and/or trip systems will be required. The choice of protective device or system should be based on the operating characteristics of the machine.

3. Protection appliances (e.g., jigs, holders, push sticks, etc) - These are used often in conjunction with guards to feed a work piece while keeping the operator’s body away from the danger zone.

4. Information, instruction, training and supervision - It is important that operators have the necessary training in safe working methods for a machine. However, this does not mean that measures (a), (b) or (c) can be omitted. It is not enough to merely tell an operator that he/she must not go near dangerous parts (as an alternative to guarding them). Operators must be trained on the hazards of their work and how to use and maintain the safety devices as well as give safety reminders to make them aware all the time.

5. Personal Protective Equipment - In addition to the above measures, it may also be necessary for the operator to use equipment like special gloves, goggles, etc. The machinery designer should specify what sort of equipment is required. The use of personal protective equipment is not the primary safeguarding method but should complement the measures shown above.
The protective device must be appropriate for the type of work being undertaken.

Lock-out/Tag-out System

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

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

The “Fatal Five” Main Causes of Maintenance Injuries:

- Failure to stop equipment
- Failure to disconnect from power source
- Failure to dissipate (bleed, neutralize) residual energy
- Accidental restarting of equipment
- Failure to clear work areas before restarting
Hazardous Energy Sources Found in the Workplace

- Electrical - sudden turning on of power source or stored energy in capacitors
- Mechanical
- Thermal - such as steam or due to chemical reaction
- Potential - stored energy that may be due to gravity, hydraulics, pneumatics, vacuum or springs

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

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

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

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

Summary

Remember that any machine part, function, or process which may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must be either controlled or eliminated.
Personal Protective Equipment
Unit 2 - Occupational Safety

Module 9: Personal Protective Equipment

This is the last module in Unit 2 and it is a very important one. Although we’ve been mentioning Personal Protective Equipment (PPE) right from the start of this course, we still feel that we have to devote a full module to it. We must review the PPE we have already mentioned and see if there are others that you need to be acquainted with. Remember that PPE can save your life, or that of your co-worker.

The PPE must be considered only after engineering and administrative controls have been found ineffective, not feasible or insufficient. It must be used only as a last resort. The selection of PPE must comply with the existing OSH standards and using these in the workplace must be combined with training and orientation on their proper use, limitations and advantages.

You must monitor proper usage and maintenance of PPE in order to attain satisfactory performance and properly administer the PPE program in your area of responsibility.

This module thus aims to impart the proper usage of PPE to the learner in order to prevent accidents at work.

Objectives

Working on this module should help you to:
- distinguish the appropriate type of PPE you need in your workplace
- know the limitation of PPE
- develop programs to introduce PPE for your company

Defining hazards

What is a hazard? A hazard is anything that produces adverse effects on anyone. Examples of hazards are slippery floors, falling objects, chemicals and many more. What do you think make these occurrences hazardous? As we discussed in Unit 1, Module 3, unsafe/unhealthy acts bring about unsafe/unhealthy conditions, causing hazards in the workplace. Although some hazards are intrinsic in nature or force majeure, a human hand is still behind most of the hazards we now encounter.
Classification of hazards

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

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

   Examples:
   • Unguarded moving parts of machines
   • Falling/flying particles
   • Slippery floors

B. Physical hazards

1. Noise.

The following table is the allowable time a worker can stay in a work area without hearing protection.

<table>
<thead>
<tr>
<th>Allowable Exposure to Noise</th>
<th>8 hrs</th>
<th>4 hrs</th>
<th>2 hrs</th>
<th>1 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 db</td>
<td>95 db</td>
<td>100 db</td>
<td>105 db</td>
<td></td>
</tr>
</tbody>
</table>

For an eight-hour exposure, the allowable noise level is 90 db.

2. Extreme Temperatures are of two types: extreme heat which can cause heat stroke and extreme cold which can cause hypothermia.

3. Radiation also has two types: the ionizing radiation and the non-ionizing type.

   Ionizing radiation
   • Ultraviolet (UV) light or alpha particle – from the sun can be shielded by paper
   • Beta particle – can penetrate paper but not concrete.
   • Gamma ray – can penetrate concrete. This can be shielded by using lead like in the x-ray room which is made up of sheeted lead in-between concrete to prevent outside exposure.

   Non-ionizing radiation
   • radio waves, electric waves and infrared rays. An example is the welding process which produces infrared rays that can damage the skin.
Radiation is dangerous because it cannot be detected by the five senses but it destroys the cells and tissues of living organisms, and has long-term effects.

Three safety practices for controlling body exposure to radiation:

a. Time – the shorter the time, the lower the exposure received
b. Distance – the greater distance, the lower the exposure received
c. Shielding – may be lead, steel, iron or concrete

4. Extreme Pressure – These are pressures beyond the allowable levels needed by the human body. Normal atmospheric pressure is 14.7 psi, and even a small change in the atmospheric pressure has a corresponding effect to humans. Examples of workers exposed to extreme pressure are those involved in excavation work, scuba diving, and piloting airplanes.

5. Vibration

C. Chemical Hazards – These are substances in solid, liquid or gaseous forms known to cause poison, fire, explosion or ill effects to health. Examples include gases, fumes, vapor, mist and dust. These are airborne particles or airborne toxic elements that evaporate in the air and can cause irritation, discomfort and even death.

Chemical routes of entry to the body are by inhalation, ingestion and skin absorption.

D. Biological Hazards – These are hazards caused by viruses, fungi and bacteria.

E. Ergonomic Hazards – These are caused by improper posture or postural stress.

Hazard control measures

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

Engineering method – this is the application of engineering technology to control hazards. An example is machine guarding which prevent anyone from coming in contact with moving parts of a machine during the operation. Other examples are installation of safety devices like emergency stop, limit, grab-wire and photo electric switches. These prevent accidents in case of improper work practices.

Other forms of the engineering method involve substituting hazardous substances with less hazardous ones (substitution) and isolating hazardous process (isolation).
**Administrative method** – this aims to minimize the exposure of humans to workplace hazards and employs administrative approaches such as rotation and shifting.

**PPE** – these are considered as the last line of defense. These devices provide limited protection to the ones using them.


**Program to introduce PPE**

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

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

**Policy**

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

**Selection of Proper Equipment**

After the need for personal protective equipment has been established, the next step is to select the proper type.

In selecting the proper protector, consideration should be given to the kind and degree of hazard. Where a choice of protectors is given and the degree of protection required is not an important issue, worker’s comfort may be a deciding factor.

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

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

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


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

Maintenance Program

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

Enforcement

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

You can check out many websites on the Internet that describe and sell various PPE. Commonly used PPE in the workplace include: helmet, respirator, spectacles, earplugs, gloves, safety shoes, etc. The following are the functions and uses of PPE.

1. Head Protection

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

- Suspension systems that show evidence of material cracking, tearing, fraying or other signs of deterioration. Suspension should provide a minimum clearance of 1 to 1.25 in. (2.5 – 3.2 cm) between the top of the worker’s head and the inside crown of the hat.

- Any cracks or perforations of brim or shell, deformation of shell, evidence of exposure to excessive heat, chemicals or radiation. Shells made of polymer plastics are susceptible to damage from ultraviolet light and gradual chemical degradation. This degradation first appears as a loss of surface gloss called chalking. With further deterioration, the surface will begin to flake away.

2. Eye Protection

A device that provides eye protection from hazards caused by:

- Flying particles
- Sparks
- Light radiation
- Splashes
- Gases

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

Source: Rule 1082.02 of OSH Standards
Eye protectors must meet the following minimum requirements:

- Provide adequate protection against the particular hazards for which they are designed
- Be reasonably comfortable when worn under the designated conditions
- Fit snugly without interfering with the movements or vision of the wearer
- Be durable
- Be capable of being disinfected
- Be easily cleaned
- Be kept clean and in good condition

3. Face Shields

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

4. Ear Protection

Hazard:
- excessive noise - Noise exceeding 85-90 dB or more on eight hour exposure.

Examples: Ear plug
           Ear muffs
           Canal caps

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

Earmuffs must make a perfect seal around the ear to be effective.

5. Respiratory Protection

Respiratory protection is required when engineering improvements and administrative controls can't eliminate risk. Engineering controls include, isolation of the source of contaminants; design process or procedural changes, etc. Administrative controls on the other hand include, monitoring, limiting worker exposure, training and education, etc.
Hazards:
- Mists or Vapors
- Gases
- Smoke
- Fumes
- Particulates or dust
- Insufficient oxygen supply

Types of respirators are divided into two categories:

A. Air purifying respirators

- **Particulate respirators or mechanical filters** - screen out dust, fog, fume, mist spray or smoke. Such filters need to be replaced at frequent intervals.

- **Chemical cartridge devices** - remove contaminants by passing the tainted air through material that traps the harmful portions. There are specific cartridges for specific contaminants. These should be used and no substitutions should be made.

B. Air supplying devices

- **Self-contained** are those where the air supply is easily transportable and they protect against toxic gases and lack of oxygen. A common example is the self-contained breathing apparatus (SCBA), where the air tank is strapped to the wearer’s back.

- **Supplied-air respirators** get air through an air line or hose. The breathable air is supplied by an air compressor or uncontaminated ambient air.

Air Contaminants – are divided into four types, gaseous, particulate, combination of gaseous and particulate and oxygen deficiency.

- **Gaseous contaminants** include gases and vapors.
- **Particulate contaminants** include dust, fumes, mist, fog and smoke.
- **Combination contaminants** usually consist of gaseous materials and particulates and result from operations such as paint spraying.
- **Oxygen-deficient atmospheres** are those that have less than 19.5 percent by volume. They often occur in confined spaces and are considered to be immediately dangerous to life and health.
6. Hand and Arm Protection

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

Examples of hand protection

- appropriate gloves
- hand pads
- barrier cream
- sleeves (for arm protection)

Hazards:
- Pinch points
- Hot surfaces
- Chemical substances
- Sharp objects
- Electrical

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

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

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated; e.g., chemical hazards, cut hazards, flame hazards, etc. Before purchasing gloves, request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated.
The following is a guide to the most common types of protective work gloves and the types of hazards they can guard against.

a. **Metal mesh, leather or canvas gloves** - Provide protection against cuts, burns, and sustained heat.

b. **Fabric and coated fabric gloves** - These gloves are made of cotton or other fabric to provide varying degrees of protection.

c. **Chemical and liquid-resistant gloves** - Gloves made of rubber (latex, nitrile, or butyl), plastic, or synthetic rubber-like materials such as neoprene protect workers from burns, irritation, and dermatitis caused by contact with oils, greases, solvents, and other chemicals. The use of rubber gloves also reduces the risk of exposure to blood and other potentially infectious substances.

7. **Foot and Leg Protection**

Hazards:
- Falling or rolling objects
- Sharp objects
- Hot surfaces
- Wet, slippery surfaces
- Electricity

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

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

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

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

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

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

Workplace hazards that could cause bodily injury include the following:

- Intense heat
- Splashes of hot metals and other hot liquids
- Impact from tools, machinery, and other materials
- Cuts
- Hazardous chemicals
- Contact with potentially infectious materials, like blood
- Radiation

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

- Vest
- Jacket
- Apron
- Coverall
- Surgical gowns
- Full-body suits

These protective clothing come in a variety of materials, each suited to particular hazards. These materials include the following:

- **Paper-like fiber** - Disposable suits made of this material provide protection against dust and splashes.

- **Treated wool and cotton** - Adapts well to changing workplace temperatures and is comfortable as well as fire resistant.
o **Duck** - This closely woven fabric protects employees against cuts and
bruises while they handle heavy, sharp, or rough materials.

o **Leather** - Leather protective clothing is often used against dry heat and
flame.

o **Rubberized fabrics, neoprene, and plastics** - protective clothing made
from these materials protect against certain acids and other chemicals.

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

**Rule 1080**

Rule 1080 of the Occupational Safety and Health Standards (OSHS) requires employers
to provide appropriate personal protective equipment to workers. Employers can be
held liable if they fail to furnish their workers with the necessary PPE.

**1081 General Provisions:**

**1081.01**
Every employer shall at his/her own expense furnish his/her workers
with protective equipment for the eyes, face, hands and feet,
protective shields and barriers whenever necessary by reason of the
hazardous nature of the process or environment, chemical or
radiological or other mechanical irritants or hazards capable of causing
injury or impairment in the function of any part of the body through
absorption, inhalation or physical contact.

**1081.02**
All protective equipment shall be of approved design and construction
appropriate for the exposure and the work to be performed.

**1081.03**
The employer shall be responsible for the adequacy and proper
maintenance of personal protective equipment used in his workplace.

**1081.04**
No person shall be subjected or exposed to hazardous environmental
condition without protection.
Commonly asked questions and answers

Q. When must I provide PPE?
A. You must provide PPE for employees if:
   - Their work environment presents a hazard or is likely to present a hazard to any part of their bodies;
   - Their work processes present a hazard or are likely to present a hazard to any part of their body;
   - During their work, they might come into contact with hazardous chemicals, radiation, or mechanical irritants;
   - You are unable to eliminate their exposure or potential exposure to the hazard by engineering, work practice, or administrative control.

Q. If employees wear eyeglasses with prescription lenses, may I consider these as eye protection?
A. No. Eye glasses designed for ordinary wear do not provide the level of protection necessary to protect against workplace hazards. Special care must be taken when choosing eye protectors for employees who wear eyeglasses with corrective lenses such as the following:
   - Prescription spectacles, with sideshields and protective lenses meeting the requirements of the standard, that also correct the individual employee’s vision.
   - Goggles that can fit comfortably over corrective eyeglasses without disturbing the alignment of the eyeglasses.
   - Goggles that incorporate corrective lenses mounted behind protective lenses.
   You also must provide protective eyewear to employees who wear contact lenses and are exposed to potential eye injury. Eye protection provided to these employees may also incorporate corrective eyeglasses. Thus, if an employee must don eyeglasses in the event of contact lens failure or loss, he or she will still be able to use the same protective eyewear.

Q. Could employees wearing hard hats and working at elevations create a potential hazard for the employees working below?
A. To protect employees working below, you must provide chin straps for the protective helmets worn by employees working at higher elevations such as aerial lifts or at the edge of a pit. The chin straps should be designed to prevent the hard hats from being bumped off the employee’s heads.

Q. Is there one kind of glove that will protect against all workplace hazards?
A. No. The nature of the hazard(s) and the operation to be performed will determine your selection of gloves. The variety of potential occupational hand injuries may make selecting the appropriate pair of gloves more difficult than choosing other protective equipment. Exercise care in choosing gloves designed for the particular circumstances of your workplace.
Q: Why should workers be outfitted with the more expensive industrial respirators when look alike “nuisance masks” are available?
A: Respirators filter toxic dusts and mists commonly found in industrial and manufacturing settings, such as welding, grinding, sanding, and maintenance or repair applications. Respirators meet minimum performance standards and the government approved agencies certify them.

A “nuisance dust mask” on the other hand, has no approved government certification and meets no government performance standards. Nuisance dust masks should not be used when exposures to hazardous conditions may exist. The filtration efficiency of nuisance dust mask is lower and the face seal around the nose and mouth is less effective than that of approved respirators.

Q: Is cotton sufficient as earplugs?
A: Plain cotton does not effectively protect against occupational noise. You may, however, choose from several products that are effective at protecting your employees’ hearing. Appropriate hearing protectors include: single-use earplugs, pre-formed or molded earplugs, canal caps, and earmuffs.

Q: Once I have selected the specific PPE for my workers, how do I make sure they use it properly?
A: Train your workers to use the protective equipment. Teach them to know...
  o Why the PPE is necessary as well as the specific hazards in their work area.
  o How the equipment will provide protection to them.
  o The limitations of the PPE
  o How to properly put on the protective equipment
  o How to identify signs of wear such as scuffed, cracked, holes, etc.
  o How to clean and maintain the PPE
  o The company PPE policy, rules and regulations

Summary

To sum it up, you must consider many factors when selecting PPE to protect yourself, your colleagues or your workers from workplace hazards. With all of the types of operations that can present hazards and all of the types of PPE available to protect the different parts of a worker’s body from specific types of hazards, this selection process can be confusing and at times overwhelming. Because of this, it is highly recommended that you implement a PPE Program to help you systematically assess the hazards in the workplace and select the appropriate PPE that will protect your workers from those hazards.

The basic information presented here attempts to establish and illustrate a logical, structured approach to hazard assessment and PPE selection and application for you to use as a starting point for your PPE Program.
Industrial Hygiene
Unit 3 – Occupational Environment

Module 10: Industrial Hygiene

Implementing safety and health in the workplace is the ultimate goal of labor protection. **Industrial hygiene** is one of the disciplines necessary in the implementation of safety and health in the workplace.

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

The WEM is one of the technical services carried out by the OSHC to help companies comply with Rule 1070 of the Occupational Safety and Health Standards (OSHS).

**Objectives**

Working on this module should help you to:
• recognize the potential occupational health hazards in the workplace.
• explain the process of evaluating the different hazards in the workplace through Work Environment Measurement (WEM), including the instruments used and the standards to be observed
• understand the concept of Threshold Limit Values (TLVs) and interpret their numerical values.

**Industrial hygiene** is “the science and art devoted to the recognition, evaluation and control of environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or citizens of the community.”

*Source: Theory and rationale of industrial hygiene practice: Patty’s industrial hygiene and toxicology, p. 14*

Implementing industrial hygiene practices such as exposure assessment and instituting control measures to minimize occupational accidents and diseases and their costs as well as enhance productivity.

Industrial hygiene is interconnected with the different aspects of work – research and development, production, medical/health, safety and management.
Recognition of occupational health hazards

A. Classification of occupational health hazards

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

1. Chemical Hazards. Occupational health hazards arise from inhaling chemical agents in the form of vapors, gases, dusts, fumes, and mists, or by skin contact with these materials. The degree of risk of handling a given substance depends on the magnitude and duration of exposure.

   a. Gases are substances in gaseous state are airborne at room temperature. Examples are chlorine, hydrogen sulfide, ammonia, carbon monoxide, sulfur dioxide, phosgene and formaldehyde.

   b. Vapour results when substances that are liquid at room temperature evaporate. Examples are the components of organic solvents such as benzene, toluene, acetone, and xylene.

   c. Mist is a fine particles of a liquid float in air (particle size of 5 to 100 um approximately. Examples: nitric acid and sulfuric acid.

   d. Dust is a solid harmful substances are ground, cut or crushed by mechanical actions and fine particles float in air (particle size of about 1 to 150 um). Examples are metal dusts and asbestos.

   e. Fume is a gas (such as metal vapor) condensed in air, chemically changed and becomes fine solid particles which float in air (particles size of about 0.1 to 1 um). Examples are oxides generated from molten metal such as cadmium oxide, beryllium oxide, etc.

2. Physical Hazards. Problems relating to such things as extremes of temperature, heat stress, vibration, radiation, abnormal air pressure, illumination, noise, and vibration are physical stresses. It is important that the employer, supervisor, and those responsible for safety and health are on guard to these hazards due to the possible immediate or cumulative effects on the health of the employees.

   a. Extreme temperature. Extreme temperatures (extreme heat and extreme cold) affect the amount of work that people can do and the manner in which they do it. In industry, the problem is more often high temperatures rather than low temperatures.
The body continuously produces heat through its metabolic processes. Since the body processes are designed to operate only within a very narrow range of temperature, the body must dissipate this heat as rapidly as it is produced if it is to function efficiently. A sensitive and rapidly acting set of temperature-sensing devices in the body must also control the rates of its temperature-regulating processes.

Heat stress may be experienced by workers exposed to excessive heat arising from work. Workers at risk of heat stress include outdoor workers and workers in hot environments such as firefighters, bakery workers, farmers, construction workers, miners, boiler room workers, factory workers, etc. workers aged 65 and older, those with heart disease, hypertension or those taking medications are at a greater risk for heat stress.

Heat can be internally generated from internal body sources or external work factors such as radiation, and hot surfaces of equipment and tools. Internally generated heat is a product of the processes that occur within the cells, tissues and organs in the body.

The factors influencing heat stress include:

- **Air Temperature** - known as the ambient room temperature.
- **Air Humidity** - the amount of water vapor or moisture content of the air.
- **Air Velocity** - the rate at which air moves and is important in heat exchange between the human body and the environment because of its role in convective and evaporative heat transfer. Air movement cools the body by convection, the moving air removes the air film or the saturated air (which is formed very rapidly by evaporation of sweat) and replaces it with a fresh air layer, capable of accepting more moisture from the skin.
- **Radiant Temperature** - the thermal load of solar and infrared radiation in the human body.
- **Clothing** – working clothes style/design/mode and the type of fabric can affect the body heat temperature.
- **Physical Workload** - may be categorized as light, moderate, or heavy depending on the task or job activity carried out by the worker.
  - Light - work-sitting or standing to control machines.
  - Moderate work - walking about, moderate lifting and pushing
  - Heavy work – intense work of the extremities and trunk.

Cold stress. Workers exposed to extreme cold or work in cold environments such as those in ice plants or refrigerated workplaces may be at risk of cold stress.
Refrigerants such as ammonia, methyl chloride and halogenated hydrocarbons used in freezing and cold storage bring risks of poisoning and chemical burns. Ammonia and other refrigerants such as propane, butane, ethane and ethylene, though less frequently used are flammable and explosive chemicals. Monitoring and evaluation of these chemicals is highly recommended when working in cold storage and refrigerating plants. (Reference: Encyclopedia of Health and Safety)

b. Radiation

Electromagnetic waves are produced by the motion of electrically charged particles. These waves are also called “electromagnetic radiation” because they radiate from the electrically charged particles. They travel through empty space as well as through air and can penetrate some other substances. Radio waves, microwaves, visible light and X-rays are all examples of electromagnetic waves.

The electromagnetic spectrum can be divided into two at a wavelength of about 10 nm, which distinguishes NON-IONIZING RADIATION and IONIZING RADIATION. Visible light, infrared and microwaves are types of non-ionizing radiation. X-rays and Gamma rays are examples of ionizing radiation. The distinction between non-ionizing and ionizing radiation is simply one of associated energy. For the ionizing region of the electromagnetic spectrum, the energy incident upon a material is large enough to remove an electron from an atom orbit to produce ionization, whereas for the non-ionizing region the energy is not normally sufficient to produce ion pairs.

Types of Non-Ionizing Radiation
- 1. Ultraviolet (UV) Radiation
- 2. Infrared (IR) Radiation
- 3. Laser Radiation
- 4. Microwave Radiation

Effects of Non ionizing radiation
Ozone may be produced as a result of electrical discharges or ionization of the air surrounding non-ionizing radiation sources, e.g. UV, high power laser, microwave and short duration exposure in excess of a few tenths ppm can result in discomfort (headache, dryness of mucous membranes and throat).

c. Extreme pressure. It has been recognized as from the beginning of caisson work (work performed in a watertight structure) that men working under pressures greater than at a normal atmospheric one, are subject to various illnesses connected with the job. Hyperbaric (greater than normal pressures) environments are also encountered by divers operating under water, whether by holding the breath while diving,
breathing from a self-contained underwater breathing apparatus (SCUBA), or by breathing gas mixtures supplied by compression from the surface.

Occupational exposures occur in caisson or tunneling operations, where a compressed gas environment is used to exclude water or mud and to provide support for structures. Man can withstand large pressures due to the free access of air to the lungs, sinuses, and middle ear.

d. **Inadequate illumination.** The measure of the stream of light falling on a surface is known as illumination. The key aspects of illumination include lux, luminance, reflectance, glare and sources of lighting.

**Key aspects of illumination:**

- **Lux** - unit of measurement.
- **Luminance** - measure of light coming from a source
- **Reflectance** - ability of a surface to return light.
- **Glare** is caused by bright light sources which can be seen by looking in the range from straight-ahead to 45° above the horizontal. There are two types of glare: direct and reflected.

  * **Direct Glare** is produced when light is positioned at the surface. It can be prevented by correct installation of lighting fittings, installing louvers below the light source, enclosing the lamps in bowl reflectors, and opaque or prismatic shades.

  * **Reflected Glare** is produced when light is reflected off a shiny surface. It may be addressed by providing indirect lighting.

**Sources of light**

There are two sources of light:

- **Daylight**, also called natural light depends on the availability at the location and weather condition.
- **Electric Light** can come from:
  * Incandescent lamps or bulbs
  * Fluorescent lamps or tubes
  * High intensity discharge or mercury
Types of Lighting

Illumination can also be viewed in terms of:

- **General lighting** illuminating the entire premises
- **Local lighting** directing light on a particular object that you are working with.

Factors in determining the quantity of light:

- **Nature of work** - more light will be required if one is working with small objects.
- **Environment** - the ability of the surrounding surfaces to reflect light.
- **Eyesight of the workers** - the ability of the eye to adjust rapidly to different distances declines as people grow older.

e. Excessive vibration

A body is said to vibrate when it is in an oscillating motion about a reference point. The number of times a complete motion cycle takes place during the period of one second is called the frequency and is measured in hertz (Hz). Vibration usually refers to the inaudible acoustic phenomena, which are recognized by through touch and feeling. It is a vector quantity described by both a magnitude and direction.

Portable meters are available for vibration measurements. These usually provide readouts that must be compared to the appropriate standards.

f. Noise or unwanted sound is a form of vibration conducted through solids, liquids, or gases. The level of noise in an industrial operation can constitute a physical hazard to the exposed workers. The extent of the hazard depends not only on the overall noise level but also on the time period and frequency and type of noise to which the worker is exposed.

Types of noise

- **Continuous noise** is a steady state noise with negligible level fluctuations during the period of observation.
- **Intermittent noise** levels shift significantly during observation.
- **Impact noise** consists of one or more bursts of sound energy, each lasting less than one second.
Factors that can influence noise exposure
A number of factors can influence the effects of the noise exposure.

These include:
- variation in individual susceptibility
- the total energy of the sound
- the frequency distribution of the sound
- other characteristics of the noise exposure, such as whether it is continuous, intermittent, or made up of a series of impacts
- the total daily duration of exposure

3. Biological Hazards. Biological hazards are any virus, bacteria, fungus, parasite, or living organism that can cause a disease in human beings. They can be a part of the total environment or associated with certain occupations such as medical professions, food preparation and handling, livestock raising, etc.

Diseases transmitted from animals to humans are commonly infectious and parasitic which can also result from exposure to contaminated water, insects, or infected people.

Biological hazards will be discussed further during the occupational health portion of this workshop.

4. Ergonomic Hazards. “Ergonomics” literally means the customs, habits, and laws of work. According to the International Labor Organization it is

“... The application of human biological science in conjunction with the engineering sciences to achieve the optimum mutual adjustment of man [sic] and his [sic] work, the benefits being measured in terms of human efficiency and well-being.”

The ergonomics approach goes beyond productivity, health, and safety. It includes consideration of the total physiological and psychological demands of the job upon the worker. It deals with the interaction between humans and traditional environmental elements as atmospheric contaminants, heat, light, sound, and all tools and equipment used in the workplace.

The human body can endure considerable discomfort and stress and can perform many awkward and unnatural movements for a limited period of time. However, when awkward conditions or motions are continued for prolonged periods, the physiological limitations of the worker can be exceeded. To ensure a continued high level of performance, work systems must be tailored to human capacities and limitations.
Examples of ergonomic hazards are:

- Poor workplace design – cramped leg area, crowded worktable, distant work materials
- Awkward body postures – prolonged sitting, twisted body while bending
- Repetitive movements – sewing, cutting, stamping
- Static posture – prolonged standing without motion
- Forceful motion – extreme pulling and pushing

In a broad sense, the benefits that can be expected from designing work systems to minimize ergonomic stress on workers are as follows:

- more efficient operation;
- fewer accidents;
- lower cost of operation;
- reduced training time; and
- more effective use of personnel.

5. Special Considerations:

The following items have become important OSH issues that need to be addressed by Industrial Hygiene professionals and employers:

a. **Confined space** is an enclosed or a partially enclosed space. It has restricted entrance and exit (by location, size, and means) thus, the natural airflow is limited. This can cause accumulation of “dead” or “bad” air and airborne contaminants. Confined spaces are not designed, and intended for human occupancy.

Examples of confined space:

Storage tanks, sewers, boilers, manholes, tunnels, pipelines, trenches, pits, silos, vats, utility vaults, culverts.

**Hazards of confined space:**

- **Oxygen deficiency** – air is considered oxygen deficient when the oxygen content is less than 19.5% by volume. Oxygen level in a confined space can decrease due to consumption or displacement by inert gases such as carbon dioxide or nitrogen. Work processes such as welding, cutting or brazing, and certain chemical reactions such as rusting and bacterial reaction (fermentation) can also reduce oxygen concentration.
• Flammable/explosive atmosphere – may result from:
  o Oxygen enriched atmosphere exists where oxygen in the air is greater than 21%. An oxygen enriched atmosphere will cause flammable materials such as clothing and hair to burn violently when ignited.
  o Flammable gas, vapor, or dust in proper proportion.

• Toxic atmospheres are those which contain toxic substances in concentrations that exceed the Threshold limit Value (TLV), as specified in the Occupational Safety and Health Standards or the Chemical/Material Safety Data Sheet of the substance used at work.

Toxic substances in the atmosphere may come from the following:
  o Products stored in the confined space
  o Work being performed in a confined space
  o Areas adjacent to the confined space

• Mechanical and physical hazards
  o Rotating or moving mechanical parts or energy sources can create hazards within a confined space
  o Physical factors such as extreme temperatures, noise, vibration and fatigue
  o Loose materials such as fine coal, sawdust or grains can engulf or suffocate the workers

An example of confined space with its accompanying occupational health hazards

b. **Indoor Air Quality (IAQ)** refers to the quality of the air inside buildings as based on the concentration of pollutants & thermal (temperature & relative humidity) conditions that affect the health, comfort and performance of occupants.

**Sources of IAQ problems:**

- Ventilation system deficiencies
- Overcrowding
- Tobacco smoke
- Microbiological contamination
- Outside air pollutants
- Off gassing from materials in the office, furniture and mechanical equipment.
- Poor housekeeping

**Indoor air pollutants:**

- Volatile Organic Compounds (VOCs)
- Formaldehyde
- Carbon Dioxide
- Carbon Monoxide
- Nitrogen Oxides
- Sulfur Dioxide
- Ammonia
- Hydrogen Sulfide
- Dust

**Other factors affecting occupants:**

- Comfort problems due to improper temperature and relative humidity conditions
- Poor lighting
- Unacceptable noise levels
- Adverse ergonomic conditions and
- Job-related psycho-social stressors.

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**B. Methods of Recognizing occupational health stresses/hazards**

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

1. **Walk-through/ocular inspection** – this is necessary in identifying the potential hazards and determining the critical conditions in the workplace. It will be good to make a checklist for inspection.
2. **Review of the process involved** – The identity of the chemical intermediates formed in the course of an industrial process and the toxicological properties of these intermediates may be difficult to establish. Undesirable chemical by-products such as carbon monoxide resulting from the incomplete combustion of organic material may be formed.

3. **Knowing the raw materials, by-products and finished products** – Knowing about the raw materials used and the nature of the products manufactured will help you determine the specific contaminants to which workers are actually exposed. Possible impurities in raw materials such as benzene in some solvents should be considered.

4. **Gathering workers’ complaints** – the actual chemicals or substances handled may be determined by interviewing the workers. More so, their complaints can also be gathered and assessed in the clinic record.

5. **Safety Data Sheet (SDS)** is a summary of important health, safety and toxicological information on the chemical or the mixture ingredients. It should contain:

   a. identification  
   b. hazard(s) identification  
   c. composition/information on ingredients  
   d. first-aid measures  
   e. fire-fighting measures  
   f. accidental release measures  
   g. handling and storage  
   h. exposure control/personal protection  
   i. physical and chemical properties  
   j. stability and reactivity  
   k. toxicological information  
   l. ecological information  
   m. disposal considerations  
   n. transport information  
   o. regulatory information  
   p. other information

The SDS should conform to the **Globally Harmonized System (GHS) of classification and labeling of chemicals.**

The GHS is an international standard for classifying chemicals and communicating its hazards. It is a basis for establishing a comprehensive national chemical safety program, and a comprehensive approach to defining and classifying hazards and communicating information on labels and safety data sheets.
The GHS was developed in Agenda 21 of the United Nations Conference on Environment and Development (UNCED) held in Brazil in 1992.

**Benefits of GHS** – All countries, international organizations, chemical producers, and users of chemicals will benefit from the GHS as it will:
- enhance the protection of humans and environment
- facilitate international trade in chemicals
- reduce the need for testing and evaluation of chemicals
- assist countries and international organizations to ensure the sound management of chemicals

**Elements of GHS**

a. **Hazard Classification Criteria** has three major hazard groups namely physical, health, and environmental hazards. Based on the three classifications of hazards, the following compose the GHS criteria:
   - **Physical hazards** – explosives, flammable gases/aerosols, oxidizing gases, corrosive to metal, substances and mixtures which, in contact with water, emit flammable gases, and others.
   - **Health hazards** – acute toxicity, skin corrosion/irritation, serious eye damage/eye irritation, respiratory or skin sensitization, carcinogenicity, reproductive toxicity, aspiration hazards, and others.
   - **Environmental hazards** – hazardous to aquatic environment, hazardous to the ozone layer, and others.

d. **Hazard communication** composed of Safety Data Sheet (SDS) and Labels.
   GHS labels must include specific:
   - signal words - warning or danger
   - hazard statements - flammable liquids, fatal if swallowed
   - symbols/ pictograms.
Evaluation of occupational stresses/hazards

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

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

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

1. **Personal Monitoring** – the measurement of a particular employee’s exposure to airborne contaminants. The measuring device is placed as close as possible to the contaminant’s entry port to the body. For example, when monitoring a toxic air contaminant, the measuring device is placed close to the worker’s breathing zone. The data collected closely approximates the concentration of contaminants to which the worker is exposed to.

2. **Area/Environmental Sampling** – Environmental sampling is the measurement of contaminant concentration in the workroom. The measuring device is placed adjacent to the worker’s normal workstation or at fixed locations in the work area. This kind of monitoring does not provide a good estimate of worker’s exposure but helps to pinpoint work areas with high or low exposure levels of contaminants.

   Instruments used to measure the different hazards

   - Lux Meter - illumination
   - Psychrometer - humidity
   - Anemometer - air movement
   - Smoke Tester - air direction
   - Globe Thermometer - heat
   - Sound Level Meter - noise

3. **Biological Monitoring** – involves the measurement of changes in the composition of body fluids, tissue or expired air to determine absorption of a potentially hazardous material. Examples are measurement of lead and mercury in blood or in urine.

   It is best that WEM be conducted on a regular basis. Work Environment Monitoring should be done at least once a year.

**B. Analysis of results**

The collected samples from the WEM are analyzed in the laboratory. Some of the analytical instruments used are as follows: UV-VIS Spectrophotometer for analyzing acids, AAS for heavy metals, Gas Chromatograph for organic solvents, and X-ray Diffractometer, Fourier Transform Infra-Red (FTIR) Spectrocopy, and Phase Contrast Microscope (PCM) for quantitative and qualitative analysis of asbestos and silica.
Laboratory analysis results are compared with the Threshold Limit Values (TLVs). These are exposure guidelines that have been established for airborne concentration of many chemical compounds. Concentrations of hazards that exceed the TLVs can cause adverse effects to humans. There are three categories of TLVs:

1. **Time-Weighted Average (TLV-TWA)** is the time-weighted average concentration for a normal 8-hour workday or 40-hour workweek to which nearly all workers may be repeatedly exposed, day after day, without adverse health effects.

   \[
   \text{TWA Concentration} = \frac{C_1T_1 + C_2T_2 + \ldots + C_nT_n}{T_1 + T_2 + \ldots + T_n}
   \]

   Where \(C_1\ldots C_n\) = different mass concentration obtained at different sampling time

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   \(T_1\ldots T_n\) = sampling time

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**Analytical Equipment**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Chromatograph</td>
<td>Solvents</td>
</tr>
<tr>
<td>High Performance Liquid Chromatograph</td>
<td>Inorganic chemicals</td>
</tr>
<tr>
<td>Atomic Absorption Spectrophotometer</td>
<td>Metals</td>
</tr>
<tr>
<td>Phase Contrast Microscope (PCM)/FTIR Spectroscopy</td>
<td>Asbestos fibers / quantitative (fiber count) and qualitative analysis.</td>
</tr>
<tr>
<td>X-ray Diffractometer</td>
<td>Mineral dust</td>
</tr>
<tr>
<td>UV-Vis Spectrophotometer</td>
<td>Acids and Other Chemicals</td>
</tr>
</tbody>
</table>
Example: Exposure Level to Hydrogen Sulfide (H2S) Gas

<table>
<thead>
<tr>
<th>H2S Concentration (ppm)</th>
<th>Sampling Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2 hours</td>
</tr>
<tr>
<td>15</td>
<td>4 hours</td>
</tr>
<tr>
<td>2</td>
<td>1 hour</td>
</tr>
<tr>
<td>5</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

TWA Concentration = \( \frac{(5\text{ ppm})(2 \text{ hrs}) + (15\text{ ppm})(4 \text{ hrs}) + (2\text{ ppm})(1 \text{ hr}) + (5\text{ ppm})(1 \text{ hr})}{2\text{ hrs} + 4\text{ hrs} + 1\text{ hr} + 1\text{ hr}} \)

TWA Concentration of H2S = 9.625 ppm

TLV for H2S is 10 ppm. So, the exposure is below TLV.

2. **Short-Term Exposure Limit (STEL)** is the maximum concentration to which workers can be exposed continuously for 15 minutes without suffering from any of the following:

   a. Irritation
   b. Chronic or irreversible tissue damage
   c. Narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency.

3. **Ceiling (TLV-C)** is the concentration that should not be exceeded during any part of the working exposure; otherwise, the exposed workers might be vulnerable to serious risks.

**TLV tables**

**Permissible Noise Exposure**

<table>
<thead>
<tr>
<th>Duration per day, hours</th>
<th>Sound Level, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>1 ½</td>
<td>102</td>
</tr>
<tr>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>½</td>
<td>110</td>
</tr>
<tr>
<td>¼</td>
<td>115</td>
</tr>
</tbody>
</table>

* ceiling value: No exposure in excess of 115 dB(A) is allowed
<table>
<thead>
<tr>
<th>Chemicals</th>
<th>TLV Category</th>
<th>Ambient Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(mg/m³) (ppm)</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>TLV – C</td>
<td>7.0 5.0</td>
</tr>
<tr>
<td>Methanol</td>
<td>TLV – TWA</td>
<td>260 200</td>
</tr>
<tr>
<td>Lead</td>
<td>TLV – TWA</td>
<td>0.15 0.0177</td>
</tr>
<tr>
<td>Xylene</td>
<td>TLV – STEL</td>
<td>435 100</td>
</tr>
<tr>
<td>Toluene</td>
<td>TLV – TWA</td>
<td>375 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ILLUMINATION LEVELS</th>
<th>Minimum Lighting Level and Task (Lux)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting cloth</td>
<td>2000 and above (200 foot candles)</td>
</tr>
<tr>
<td>Sewing cloth</td>
<td></td>
</tr>
<tr>
<td>Finish inspection</td>
<td></td>
</tr>
<tr>
<td>Fine assembly</td>
<td></td>
</tr>
<tr>
<td>Color grading</td>
<td></td>
</tr>
<tr>
<td>Fine machining</td>
<td></td>
</tr>
<tr>
<td>Inspection and assembly</td>
<td></td>
</tr>
<tr>
<td>Clay enameling and glazing</td>
<td></td>
</tr>
<tr>
<td>Electric motor insulating</td>
<td></td>
</tr>
<tr>
<td>Coil winding and testing</td>
<td></td>
</tr>
<tr>
<td>Chipping</td>
<td></td>
</tr>
<tr>
<td>Grinding</td>
<td>1000 (100 foot candles)</td>
</tr>
<tr>
<td>Fine core making</td>
<td></td>
</tr>
<tr>
<td>Machine shop bench work</td>
<td></td>
</tr>
<tr>
<td>Transcribing handwriting</td>
<td></td>
</tr>
<tr>
<td>Indexing references</td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td></td>
</tr>
<tr>
<td>Pattern making</td>
<td></td>
</tr>
<tr>
<td>Drafting</td>
<td></td>
</tr>
<tr>
<td>Welding</td>
<td>500 (50 foot candles)</td>
</tr>
<tr>
<td>Automotive frame assembly</td>
<td></td>
</tr>
<tr>
<td>Chemical laboratory</td>
<td></td>
</tr>
<tr>
<td>Foundry moulding</td>
<td></td>
</tr>
<tr>
<td>Metal pouring</td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td></td>
</tr>
<tr>
<td>Core making</td>
<td></td>
</tr>
<tr>
<td>Rubber extrusion and tire making</td>
<td></td>
</tr>
<tr>
<td>Punch press</td>
<td></td>
</tr>
<tr>
<td>Shearing</td>
<td></td>
</tr>
<tr>
<td>Stamping</td>
<td></td>
</tr>
<tr>
<td>Spinning</td>
<td></td>
</tr>
<tr>
<td>Woodworking</td>
<td></td>
</tr>
<tr>
<td>Area of Exposure</td>
<td>Minimum Lighting Level and Task (Lux)</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Sizing Planning</td>
<td>500 (50 foot candles)</td>
</tr>
<tr>
<td>Rough sanding</td>
<td></td>
</tr>
<tr>
<td>Medium quality machine and benchwork</td>
<td></td>
</tr>
<tr>
<td>First aid station</td>
<td></td>
</tr>
<tr>
<td>Packaging</td>
<td>300 (30 foot candles)</td>
</tr>
<tr>
<td>Barrel washing</td>
<td></td>
</tr>
<tr>
<td>Turbine</td>
<td></td>
</tr>
<tr>
<td>Clay molding and pressing</td>
<td></td>
</tr>
<tr>
<td>Chemical furnace</td>
<td></td>
</tr>
<tr>
<td>Tank</td>
<td></td>
</tr>
<tr>
<td>Dryer</td>
<td></td>
</tr>
<tr>
<td>Evaporator</td>
<td></td>
</tr>
<tr>
<td>Extractor</td>
<td></td>
</tr>
<tr>
<td>Cleaning and annealing furnace</td>
<td></td>
</tr>
<tr>
<td>Plating</td>
<td></td>
</tr>
<tr>
<td>Drop-forgue shop</td>
<td></td>
</tr>
<tr>
<td>Lunch room</td>
<td></td>
</tr>
<tr>
<td>Locker room</td>
<td></td>
</tr>
<tr>
<td>Rest room</td>
<td></td>
</tr>
<tr>
<td>Shower room</td>
<td></td>
</tr>
<tr>
<td>General construction plants and shops</td>
<td>100 (10 foot candles)</td>
</tr>
<tr>
<td>e.g. batching plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active storerooms, barracks or living quarters, tunnel and shaft heading during drilling, mucking, and scalding</td>
<td></td>
</tr>
<tr>
<td>Tunnels, shaft and general underground work areas, General construction areas:</td>
<td>50 (5 foot candles)</td>
</tr>
<tr>
<td>Concrete placement, access ways, Active storage areas, loading platforms, Refueling, and field maintenance areas. Indoors: warehouses, corridors, hallways, and exit ways.</td>
<td></td>
</tr>
</tbody>
</table>
TLVs for other environmental hazards and stresses may be found in the Philippine Occupational Safety and Health Standards (OSHS) and in the ACGIH, OSHA, and NIOSH web sites

Notes:

- The impact of hazard exposure depends on the following:
  - Nature of the material or energy involved
  - Intensity of exposure
  - Duration of exposure
  - Individual susceptibility

- The key elements to be considered when evaluating a health hazard are:
  - how much of the material in contact with the body cells is required to produce an injury
  - the probability of the material being absorbed by the body to result in an injury
  - rate that airborne contaminants is generated
  - total time in contact
  - control measures in use

- The TLV conversion equations for parts per million (ppm) to milligram per cubic meter (mg/m$^3$) at standard temperature and pressure are:

$$\text{TLV in ppm} = \frac{(\text{TLV in mg/m}^3) \times 24.45}{\text{gram molecular weight of substance}}$$

$$\text{TLV in mg/m}^3 = \frac{(\text{TLV in ppm}) \times (\text{gram molecular weight of substance})}{24.45}$$

**Occupational Safety and Health Standards (OSHS) Rule 1070**

Rule 1070 is OSH standard for occupational health and environmental control. It has seven (7) rules:

**Rule 1071 – General Provisions**

“This rule establishes TLVs for toxic and carcinogenic substances and physical agents which may be present in the atmosphere of the work environment. TLVs refer to airborne concentration of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed daily without adverse effect.”
Rule 1072 – TLVs for Airborne Contaminants and Rule 1073 (Tables)
These refer to TLVs of airborne contaminants for “time weighted concentration for an 8-hour workday and a total of forty-eight 48 hours of work exposure per week.” TLVs tables for airborne contaminants, mineral dusts, and human carcinogens are also established.

Rule 1074 – Physical Agents
This refers to TLVs for physical agents particularly noise or “sound pressure that represents conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech.

Rule 1075 – Illumination
“All places where persons work or pass or may have to work or pass in emergencies, shall be provided during time of use with the adequate natural lighting or artificial lighting or both, suitable for the operation and the special type of work performed.”

Rule 1076 – General Ventilation
This is about General Ventilation that encompasses the workroom condition for air supply, temperature, humidity, and odor. It states that:

“Suitable atmospheric conditions shall be maintained in workrooms by natural or artificial means to avoid insufficient air supply, stagnant or vitiated air, harmful drafts, excessive heat or cold, sudden variations in temperature, and where practicable, excessive humidity or dryness and objectionable odors.”

Rule 1077 – Work Environment Measurement
“WEM shall mean sampling and analysis carried out in respect of the atmospheric working environment and other fundamental elements of working environment for the purpose of determining actual condition therein.”

It also includes the responsibility of the employer that WEM “shall be performed periodically as may be necessary but no longer than annually.” Industrial hygiene is also concerned with the development of corrective measures to control hazards by reducing or eliminating the exposure. These control procedures may include:

1. **Engineering controls** such as substitution of harmful or toxic materials with less dangerous ones, changing work processes, and installation of exhaust ventilation system.

2. **Administrative controls** such as safety and health policies and programs (i.e.: hearing conservation program, healthy lifestyle project)

3. **Provision of personal protective equipment** like earplugs, face shield, and dust mask.

These control measures will be further discussed in the next module.
Summary

Industrial hygiene is a discipline within occupational safety and health of anticipating, recognizing, evaluating and controlling physical, chemical, biological and ergonomic hazards in the working environment with the objective of protecting worker’s health and well-being and safeguarding the community.

Industrial hygienist uses strict and rigorous scientific methodology and requires professional experience and judgment in determining the potential for hazard, exposure or risk in the workplace and recommend appropriate control measures for hazard abatement.

Work Environment Measurement (WEM) as stated in Rule 1077 of the OSHS shall be carried out periodically but not longer than annually to determine the potential hazards in the working environment. This is primarily the responsibility of the employer in order to promote and maintain the health of his workers.

Commonly-Asked Questions and Answers

Q. How do we evaluate noise levels in the workplace?
A. First, we must study the noise pattern to be able to note the kind of noise (whether continuous, intermittent or impact) that is generated. Then determine the number of hours of exposure of workers. The noise reading is then compared with the permissible noise exposure level prescribed in Table 8b of Occupational Safety and Health Standards.

Q. Do we have local distributor of IH equipment?
A. Yes. There are suppliers of IH instruments locally.

Q. Do we have private companies that conduct WEM?
A. Yes, there are private service providers that conduct WEM, but the OSH Standards requires a WEM provider to be accredited.

Q. How often should we conduct WEM? What are the conditions or parameters to be measured?
A. WEM shall be conducted periodically as may be necessary but not longer than annually. As required by the OSHS, WEM shall include temperature, humidity, pressure, illumination, noise, ventilation and concentration of substances and chemicals.

It is important to recognize environmental hazards or stresses in the workplace. The magnitude or level of hazards can be accurately determined by using industrial hygiene equipment. Prevention is better than cure so it is necessary to assess and evaluate these hazards.
Additional Instruction/References

For further readings, please refer to the following websites:

- www.ohseinstitute.org/training/johsc/5CaseStudiesForJOHSCourse.pdf
- www.ccohs.ca
- www.osha.gov
- http://www.cdc.gov/niosh/topics

References:


United States. American Conference of Governmental Industrial Hygienists (ACGIH®). (2010). TLVs® and BEIs® Based on the documentation of the threshold limit values for chemical substances and physical agents & biological exposure indices. Cincinnati, OH: ACGIH.

Environment Control Measures
Unit 3 – Occupational Environment

Module 11: Environment Control Measures

Introduction

We are already halfway through the BOSH Course. In this module, we will introduce you to the different work environment control measures and discuss the importance of each in detail. We hope you will understand how these control measures can be applied in your respective work setting.

In controlling hazards in the workplace, it is critical that adequate attention be paid to engineering control. The application of industrial ventilation most of the time addresses the problem, since 80% of the work environment problem is attributed to poor ventilation, especially when presence of chemical and hot processes are involved. While general ventilation can be used for thermal comfort of workers, local exhaust ventilation is a very practical and beneficial approach in controlling hazardous substances in the workplace.

Administrative control measures on the other hand, can be readily implemented by management. Using personal protective equipment (PPE) is also useful as interim control measures while the necessary engineering control measures are being installed or where other controls may not be feasible.

We sincerely hope that learning about environmental control measures will help ensure the safety of your workplace.

Objectives:

Working on this module should help you:
• identify and explain the different work environment control measures
• recognize appropriate control measures to reduce or eliminate the different hazards
• understand how environment control concepts, particularly industrial ventilation, can be applied to the environmental hazards
• identify the different respiratory protective equipment
Environmental Control Measures

There are three general environmental control measures that are useful in the workplace: engineering controls, administrative controls and personal protective equipment.

Hierarchy of environmental controls:

1. **Engineering Controls** - eliminate the hazard by considering safety and health provisions, substitution, modification of process/equipment, isolation, wet methods and industrial ventilation.

   Engineering methods of control are the most effective in preventing or reducing work environment factors or stresses. Among these methods are:

   a. **Proper design and planning** – Initial consideration regarding safety and health aspects must be made in the planning and construction stage. We should bear in mind that once the control measures are in place, it is already very hard to alter or modify the design, especially when we realize that the control measure being adopted is ineffective. Besides it is more expensive and will cost the company a lot to do so. The correct identification of the problem and careful evaluation should be ensured and we have to make sure that the intervention or control measure to be employed is the most cost effective.

   b. **Substitution/replacement of materials used**. One of the control methods is through substitution of non-toxic chemicals for the highly toxic ones. A number of years ago, paints contain toxic chemicals such as benzene, toluene diisocyanate (TDI) and other toxic organic solvents which are known to cause adverse health effects. Due to the advancement in material and chemical sciences, paints nowadays are being reformulated and its toxic components are eliminated and replaced by safer non-toxic substitutes (from solvent based to water based paints). However, an industrial hygienist must exercise extreme caution when substituting one chemical for another, to ensure that some previously unforeseen hazards do not occur along with the substitution.

   c. **Modification in the process/equipment**. A change in the process offers an ideal chance to concomitantly improve working conditions. Most changes are made to improve quality or reduce cost of production. However, in some cases, a process is modified to reduce the hazard. For instance, in modifying a process, automation can be used to lessen worker’s exposure to the contaminant. In modifying equipment, the use of lids can prevent dispersion of dust during mixing.

   d. **Isolation**. Hazardous operations should be isolated to minimize exposure of workers. The isolation can be a physical barrier, such as acoustic panels, to minimize noise transmission from a genset, whining blower or ripsaw. The worker may also be isolated or enclosed in a soundproof control booth with a
clean source of air supplied to the booth. Isolation can also be in terms of time or distance.

e. **Wet methods.** Airborne dust hazards can be minimized or greatly reduced by applying water or other suitable liquids. Dampening powder materials or suppressing dust generation through misting or spraying of water will definitely control dust dispersion. Dampening or drenching powder materials to prevent it from getting airborne is one of the simplest methods for dust control. Its effectiveness, however, depends upon proper wetting of the particulates. Its application also depends on the nature of process and product. Some powder conveying systems provide auxiliary water piping systems with sprinklers or water sprays at the unloading side since formation of dust clouds occur when powder materials drop.

f. **Industrial ventilation.** A very important aspect of engineering control has to do with ventilation. Industrial ventilation is the process of supplying fresh air and/or removing contaminant laden air by natural or mechanical means to and from any space.

**Purpose:**

1. To provide workers with a comfortable working condition.
2. To renew the air in the workplace, therefore diluting eventual air contaminants to acceptable levels.
3. To prevent hazardous air contaminants from reaching the workers breathing zone.

**Types of Industrial Ventilation**

- **General Ventilation** – is classified into **mechanical ventilation** which utilizes fans and blowers and **natural ventilation** which uses natural airflow (wind) caused by difference in temperature, room air pressure through open doors or windows, roof ventilators, and chimneys, etc.

**Natural Ventilation** – utilizing roof ridge opening

General Exhaust Ventilation – utilizing supply and exhaust fans
(Mechanical Ventilation)

General ventilation is used when:

- Only small quantities of air contaminants are released into the workroom at fairly uniform rates.

- There is sufficient distance between the worker and the contaminant source to allow sufficient air movement to dilute the contaminant to safe levels.

- There is no air cleaning device to collect or filter the contaminants before the exhaust air is discharged into the community environment (no dust collector used).

- There is no corrosion or other damage to equipment in the workroom as a result of contaminated room air (no. scrubber used).

- **General Exhaust Ventilation** - a system normally used to remove hot air and other airborne contaminants in a general work area. Exhaust fans mounted on roof and walls and other openings also constitute general exhaust ventilation.

- **Dilution Ventilation** - using fresh air supply, a fraction of air is introduced into the workroom such that airborne contaminants or heat are diluted to levels not harmful to health.

The major disadvantage of general or dilution ventilation is that worker exposures can be very difficult to control near the source of contaminant. This is why local exhaust ventilation is most often the best method to control exposure to toxic contaminants.

When air is removed from a work area through exhaust, make up or replacement air must be provided. Air make-up volumes should be matched or equal to the air being removed such that room pressure is maintained on a safe level.

- **Local Exhaust Ventilation (LEV)** - Local exhaust ventilation system incorporating hoods, ductworks, air cleaning device, fans and blowers and exhaust ducts is commonly used in industrial ventilation.

The purpose of LEV is to remove air contaminants generated or dispersed from the work process before they can reach the breathing zone of the workers in harmful concentration. Particularly in combination with adequate enclosures, it is the most efficient engineering control measure for airborne chemical agents and particulates in the working environment.

**LEV is used when:**
- Contaminants are moderately or highly toxic or hazardous
- Only one or few emission sources are present
- There is a risk of direct exposure of workers

A major advantage of local exhaust ventilation is that the system requires less exhaust airflow than general exhaust ventilation system. The total airflow is necessary for plants that are cooled since air-conditioning costs are important operating expense.

- **Principles of LEV**
  - Enclose the contaminant
  - Capture contaminant with adequate air velocities
  - Keep contaminant out of the worker' breathing zone
  - Discharge exhausted air outdoors

- **Basic Elements of LEV**
  - Hoods
  - Duct work
  - Fan and motor
  - Air cleaning device
  - Exhaust stack
The design of local exhaust ventilation systems should be carefully considered. The type of exhaust hoods must be properly selected and located such that air contaminants can be easily captured; duct works and the fan motor must be calculated to draw the correct volumetric flow rates of air. Hood selection is based on the characteristics of the contaminants and how they are dispersed.

- **Classifications/Types of hood**
  - Enclosure-type
  - Exterior type
  - Receiving type

Sources:
### Range of Control Velocities

<table>
<thead>
<tr>
<th>Condition of Dispersion of Contaminant</th>
<th>Example</th>
<th>Capture Velocity, fpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Released with practically no velocity into quiet air</td>
<td>Evaporation from tanks; degreasing, etc</td>
<td>50 – 100</td>
</tr>
<tr>
<td>Released at low velocity into moderately still air</td>
<td>Spray booths; intermittent container; filling low speed conveyor transfers; Welding; plating; Pickling</td>
<td>100 – 200</td>
</tr>
<tr>
<td>Active generation into zone of rapid air motion</td>
<td>Spray painting in shallow booths; barrel; barrel filling; conveyor loading; Crushers</td>
<td>200 – 500</td>
</tr>
<tr>
<td>Released at high initial velocity into zone at very rapid air motion</td>
<td>Grinding, abrasive blasting; tumbling</td>
<td>500 – 2000</td>
</tr>
</tbody>
</table>

After the local exhaust ventilation system is installed and set in operation, its performance should be checked to see that it meets the engineering specifications-correct rates of airflow and duct velocities. Its performance should be rechecked periodically as a maintenance measure.

2. **Administrative Controls** - control employees’ exposure by scheduling hazardous work process; reduced working hours in hot processes and work areas with excessive noise levels; assigning workers to other less hazardous work areas of production and training of workers on various health and safety aspects.

   a. **Reduction of work periods.** Reduction of work periods is a method of control in limited areas where engineering control methods at the source are not practical.

   b. **Adjusting work schedules.** For workers who must labor in a compressed-air environment, schedules of maximum length work shift and length of decompression time have been prepared. The higher the pressure, the shorter the work shift and the longer the decompression time period.

   c. **Job Rotation.** Job rotation when used as a way to reduce employee exposure to toxic chemicals or harmful agents must be used with care. While rotation keeps exposure below recommended limits exposes more workers to the hazard.
d. **Education of supervisors.** The education of supervisors usually is process equipment-oriented. The aim of the safety and health professional should be to teach them about the safety and health hazards that may be found in work areas. Supervisors should be knowledgeable and well-informed about hazardous processes, operations and materials for which they are responsible.

e. **Employee information and training.** The worker must know the proper operating procedures that make engineering control effective. If performing an operation away from an exhaust hood, the purpose of the control measure will be defeated and the work area may become contaminated. Workers can be alerted to safe operating procedures through manuals, instruction materials, signages, labels, safety meetings, and other educational devices.

f. **Emergency response training and education.** Also, be sure to give employees training on how to respond to emergencies. OSH training on when to respond or not is also critical. Many deaths have occurred when untrained workers rushed in to save fallen co-workers and were overcome, themselves.

g. **Housekeeping and maintenance.** Good housekeeping plays a key role in the control of occupational health hazards. Remove dust on overhead ledges and on the floor before it can become airborne by traffic, vibration, and random air currents. Stress that good housekeeping is always important; but where there are toxic materials, it is of paramount importance.

From the management perspective, maintenance breakdown costs a lot, especially if the process that fails is critical in manufacturing their product. Some companies cannot tolerate a long downtime, thus, scheduled preventive maintenance is one of production controls that should not be overlooked. Some people call it predictive maintenance since some parts and equipment have certain “life spans” due to wear and tear. Replacing worn out parts should be done if 80 - 90 % of its service life has already been used up to prevent future manufacturing problems. Worn out parts produce noisier operation and emit foul odor and chemical leaks, especially for moving metal to metal contact, shaft packing seal and gaskets and chemical processes. Application of lubricant or grease to bearing and moving parts will reduce noise and provide more efficient operation. Preventive maintenance should also be done for other parts or equipment such as fabric filter of dust collectors, water spray of scrubber, cleaning of piping and ductwork systems.

3. **Use of Personal Protective Equipment** - should be considered as the last resort when engineering controls are not feasible or are not sufficient to achieve acceptable limits of exposure. PPE can be used in conjunction with engineering controls and other methods.

However, PPEs protective devices have one serious drawback - they do nothing to reduce or eliminate the hazard. The fact that a protective device may become ineffective when the wearer lacks sufficient knowledge on how to use it.
The use of this should be confined to situations...

a. where temporary control measures are necessary before engineering controls installed.
b. where engineering controls are not practicable.
c. to supplement engineering controls in reducing exposure during maintenance and repair.
d. during emergencies

PPEs vary in design, equipment specifications, application and protective capability. Proper selection depends on the toxic substance involved, conditions of exposure, human capabilities and equipment fit. The different types were already discussed in Module 9. In this module though, we will be giving particular attention to respiratory protective equipment.

Types of respirators:

a. **Air-purifying respirators** - clean the air by filtering contaminants before they are inhaled. Cleaning devices are made of filters to remove dust or chemical cartridges for absorbing gases, fumes, vapors and mists. Air-purifying or filtering respirators are also used when there’s enough oxygen (19.5%), but it’s contaminated with gases, vapors, dusts, etc. The respirator may screen out the dangerous materials or divert the air through a chemical that "washes" the air so you can breathe it.

Kinds of air purifying respirators:

* Mechanical Filter Respirators
* Chemical Cartridge Respirators
* Combination Mechanical Filter/Chemical Cartridge
* Gas Masks
* Powered Air-Purifying respirators

b. **Air-supplying respirators** – provide a continuous supply of uncontaminated air and offer the highest level of respiratory protection. Air can be pumped from a remote source (connected to a high-pressure hose) or from a portable supply such as from a cylinder or tank containing compressed air or oxygen. This type is known as self-contained breathing apparatus (SCBA).

The selection of respirators should consider the following criteria:

* The identification of contaminants
* Maximum possible concentration of contaminants in the work area
* Acceptability in terms of comfort.
* Compatibility with the nature of the job
* Proper fit to the face of the user to prevent leakage
Summary

- Engineering control is considered to be the most expensive to implement, however, it is also considered the most cost effective control measure.
- Administrative control use management prerogative to alter work flow or work schedule. It also improves workers awareness through continuous training and education.
- The use of personal protective equipment such as respirators may be considered as the last resort or it may supplement and complement the existing engineering or administrative control measures.

Commonly Asked Questions and Answers

Q. Is there a standard used for general ventilation?
A. Yes: Rule 1076.04 on Air Movement. The air movement in enclosed workplaces shall be arranged such that the workers are not subjected to objectionable drafts. The air velocity shall not exceed 15 meters (50 ft.) per minute during the rainy season and 45 meters (150 ft.) per minute during the summer season. However, the recommended air velocity range of 0.5 – 1.0 meter per second (m/s) is used to evaluate non-air-conditioned work areas while 0.25 – 0.375 (m/s) is used for air-conditioned work areas. This is adopted by international ventilation standards.

Q. What is the appropriate respiratory protective equipment?
A. The appropriate PPE to be used will depend on the contaminants present in the workplace. There are suitable respirators for dust and other chemicals. Refer to the guide for the selection of respirators provided by the supplier.

Q. How would you control hazardous contaminants?
A. Engineering control measures must be applied to control hazardous contaminants. Workers must also be trained on the precautionary measures for protection against hazardous contaminants.

Q. How can they avail of WEM?
A. Technical services offered by OSHC can be availed of by making a request letter addressed to the executive director.

Q. Is hazard present at home, like in cooking?
A. The possible hazards that may be encountered in cooking are heat, gases such as carbon monoxide, nitrogen dioxide, etc.

We should emphasize here the importance of industrial ventilation, as the appropriate engineering control measures necessary in the control of hazards in the workplace and in maintaining favorable condition of comfort for workers.
Additional Instruction/References

The participant may browse the following websites for further inquiry:

- www.acgih.org
- www.ccohs.ca
- www.osha.gov

References:


Occupational Health
Module 12: Occupational Health Hazards and Their Health Effects

Exposure to the different hazards in the workplace can cause problems with health which may bring about disease or death. This module aims to give you basic knowledge on the health effects of the different hazards encountered in the workplace and the means to prevent such occurrences.

It is important to understand the key concepts in the causation of disease from work exposures. You will be defining the following terms in the course of this module: exposure, toxicity, hazard, and risk. You also wish to emphasize that hazards in the workplace can cause harm if there is undue exposure through elevated workplace concentration without control measures in place.

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

Objectives

Working on this module should help you to:
- explain the key concepts of occupational health.
- discuss and explain common hazards in the workplace and their effects on workers’ health.
- describe the role of medical surveillance in preventing occupational illnesses and injuries.
- identify ways to protect one’s self from health hazards.

Workplace hazards and ill-health

The main thrust of the concepts of occupational health is to emphasize prevention of occupational diseases and work-related illnesses rather than its cure.

Technical and ethical guidelines for workers' health surveillance (OSH Series, No. 72) show the recent changes in occupational health. With technical progress, more sophisticated means of investigation, greater emphasis on prevention and holistic approaches on primary health care, human rights and organizational aspects are now available. This has led the Joint International Labour Organization / World Health Organization (ILO/WHO) Committee on Occupational Health to redefine the concept of occupational health during its 12th Session in 1995. Under these new circumstances, a tripartite ILO Committee of Experts used the definition as a starting point to develop guidelines for adapting workers' health surveillance to these changes.
The purpose of health surveillance needs clarification and the individual and collective health assessments must be combined. Workers’ health surveillance must:

- operate under controlled, well-organized conditions, preferably in accordance with the ILO's Occupational Health Services Convention. This Convention sets general principles on occupational health practice and how to establish and run health services
- be based on sound ethical and technical practice
- ensure professional independence and impartiality of health professionals, as well as workers' privacy and confidentiality of individual health information

Workers' health surveillance is not an independent answer, but is a useful complement to guide preventive action that should be linked to monitoring occupational hazards, which may be just as useful as injury and disease surveillance in targeting prevention programs.

**Definition of Occupational Health**

Occupational health has been defined by the ILO and the WHO as the

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

As you know,

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

Recall the different hazards presented in the previous module. Exposure to these health hazards is most often the cause of ill-health and that is what you want to avoid. Eliminating exposure to hazards removes the conditions for ill-health and its negative consequences while you are at work.

The ill-health that results from exposure to harmful environmental conditions in the workplace is explained in this flowchart:

Key Concepts in Occupational Health

You should realize that predisposition of a worker to suffer from an occupational illness depends on the characteristics of exposure to a hazard and on individual susceptibility. Not all workers exposed to hazards get sick. For example, some workers become deaf because of noise only after prolonged and frequent exposure to high levels of noise over many years.

Remember that workplace hazards can potentially cause harm to a worker. However, the risk or the likelihood that this harmful effect would take place depends on the conditions of exposure. These factors include intensity and duration of exposure to the hazards, timing of exposure and multiplicity of exposure.

1. **Exposure duration or the length of time of being vulnerable to work hazards.**
   Constant exposure to amounts which have low levels in the workplace over a prolonged period of time increases the risk of disease after a latency period (the interval between exposure to a hazard(s) and the clinical appearance of disease);

2. **Magnitude, level or dose of exposure.** As the concentration or amount of a hazard is increased the likely it can do more harm.

3. **Timing of exposure.** This is related to exposure duration. A worker who is exposed to a hazard continuously or for several periods in a day is more at risk than those with less exposure.

4. **Multiplicity of exposure.** Exposures to mixtures of hazards or several chemicals at the same time can cause synergistic or cumulative effects.
Despite having similar exposure to workplace hazard, workers may be affected differently due to non-occupational factors. In smokers, for instance, clearance of dusts that have entered the lungs is inhibited, thereby increasing the risk of succumbing to the ill-effects of the hazard. The non-occupational factors that must be considered include age, sex, genetic factors, previous medical history and lifestyle habits of the worker.

**Age** is an important factor since elderly and young workers have poor metabolic processes, which allow a buildup of toxic substances. In a normal adult, these substances can be easily neutralized.

**Sex** is a very important consideration, too. A hazardous agent may be toxic to female workers and not toxic to male workers or vice versa. For pregnant women, some toxins may cause developmental problems in the fetus. Lead and mercury have been documented to cause neurological defects in the offspring of exposed pregnant women. In both men and women, other toxins may affect their reproductive systems.

The **genetic make-up** of a worker should also be considered because those with history of allergies will find it difficult to work in an environment where their allergies would likely flare up. Also those with enzyme deficiencies may not be able to handle toxic substances that enter the body.

Your **medical history** is important to identify previous illnesses, which may be aggravated by substances, or agents found in the workplace. An anemic (weak and pale) worker who will be employed in a company using lead may continue suffering from anemia (condition characterized by an abnormally low number of red blood cells in the circulating blood) due to lead exposure. A worker diagnosed with a liver disease should be closely monitored if he/she would be working with solvents since which may compromise the liver functions.

**Lifestyle factors** such as smoking, alcohol consumption, physical inactivity, unhealthy diet, drug abuse, among others can alter a worker’s natural defense mechanisms and increase the chance of developing ill-effects. For example, higher risk of liver disease in a worker exposed to solvents and a history of alcohol consumption; or increased risk of hypertension in a worker with occupational stress who is also eating high salt and high fat diet. The risk of lung cancer is much greater in workers who have workplace exposure to asbestos fibers and who also smoke.
Health Effects of Occupational Health Hazards

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

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

Health Effects of Chemical Hazards

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

- **Toxicity** is the intrinsic capacity of a chemical agent to adversely affect an organism, including humans.
- **Toxic chemical** is the agent that can cause the adverse effect
- **Hazard** is the potential for the toxicity to be realized in a specific setting or situation.
- **Exposure** refers to the process or extent that a worker experiences or comes in contact with a particular hazard in the workplace or as a result of one’s occupation
- **Dose** is the amount of the toxic agent that has entered the body
- **Risk** is the probability or chance of a specific adverse effect to occur.

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

- Although the body filters many of the normal pollutants from the air a person breathes, it cannot eliminate every type of contaminant.

- Small particles are difficult for the body to eliminate and can get deep into the lungs where they can cause respiratory problems.

- Workers in dusty occupations are more susceptible to respiratory diseases than workers in non-dusty occupations.

- Chemicals in their various forms can be inhaled and damage various target organs (organs most affected) as well as the lungs.

Points to consider regarding skin absorption of substances:

- The skin is a major route of entry for hazardous substances in the workplace.

- Chemicals can be absorbed faster through inflamed or abraded skin but solvents may also be absorbed in healthy skin into the bloodstream and transported to target organs where they can have damaging results.

Points to consider regarding entry of hazardous agents through the mouth:

- Hazardous agents can enter the body by being ingested or swallowed, usually through involuntary actions which you may not be aware of such as through smoking, eating with contaminated materials in the workplace, or eating with unwashed hands.

- Although some ingested hazardous agents are neutralized in the stomach, others are absorbed into the bloodstream and transported to target organs.

- The most important method of prevention is personal hygiene. You must ensure that you have access to washing facilities and that food storage and dining areas are separate from your work areas to avoid contamination with hazardous agents.

Once substances enter the body, they can cause a variety of harmful effects. The effects may occur at the site of chemical contact such as irritation of skin, eyes or upper respiratory tract. Other chemicals may involve organ systems distant from the point of contact. Inhaled substances such as inorganic lead, do not produce ill-effects to the lungs but can damage the radial nerve causing wrist drop.
The effects may be seen immediately (acute) or may show up months or years after the exposure (chronic). Again, the effect will depend on the type of the chemical, the route of entry, and the degree of exposure.

Target organ toxicity occurs when disease states or adverse health effects manifest in specific organ system of the body. The different organ specific toxic effects are:

1. Blood Toxicity
2. Dermal Toxicity – adverse effects on the skin
3. Eye toxicity
4. Hepatotoxicity – adverse effects on the liver
5. Immunotoxicity – adverse effects on the immune system
6. Nephrotoxicity – adverse effects on the kidneys
7. Neurotoxicity – adverse effects on the brain or nerves outside of the brain
8. Reproductive Toxicity – adverse effects on the reproductive system
9. Respiratory Toxicity – adverse effects on the lungs

A summary of these organ-specific effects are shown below.

**Organ Specific Diseases that may arise from chemical exposures in the workplace**

<table>
<thead>
<tr>
<th>Causative Agents</th>
<th>Industry</th>
<th>Target Organ</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury, Lead</td>
<td>Battery, Chemical Industries</td>
<td>Kidney</td>
<td>Chronic renal failure</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Battery</td>
<td></td>
<td>Renal stones</td>
</tr>
<tr>
<td>Mercury</td>
<td>Battery, Chemical Industries</td>
<td></td>
<td>Nephrotic Syndrome</td>
</tr>
<tr>
<td>Chloroform</td>
<td>Solvents, Chemical Industries</td>
<td></td>
<td>Acute renal failure</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>Solvents, Chemical Industries</td>
<td></td>
<td>Chronic renal failure</td>
</tr>
<tr>
<td>Ethylene glycol</td>
<td>Solvents, Cosmetics Industries</td>
<td></td>
<td>Chronic renal failure</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>Solvents, Pesticide Industries</td>
<td></td>
<td>Chronic renal failure</td>
</tr>
<tr>
<td>Inorganic dust</td>
<td>Mining, Sandblasting, Coal</td>
<td>Respiratory system</td>
<td>Pneumoconiosis, Silicosis, Asbestosis</td>
</tr>
<tr>
<td></td>
<td>Mining</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemp, flax</td>
<td>Textile Industries</td>
<td></td>
<td>Byssinosis</td>
</tr>
<tr>
<td>Bagasse</td>
<td>Agriculture</td>
<td></td>
<td>Farmer's lung, Bagassosis</td>
</tr>
<tr>
<td>Plastics epoxies</td>
<td>Plastic, Varnish</td>
<td></td>
<td>Allergic Contact Dermatitis</td>
</tr>
<tr>
<td>Sodium Hydroxide, Acids</td>
<td>Chemical Industry, laundry</td>
<td></td>
<td>Irritant/ Contact Dermatitis</td>
</tr>
<tr>
<td></td>
<td>business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td>Construction, Cement manufacturing</td>
<td></td>
<td>Burns. Irritation, Contact Dermatitis</td>
</tr>
<tr>
<td>Causative Agents</td>
<td>Industry</td>
<td>Target Organ</td>
<td>Disease</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Solvents, Ammonia, Formaldehyde</td>
<td>Chemical process, Plastics, Pulp and Paper production, Laboratory</td>
<td>Immune system; lungs</td>
<td>Irritation, Inflammation, Edema</td>
</tr>
<tr>
<td>Diisocyanates in varnish</td>
<td>Platinum jewelers, Electroplating</td>
<td></td>
<td>Asthma</td>
</tr>
<tr>
<td>Nickel, Arsenic Chromium</td>
<td>Pigments, Plating Industries Metal refining industries</td>
<td>Lungs</td>
<td>Cancer</td>
</tr>
<tr>
<td>Cutting oils, Grease</td>
<td>Machine-tool operators</td>
<td>Skin</td>
<td>Acne</td>
</tr>
<tr>
<td>Chlorinated hydrocarbons</td>
<td>Chemical processes</td>
<td></td>
<td>Chloracne</td>
</tr>
<tr>
<td>Arsenic, Tar</td>
<td>Petroleum refinery</td>
<td></td>
<td>Skin Cancer</td>
</tr>
<tr>
<td>Polycyclic Hydrocarbons</td>
<td>Asphalt workers</td>
<td></td>
<td>Skin Cancer</td>
</tr>
<tr>
<td>Lead</td>
<td>Battery manufacturing, Lead Smelting</td>
<td>Blood</td>
<td>Anemia</td>
</tr>
<tr>
<td>Benzene</td>
<td>Solvent, Soap manufacturing</td>
<td></td>
<td>Aplastic anemia</td>
</tr>
<tr>
<td>Arsine gas</td>
<td>Chemical industries</td>
<td></td>
<td>Destruction of red blood cells</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>Cleaning fluids, Dry cleaners</td>
<td>Liver</td>
<td>Acute liver toxicity</td>
</tr>
<tr>
<td>Arsenic Chlorinated hydrocarbons</td>
<td>Smelting, Insecticides Chemical Industries</td>
<td></td>
<td>Cirrhosis</td>
</tr>
<tr>
<td>Epoxy resins</td>
<td>Rubber, synthetic fabrics</td>
<td></td>
<td>Acute obstructive hepatitis</td>
</tr>
<tr>
<td>Vinyl chloride</td>
<td>Plastics, Vinyl chloride monomer manufacturing</td>
<td></td>
<td>Liver Cancer</td>
</tr>
<tr>
<td>Lead</td>
<td>Battery Recycling, Manufacturing</td>
<td>Cardiovascular system</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>Degreasing, Dry Cleaning</td>
<td></td>
<td>Atherosclerosis</td>
</tr>
<tr>
<td>Fluorocarbons Trichloroethylene</td>
<td>Refrigeration, solvent workers</td>
<td></td>
<td>Arrhythmias</td>
</tr>
<tr>
<td>Nitrates</td>
<td>Explosives</td>
<td></td>
<td>Angina, Myocardial Infarction</td>
</tr>
</tbody>
</table>

Some chemicals affect numerous organ systems. Some adverse effects of chemicals may be related to the dose or amount absorbed by the body. Generally, the higher the exposure and the absorbed dose, the worse are the adverse effects noted. Inorganic lead is a good example. Its effects are related to the absorbed dose.
Health effects of physical hazards

Noise, extremes of temperature, inadequate illumination, radiation, and vibration are among the physical hazards that workers experience in their environments.

Noise

Although some claim that noise is subjective, you cannot deny that damage results from the intensity of noise (the louder the noise, the more likely noise-induced illnesses will occur), the duration of exposure to loud sounds in the work environment (the longer a worker is exposed, the risk for hearing impairment is also greater) and the type of noise (very loud sounds such as blasts may immediately destroy the eardrum and affect the level of hearing).

Intensity in noise can range from even the quietest sounds to the loudest bearable noise. The range of permissible noise exposures in the Philippines is found below

<table>
<thead>
<tr>
<th>Duration/day (hrs)</th>
<th>Sound Level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>1 1/2</td>
<td>102</td>
</tr>
<tr>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>1/2</td>
<td>110</td>
</tr>
<tr>
<td>1/4 or less</td>
<td>115</td>
</tr>
</tbody>
</table>

(Data from the Dept. of Labor and Employment: Occupational Safety and Health Standards)

As seen in the table, for every increase of 5 dB, the duration of exposure should be reduced by half. Other countries however, have already started using the 85 dBA as the permissible level for an 8 hours exposure to noise.

Hearing damage may be acute or immediate after exposure to very loud sounds such as blasts, or chronic which would be secondary to long-term exposure to hazardous noise levels. The major risk factor that may cause hearing damage from noise is prolonged and unprotected exposure to harmful levels.
There are two types of noise-induced hearing loss: **temporary threshold shift (TTS)** or **auditory fatigue** where hearing recovery occurs after 24-48 hours and **permanent threshold shift (PTS)**. In PTS, irreversible hearing loss occurs and manifestations of hearing loss are present.

When hearing is damaged, blended sounds such as “sh” or “ch” are the first to be affected. Sounds seem to be muffled and there are frequent complaints of ringing in the ear or tinnitus.

Noise affects not only your hearing but also your entire well-being or general health. It brings about other health effects such as hypertension and hyperacidity. Stress-related disorders also occur due to noise such as irritability and difficulty in sleeping.

In order to see changes in the hearing ability, a worker may be asked to undergo an audiometric examination. It should be done after a day off to prevent the effect of auditory fatigue or temporary threshold shift from occurring since this may cause false positives in the audiogram. Health surveillance such as audiometric exams are used to detect early signs of hearing damage among the employees and to prevent progression of the damage. Decrease in the hearing of workers suggests the need for noisy industries to start a hearing conservation program.

**Extremes of temperature: Heat and Cold**

**Heat**

Heat is a form of thermal energy, which may come from body metabolism, increased physical activities, radiation from hot objects or from the sun, and byproducts of industrial processes. To keep the temperature at a stable level, the amount of heat gained by the body must be equal to by the amount lost. Heat loss happens through convection, radiation, conduction and evaporation.

Heat balance is also affected by the physiological mechanisms regulating cardiovascular function and sweating. These mechanisms can influence heat exchanges in two ways. The first is by changing the rate of heat transfer from the internal organs and tissues to the periphery of the body. The second way is through the alteration of the temperature and vapor pressure on the surface of the skin.

Heat disorders can arise from natural conditions. These disorders, however, occur more frequently following exposure to artificial conditions such as hot processes related to working with furnaces, kilns, boilers and smelting.
In the presence of elevated environmental temperature, high humidity, heavy physical activity, loss of fluids and electrolytes or impaired heat dissipation, heat stress-related disorders may manifest. They include skin lesions termed as miliaria rubra, heat cramps, heat exhaustion, and heat stroke. There are different clinical features that differentiate the heat-related illnesses and the prognosis or usual outcomes of these diseases.

For a worker to adapt to a very hot working environment, he/she must first be acclimatized by being exposed to the area progressively. During his/her first working day, a three to four hour work exposure is warranted. This duration will be increased gradually so that in two weeks, he/she can adapt and be able to spend eight hours in the workplace. However, despite adaptation, frequent drinking of small amounts of water is essential.

**Cold**

In the Philippines, exposure to cold environment only occurs in certain work areas, e.g., ice plants and freezers in the food industry. Being a tropical country, the Philippines does not present cold stress as a severe occupational hazard but is still an important OSH issue in some sectors.

Cold exposure and the associated behavioral and physiological reactions have an impact on human performance at various levels of complexity. Mild exposure implies no or negligible body core cooling and moderate cooling of the skin and extremities. Severe exposure results in negative heat balance, a drop in core temperature and concomitant pronounced lowering of temperature of the extremities.

Effects may be localized such as frostbite in the extremities or may affect the entire body causing general hypothermia. As previously mentioned, cold exposure causes distraction and cooling. Behavior and mental functions are more susceptible to the distraction effect, whereas physical performance is more affected by cooling. It is assumed that physical performance is highly dependent on tissue temperature and deteriorates when temperature of vital tissue and organ parts drops. An important factor contributing to performance decrements is exposure time. The longer one is exposed to the cold exposure, the greater the effect upon the deeper tissues and neuromuscular functions of the victim.
The physical characteristics of mild and severe cold exposure are very much dependent on the balance between internal body heat production (as a result of physical work) and heat losses. Protective clothing and ambient climatic conditions determine the amount of heat loss.

Radiation: Non-Ionizing and Ionizing

Different radiation energies comprise the electromagnetic spectrum. Areas occupied by ionizing radiation have the shortest wavelength and generates the highest energies. On the other hand, non-ionizing radiation is characterized by longer wavelengths and lower energies.

Ionizing radiation is capable of producing ion pairs by interaction with matter. Ionizing radiation differs from other forms of radiant energy in being able to deposit enough localized energy in an absorbing material to disrupt atoms and molecules and produce ions and free radicals that causes biochemical changes. Alpha particles, beta particles, neutrons, x-ray and gamma rays are examples of ionizing radiation.

Exposure to ionizing radiation impinges on and penetrates into matter. The media is altered and may produce cell death, change in cell reproduction or division and genetic mutation.

X-ray is the most common radiation in the medical field. Individuals undergoing treatment for cancer may also be exposed to the gamma rays produced by radioactive materials such as radium and cobalt 60. There are naturally occurring radioactive materials such as radon and uranium found in mines. Natural background radiation comes from terrestrial radiation, (which emanates from radium and other radioactive materials in the earth’s crust, cosmic rays that originate from outer space and internal radiation which is emitted by potassium-40) and other naturally occurring radio nuclides normally present in the body.

In an individual, injury from ionizing radiation may occur as a somatic effect (those that are seen in the individual that receives the agent) that occurs immediately after irradiation or after several months or years. Effects of radiation may also be heritable, affecting the progeny or children of those with exposure during pregnancy.

Ionizing radiation may affect different organ systems in the body and, depending on the dose, health effects may manifest from skin reddening with small doses to sterility and even death with large doses.
In Non-Ionizing Radiation or NIR, there is not enough energy to cause ionization of matter.

The types of NIR are Ultraviolet (UV) rays, Infrared (IR), Lasers, Microwaves (MW), Radio frequencies (RF), Extremely Low Frequency and Static Fields. They have distinctive features depending on their wavelength. Different processes in the workplace can produce NIR. Apart from sunlight, welding is another source of UV. Sources of RF and MW radiation include radio emitters and cell phones while sources of IR are furnaces, heat lamps and IR lasers.

Exposure to NIR may also affect the body’s organ systems. The usual target organ for UV or ultraviolet radiation is the skin and cornea of the eyes and effects may be skin redness, premature skin ageing, and skin cancer. Eye injuries may manifest as cataract, retinal injury and a type of conjunctivitis known as welder’s flash. Infrared affects the eyes and may cause corneal and conjunctival burns, retinal injury and cataract. Lasers are potential hazards also to both the skin and eye. Other forms of NIR may cause current conduction and heat.

**Vibration**

Vibration is a physical factor that causes mechanical oscillations. It affects workers when the mechanical energy is transmitted to the body. There are two types of vibration: general or whole body vibration and local or segmental vibration. Workers operating heavy equipment or driving buses or tracks are exposed to general or whole body vibration. Workers using pneumatic or powered hand tools such as drills, grinders, chain saws are exposed to local or segmental vibration.

Exposure to whole-body vibration can cause discomfort or cause injury. It is also associated with elevated health risk for low back pain in workers exposed for many years to intense whole-body vibration. Stomach problems, headache and muscle pains have been reported among workers with occupational exposure to whole-body vibration.

The harmful effect of vibration on the human body also arises from local or segmental vibration. Prolonged exposure of the hands to vibrating tools may lead to the development of vibration disease, or “Hand Arm Vibration Syndrome” (HAVS). The risk of HAVS is increased in the presence of other factors such as cold environmental temperature and long working duration. HAVS is characterized by attacks of whitening (blanching) of one or more fingers when exposed to cold; tingling and numbness in the fingers; and pain.
Administrative and engineering control measures should be implemented to prevent the adverse health effects caused by vibration. Adequate information and training of operators of vibrating equipment will help them adopt safe work practices. Adequate rest periods should also be provided to decrease the duration of exposure to the hazard and, in effect, decrease the risk of the disorders. Selection of proper tools with lowest vibration is advisable.

Medical surveillance should be performed for early detection of vibration-related health disorders and for evaluation of effectiveness of control programs.

The worker should be advised to keep the entire body warm. Gloves may be needed to keep the hands warm. The workers must be advised to avoid smoking as this may aggravate the effects of segmental vibration by diminishing blood flow to the hands and fingers.

**Illumination**

Proper lighting or illumination of the workplace is important to have safe and healthy workers. Signs that are lighted properly decrease the risk of accidents. Adequate illumination improves productivity by ensuring that the details of the task can be easily seen by the worker thereby decreasing errors and wastage of materials.

It is not only the quantity of light in the work area that is important for optimum vision but the quality as well. For example, shadows and silhouettes can be produced by improper light sources or light distribution that is not uniform. Inadequate illumination may cause visual complaints among workers and cause productivity problems. The usual complaints after working in poorly lighted areas are visual fatigue, double vision, headaches, painful irritation, redness of the eyes or conjunctivitis and frequent tearing or lacrimation.

The appropriate lighting level is dependent on the task being performed. Generally, precision work would need higher levels of light compared to tasks that do not deal with details.

**Health Effects of Biological Hazards**

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

Tuberculosis is at the top of the list because it remains one of the most prevalent illness affecting Filipinos. It is among the leading causes of morbidity and mortality based on Philippine Health Statistics and Field Health Service Information System.

Tuberculosis (TB) is the sixth leading cause of illnesses and deaths in the Philippines; the country is ninth out of the 22 highest TB-burden countries in the world and has one of the highest burdens of multidrug-resistant TB.

Tuberculosis is a long-standing infection caused by the bacteria Mycobacterium tuberculosis. The TB bacteria usually attack the lungs, but can also attack any part of the body such as the kidney, spine, brain, bones and intestines. If not treated properly, TB disease can be fatal.

TB is primarily an airborne disease. The bacteria are spread from person to person in tiny microscopic droplets or aerosol when a TB sufferer forces air from his/her lungs when coughing, sneezing, speaking, singing, or laughing. A person then inhales the bacteria vigorously expelled from the lungs of an active TB patient. A person needs only to inhale a small number of these to be infected.

TB can survive for extended periods of time in the air and on various surface areas. It was found that 28% of the tuberculosis bacteria remain alive in a room after nine hours. Tuberculosis can live up to 45 days on clothing, 70 days in carpet, 90 to 120 days in dust, approximately 105 days on a paper book, and approximately six to eight months in sputum. Ultraviolet light, volume of air in a room and recirculation of air through a HEPA filter are important factors that affect the survival of the bacteria. Until the droplet falls, it can be breathed in at any time.

Symptoms do not appear unless a patient has active TB. The most common symptom of active pulmonary tuberculosis is coughing that lasts two or more weeks. Other symptoms are low grade fever, night sweats, feeling weak and tired, losing weight without trying, decreased or no appetite, chest pains and coughing up blood.

Only people with active TB whose sputum is contains the TB bacilli can spread the disease to others. However, exposure does not necessarily mean one will become infected with tuberculosis. If you have been exposed to an active tuberculosis patient or an area that is contaminated, you should seek medical advice immediately. It is therefore best to understand the life cycle of tuberculosis. An index case or the first patient in an outbreak may spread the infection to people they spend time with every day. This includes family members, friends, and coworkers. However, people infected with the TB bacilli will not
necessarily become sick with the disease. The immune system "walls off" the TB bacilli which, protected by a thick waxy coat, can lie dormant for years. About 90-95% undergo healing of their initial infection and the bacteria eventually die off. This stage manifests no symptom and is not contagious. This condition is known as inactive or latent TB. If, however, the body's resistance is low because of aging, infections such as HIV, malnutrition, or other reasons, the bacteria may break out of hiding and cause active TB in 5-10% of patients. Active TB patients manifest symptoms and become sick during their life while 30% of them, even if left untreated, will spontaneously remit or restore back to being healthy.

A person with TB disease, if left untreated, could infect approximately 10-20 persons within two years' time. The most infectious are the sputum smear (+). Persons with contagious TB disease must be treated and cured to stop the spread of TB in our communities. Active TB can also spread to other parts of the body through the bloodstream.

The best way to prevent tuberculosis is to strengthen one’s immune system by eating healthy, exercising regularly and getting plenty of rest. If one has active TB, covering the mouth when coughing, sneezing or laughing is one way to help prevent the propulsion of the bacteria into the environment.

Wearing a mask during this time is very helpful as well as staying at home until one’s sputum examination has reverted back to normal as certified by one’s physician. At home, sleep in a room by oneself to help prevent the transmission of the disease to other members of the family. Making sure that the workplace has proper ventilation is one way of preventing the transmission of the disease to co-workers.

In 2006, the World Health Organization (WHO) launched the new Stop TB Strategy. The core of this strategy is DOTS, the TB control approach launched by WHO in 1995. DOTS stands for Directly Observed Treatment Short course, the curative treatment for tuberculosis. At its core, it involves supervising the patient’s intake of medication. One cannot have DOTS, however, without a coordinated program with the following components: reliable, widely available smear microscopy diagnosis; an uninterrupted drug supply; recording and reporting of cases and outcome; and, most important, government commitment to assure that necessary resources are available to maintain the program. These 5 elements make up the DOTS strategy.

Patients who have been treated under DOTS-based services have >90% cure rate while about 70% of those with disease and untreated will die in 5 years. Those who have not been treated will spread the disease to others thereby completing the cycle.
In 2003, Executive Order No. 187 on Instituting a Comprehensive and Unified Policy for the Tuberculosis Control in the Philippines adopted the DOTS strategy of the National TB Program (NTP) which has become the basis of implementation of TB control among the concerned sectors. The treatment success in the 2008 DOTS campaign was 90% overall, surpassing the 85% target for the first time.

The National TB Control Programme (NTP) develops policies and plans and provides technical guidance to regional and provincial / city-level NTP management teams, overseeing the implementation of the programme at the municipal and barangay levels based on NTP policies and standards.

Under NTP, TB control services are provided mainly through public primary health care facilities (also called DOTS facilities) operated by local government units in a devolved set-up. There are additional DOTS facilities within the NTP’s network of service providers that either refer diagnosed TB patients for treatment or directly provide TB treatment services using DOTS strategy. These include private outpatient clinics; public and private primary, secondary and tertiary care hospitals; workplaces; clinics under faith-based organizations and community-based nongovernmental organizations (NGOs); and public institutions such as military facilities, jails and prisons.

The Department of Labor and Employment (DOLE) issued Department Order (DO) No. 73-05: Guidelines for the Implementation on Policy and Program on Tuberculosis Prevention and Control in the Workplace to assist companies in strengthening TB prevention efforts through enterprise-level policies and programs. This DO was signed on March 31, 2005.

**HIV and AIDS**

Another biologic hazard that has an impact in the workplace is HIV and AIDS though workers in the manufacturing sector are hardly exposed to this virus by the nature of their work. The Human Immunodeficiency Virus (HIV) is the cause of Acquired Immune Deficiency Syndrome (AIDS) - a condition in which progressive failure of the immune system allows life-threatening opportunistic infections and cancers to thrive.

HIV belongs to a group of viruses known as retroviruses. Once inside the human body, the virus attacks the cells of the immune system, specifically the CD4+ helper cells. The virus uses the helper cells’ cellular material or genetic material to replicate itself consequently filling the helper cell. The body tries to keep up by making new cells or trying to contain the virus, but eventually the HIV wins out and progressively destroys the body’s ability to fight infections and certain cancers. HIV is present blood, semen, vaginal fluids and breast milk of an infected mother in infectious quantity.
AIDS is the result of HIV’s attacks on the body’s immune system. This medical condition leaves the individual so unprotected that any other virus that attacks the body can cause grave damage. It is the most advanced stage of infection with HIV.

Contrary to some popular misconceptions, HIV is a difficult disease to get. For HIV to be transmitted, the following three conditions must be met:

1. **HIV must be Present**
   Infection can only happen if one of the persons involved is infected with HIV. Some people assume that certain behaviors (such as anal sex) cause AIDS, even if HIV is not present. This is not true.

2. **There must be a sufficient quantity of HIV**
   The concentration of HIV determines whether infection may happen. In blood, for example, the virus is very concentrated. A small amount of blood is enough to infect someone. A much larger amount of other fluids would be needed for HIV transmission.

   Blood contains the highest concentration of the virus, followed by semen, then by vaginal fluids. Breast milk can also contain a high concentration of the virus, but in this situation, transmissibility depends on WHO and HOW. An adult can ingest a small amount of breast milk at no probable risk. But an infant, with his/her very small body and newly forming immune system, consumes vast quantities of breast milk relative to his/her body weight. Therefore an infant is at risk from breast milk, whereas an adult may not be.

3. **HIV must get into the bloodstream**
   It is not enough to be in contact with an infected fluid to become infected. Healthy, unbroken skin does not allow HIV to get into the body; it is an excellent barrier to HIV infection. HIV can only enter the bloodstream through an open cut or sore, or through contact with the mucous membranes or damaged tissue in the anus and rectum, the genitals, the mouth, and the eyes; or be directly injected from a needle or syringe.

   You cannot get HIV from kissing, hugging, casual contact, drinking from the same glass, eating together, swimming pools, public toilets, pets, and mosquito bites. HIV is not transmitted through casual, every day contact. Since HIV is not transmitted by saliva, it is impossible to get it through sharing a glass, a fork, a sandwich, or fruit. The chemicals used in swimming
pools and hot tubs would instantly kill any HIV, if the hot water had not killed it already.

Sterilized needles are always used in taking blood from donors, so HIV is not spread in this manner. Humans are the only animals that can carry HIV. HIV is not transmitted by mosquitoes, flies, ticks, fleas, bees or wasps. If a bloodsucking insect bites someone with HIV, the virus dies almost instantly in the insect's stomach (as it digests the blood). HIV can only live in human cells.

There are laboratory tests that can be availed of should one decide to be tested. How do HIV tests work? The most commonly used HIV tests detect the presence of HIV antibodies – the body’s army that comprise part of our immune system and fights off invaders such as bacteria and viruses. There are tests that identify HIV’s genetic material or proteins directly.

It can take some time for the immune system to produce enough antibodies for the antibody test to detect it, and this “window period” between infection with HIV and the ability to detect it with antibody tests can vary from person to person. During this time, the HIV viral load and the likelihood of transmitting the virus through sex or needle-sharing partners may be very high. Most infected individuals will develop detectable antibodies within 2 to 8 weeks (the average is within 25 days) of their infection. Ninety-seven percent (97%) of persons will develop detectable antibodies in the first 3 months. Even so, there is a small chance that some individuals will take longer to develop detectable antibodies. Therefore, a person should consider a follow-up test more than three months after their last potential exposure to HIV. In extremely rare cases, it can take up to 6 months to develop antibodies to HIV.

Conventional HIV tests are sent to a laboratory for testing, and it can take a week or two before the test results are available. There are also rapid HIV tests available that can give results in as little as 20 minutes. A positive HIV test result means that a person may have been infected with HIV. All positive HIV test results, regardless of whether they are from rapid or conventional tests, must be verified by a second “confirmatory” HIV test.

HIV antibody tests can have two different results: positive or negative.

1. A positive result on a confirmed HIV antibody test means that HIV antibodies are present and one is infected with HIV (called "HIV positive"); the person can infect others but does not mean that the person has AIDS.
2. A negative result on an HIV antibody test means that most likely one is not infected with HIV. However, it can take 3 to 6 weeks, and sometimes up to 3 months (and in few cases up to 6 months) before HIV antibodies show up on a standard test. As a result, some people who are recently infected with HIV may still have a negative test result during this time.

Knowing your status can allow you to begin treatment which can help prevent the further spread of the virus, and in some cases prevent complications associated with HIV infection. HIV testing should be voluntary and confidential. Counseling before and after HIV testing will help you understand what behaviors put you at risk and teach you how to decrease the chance of becoming infected. If the test result is positive, counseling will address your immediate needs for support and information, and teach you on how to decrease the chance of infecting others.

In the early 1980s when the HIV/AIDS epidemic began, people with AIDS were not likely to live longer than a few years. Today, there are 31 antiretroviral drugs (ARVs) to treat HIV infection. These treatments do not cure people of HIV or AIDS. Rather, they suppress the virus, even to undetectable levels, but they do not completely eliminate HIV from the body. By suppressing the amount of virus in the body, people infected with HIV can now lead longer and healthier lives. However, they can still transmit the virus and must continuously take antiretroviral drugs in order to maintain their health quality.

Recent information from UNAIDS showed rapidly expanding epidemic among men having sex with men (MSM) from 0.28% in 2007 to 7.7% in 2013, there is also increasing prevalence among freelance Female Sew Workers (FSW) from 0.16% in 2007 to 0.68% in 2011.

With the rising trend in the number of new cases in a month, the Philippines cannot afford to be complacent. Several factors have been identified which may lead to continued considerable increase of new HIV infections in the country: high rates of sexually transmitted infection (STI); a substantially large sex industry, networks of men having sex with men with behaviors putting them at considerable risk of HIV infection; a legal situation which does not support HIV prevention services to injecting drug users; an increasing number of HIV cases in adolescents and young people, large numbers of adolescents living or working under conditions which make them very vulnerable to sexual abuse or exploitation, combined with overall low awareness of STI and HIV risk and low condom use (UNICEF).
In addition, the Philippines has more than 7 million migrant workers moving in and out of the country. Twenty-eight percent of the total number of reported HIV/AIDS cases are migrant workers (PNAC).

In a UNAIDS report, “HIV in Asia and the Pacific: Getting to Zero” cited HIV prevalence among people who inject drugs particularly in Cebu City accelerated rapidly from 0.6% to 53% in just two years, between 2009 and 2011. In nearby Mandaue, 3.6% of people who inject drugs are HIV-positive. The overlap between injecting drug use and sex work means that HIV epidemics in people who inject drugs invariably spread to other population groups until effective prevention efforts take hold.

In December 2013, there were 358 new HIV Antibody sero-positive individuals confirmed by the STD/AIDS Cooperative Central Laboratory (SACCL) and reported to the HIV and AIDS Registry. This was a 22% increase compared to the same period last year (n=293 in 2012).

Most of the new cases (95%) were males. The median age was 27 years (age range: 17-78 years). The 20-29 year (59%) age-group had the most number of cases. Fifty percent (7,622) of the reported cases were from the National Capital Region (NCR).

Of the 16,516 HIV positive cases reported from 1984 to 2013, 93% (15,345) were infected through sexual contact, 4% (711) through needle sharing among injecting drug users, <1% (62) through mother-to-child transmission, <1% (20) through blood transfusion and needle prick injury <1% (3). No data is available for 2% (375) of the cases. Cumulative data shows 41% (2,697) were infected through heterosexual contact, 36% (2,386) through homosexual contact, and 23% (1,489) through bisexual contact. From 2007 there has been a shift in the predominant trend of sexual transmission from heterosexual contact (24%) to males having sex with other males (76%).

Of the 358 (339 males and 19 females) HIV positive cases, 31 were reported as AIDS cases. The median age is 30 years (age range: 24-30 years) acquired the infection through sexual contact (heterosexual, homosexual, bisexual).

There is a significant difference in the number of male and female cases reported. Eighty-one percent (5,826) were males. Ages ranged from 4-79 years (median 27 years). The age groups with the most number of cases were: 20-24 years (19%), 25-29 (26%) and 30-34 years (19%).

HIV and AIDS is an urgent issue for the workplace that we must pay attention to because it has the potential to reduce productivity and economic growth. The virus can place heavy financial and social burden on families as they are faced with reduced income and often need to pay for
an array of medical treatments. Workers and families also face considerable stigma and discrimination from the virus causing loss of jobs and other acts of discrimination in the community.

The ABC approach to preventing the sexual transmission of HIV has been defined and adopted by a variety of organizations, governments and non-governmental organizations ever since the term was first used in 1992 when the then Secretary of Health, seeking a compromise between the Catholic Church and government at the time brought together abstinence, fidelity and condom use to create the ‘ABC slogan.’

According to UNAID’s 2004 Global Report on the AIDS Epidemic, ’ABC’ stands for:

• Abstinence (not engaging in sex, or delaying first sex)
• Being safer, by being faithful to one’s partner or reducing the number of sexual partners
• Correct and consistent use of condoms

These were later expanded to include:

• Don’t share needles/sterilized needles
• Education and information

In recognition of the fact the HIV and AIDS has far-reaching consequences beyond the health sector, the government passed Republic Act 8504 otherwise known as The Philippine AIDS Prevention and Control Act of 1998 to prevent the spread of the virus among the working population.


**Tetanus**

Tetanus, commonly called lockjaw, is another illness caused by a bacterial toxin or poison from the spore of the bacterium Clostridium tetani.

Tetanus affects the nervous system and is characterized by an increase in muscle tone causing painful spasms. Lockjaw is one of the usual manifestations of untreated tetanus infection. Severe spasms and convulsions may occur which can lead to death if not treated early.

Workers engaged in agriculture have an increased risk of contracting tetanus. Such workers are particularly susceptible to cuts and abrasions, and owing to the nature of the work environment it is likely that wounds will become contaminated with soil containing tetanus spores. Other susceptible workers include miners and construction workers.
The illness is contracted through a cut or wound that becomes contaminated with tetanus bacteria. The bacteria can get in through even a tiny pinprick or scratch, but deep puncture wounds or cuts like those made by nails or knives are especially susceptible to infection. Tetanus bacteria are present worldwide and are commonly found in soil, dust and manure. Tetanus causes severe muscle spasms, including “locking” of the jaw so the patient cannot open his/her mouth or swallow, and may lead to death by suffocation.

Common first signs of tetanus include muscular stiffness in the jaw (lockjaw) followed by stiffness of the neck, difficulty in swallowing, rigidity of abdominal muscles, generalized spasms, sweating and fever. Symptoms usually begin 7 days after bacteria enter the body through a wound, but this incubation period may range from 3 days to 3 weeks.

Tetanus is not transmitted from person to person. Effective prevention of tetanus is achieved by active immunization, using tetanus toxoid. In view of the substantial risk of contracting tetanus following an injury and in view of the fatal consequences of the disease, mass immunization is fully justified. Immunization is usually carried out as part of the occupational health program for workers. Active immunity is preferable to passive immunity, because there are fewer side reactions and because better protection is afforded.

Health Effects of Ergonomic Stresses

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

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

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

There are different factors in the workplace that may cause physical injury or psychosocial illness. In the case of work-related musculoskeletal disorders, several work factors have been identified to increase the risk of these disorders. When a worker assumes awkward positions or his posture remains static or unmoving for long periods, excess load is carried by certain muscle groups that may cause discomfort and even pain after long periods. The same mechanism applies to work entailing forceful exertions, movement over an extreme range of motion and highly repetitive work.

The risk of work-related musculoskeletal disorders (WMSD) depends on the magnitude of the factor (i.e. the intensity, frequency and duration of exposure). Single or, more commonly, multiple risk factors may be present in the workplace. Multiple risk factors often interact to produce a higher risk for developing WMSDs.

The primary goal in the prevention of WMSDs is to reduce or eliminate the risk factors involved in their etiology. Involving all business or factory stakeholders, including the workers, in the problem-solving process will enhance problem-solving capabilities, compliance to changes and job satisfaction. Careful examination of sick leave forms, compensation claims, medical records and outcomes of worker interviews may reveal risk factor indicators. Symptom surveys and periodic medical examinations may provide additional clues. A walk-through survey of the workplace is imperative to observe how the risk factors are produced under usual working conditions.

After identifying and properly evaluating the ergonomic stresses that exist, interventions are selected with the objective to reduce the magnitude and duration of risk factors. Controlling the risk factors may require redesigning the employee’s workstation, tools, work schedule or work methods. These measures aim to lengthen the recovery time of the muscle groups often used, by using other muscle groups and joints and finding ways in improving worker’s posture. For example inadequate space may be the reason for awkward postures and providing enough workspace may improve such posture. It is important to acknowledge that workers’ education and training are vital in the success of ergonomic interventions.

Policies may be implemented by companies to promote compliance with the preventive strategies.

Psychosocial factors that have been identified as ergonomic stresses include work, which calls for increased cognitive demands, poor job design and stressful organizational climate. In the workstation, the workplace dimension, i.e., providing adequate room to fit, reach and see the work, are important ergonomic factors to improve productivity. In addition, the workplace
environment, comfortable temperature, proper lighting, reduced vibration and noise levels do much to improve workers efficiency.

Frequently asked questions

1. Is it true that drinking alcohol washes away the toxic substances found in mineral dusts and solvents?

A chemical usually enters the body through inhalation, skin absorption or ingestion. Once absorbed, the chemical may remain at the site where it is deposited, mineral dusts in the lungs; or in the case of solvents, is absorbed into the bloodstream and is brought to the liver where it is broken down or metabolized. The effects of these chemicals arise from the action of the chemical in the different organ systems of the body.

When one drinks alcohol, it enters the gastrointestinal tract where it is absorbed. Alcohol affects the brain and may cause narcosis or drowsiness, depress reflexes and impair judgment. Diuresis or frequent urination is the effect of alcohol on the kidneys. This frequent urination has been implied as the action of alcohol in removing body toxins but this is not true.

Alcohol is another toxin and aside from the acute effects mentioned above, frequent alcohol drinking can damage the liver as well.

2. Where do we get information about the health effects of the chemicals being used in our workplace?

There are many sources of information on occupational health. The OSHC has a library and technical staff that can may be of assistance. However for those who stay outside NCR, the DOLE Regional offices may have the necessary materials needed.

A major source of information is also the Internet. There are many sites, which can provide the information, the International Labor Organization (www.iolo.org); the World Health Organization (www.who.org), the National Institute of Occupational Safety and Health (NIOSH) (www.cdc.gov/NIOSH/), and the Canadian Centre for Occupational Health and Safety (CCOHS) (www.ccohs.ca).

References/ Additional readings:


You cannot over-emphasize the importance of occupational safety and health. You must always remember that occupational health encompasses the social, mental and physical well-being of workers in all occupations. Indeed, you need adequate monitoring and medical surveillance.
Safety and Health Inspection
Unit 5 – Responses to OSH Issues / Concerns

Module 13: Safety and Health Inspection

After knowing all the hazards and possible negative consequences of these hazards, you will now learn how to perform safety and health inspection and determine how to eliminate the conditions that may cause harm to your workers and the workplace. As we have often heard, an ounce of prevention is better than a pound of cure.

Safety and health inspection is a potent tool in identifying workplace hazards even before they cause accidents or illnesses. You are in the best position to use this tool. The Inspection Cycle together with the Checklist represents a clear and structured roadmap for you to follow and enrich your workplace improvement efforts.

This module aims to discuss the value and key elements of safety inspection as a reliable approach to identifying and eliminating conditions that contribute to illness, accident or environmental damage in the workplace.

Some OSH officers may ask: What is the difference between safety inspection and safety audit? Safety audit is a comprehensive evaluation of the general working conditions of the organization while safety inspection is the identification of hazards in a certain area or equipment within the organization in order to improve its working condition.

Objectives

Working on this module should help you to
• define safety inspection items and conditions
• determine areas needing safety inspection
• articulate the importance of inspection to the OSH programs as a whole
• identify personnel who are best capable to conduct safety inspection
• enumerate the roles of personnel in the conduct of safety inspection
• practice using relevant inspection tools

Views on safety and health inspection

Let us start with a quick assessment of your views on the subject matter by providing your responses to the items in this activity. This activity is meant to have the same frame of mind for you and your peers on the value of safety and health inspection as a tool to effectively assess status of workplace OSH programs and prioritize corrective or improvement actions.

The positive views that can be gathered in this exercise can help you appreciate inspection better, giving you the confidence to use the tool as among your hazard identification and corrective action determination instruments. The negative views
will spell the pitfalls that safety inspectors need to avoid in the performance of their functions.

What is safety and health inspection?

Safety inspection is a tool in the prevention of accident to locate and report existing and potential unsafe conditions that, if left uncontrolled, have the capacity to cause accident in the workplace. Safety and Health Inspection is a central part of most safety, health and environmental protection programs and that it provides a reliable way for identifying and eliminating conditions that could contribute to accidents, illnesses or environmental damages.

What are the requirements of Effective Safety and Health Inspection Programs?

- Sound knowledge of the facility
- Knowledge of relevant standards, regulations and codes
- Systematic inspection steps
- Method of reporting, evaluating and using the data

Sound knowledge of the facility

It is the familiarity with the facilities of the establishment is an effective tool in determining what are the things to be inspected and how often these things be inspected.

Knowledge of relevant standards, regulations and codes

The reference of all safety and health rules and regulations of the company should always be the established local legislations and codes. These standard regulations will be our guide in assessing whether our workplace is safe or not.

Systematic Inspection system

In occupational safety and health time is very important. An established inspection system will facilitate inspection activities and will allow the designated safety inspector to improve the workplace based on identified hazards as early as possible.
Method of reporting, evaluating and using the data

Evaluation of effectiveness of the program is a must to determine whether a program is a success or a failure. Inspection should be documented. Reports prepared and submitted and other safety and health data are vital in evaluating the program.

An effective program begins with analysis, planning and with consider the following:

- What is the purpose of inspection?
- Who will conduct the inspection?
- How often must items be inspected?
- What aspects of each item need to be examined?
- What conditions need to be inspected?

What are the components of the Safety and Health Inspection Cycle?

The primary purpose of inspection is to detect potential hazards so that these can be corrected before an accident occurs. Inspection should be conducted in an organization to locate and report existing and potential unsafe conditions or activities. It is important that every potential hazard found in workplaces must be corrected to ensure no one will be injured, no one will be exposed to any diseases and workers’ working environment will not be contaminated by hazardous chemicals emitted from the process.
Who will conduct the safety and health inspection?

**Safety Professionals**

Clearly, the safety professionals (like the participants in this course) should spearhead the inspection activity. During both individual and group inspections, the professional can educate others in inspection techniques and hazard identification by using on-the-spot examples and firsthand contact.

**Company or Facility Management**

Management demonstrates its commitment to maintain a safe working environment. But the psychological effect of inspection by senior executives goes beyond merely showing an interest in safety. When employees know that the management is coming to inspect their area, conditions that seemed “good enough” suddenly appear unsatisfactory and are quickly corrected.

**First-line Supervisors or Foremen**

Supervisors and foremen spend practically all their time in the shop or facility, they are continually monitoring the workplace. At least once a day, supervisors need to check their areas to see that:

- employees are complying with safety regulations,
- guards and warning signs are in place,
- tools and machinery are in a safe condition,
- aisles and passageways are clear and proper clearances maintained, and
- materials in process are properly stacked or stored

**Employees**

Employee participation in continuous inspection is one goal of an effective hazard control program. Before beginning the workday, the employee should inspect the workplace and any tools, equipment and machinery that will be used. Any defects the employee is not authorized to correct should be reported immediately to the supervisor.

**Maintenance Personnel**

Maintenance employees can be of great help in locating and correcting hazards. As they work, they can conduct informal inspections and report hazards to the supervisor, who in turn should encourage the mechanics to offer suggestions.
Joint Safety and Health Committees

Joint safety and health committees conduct inspections as part of their function. They give equal consideration to accident, fire, and health exposures. By periodically visiting areas, members may notice changed conditions more readily than someone who is there every day. Another advantage provided by the committee is the members’ various backgrounds, experience and knowledge are represented.

What are the qualifications of a good inspector?

- Knowledge of the organization’s accident experience
- Familiarity with accident potentials and with the standards that apply to his/her area
- Ability to make intelligent decisions for corrective action
- Diplomacy in handling personnel and situations
- Knowledge of the organization’s operations – its workflow, systems and products

WHAT TO LOOK FOR

1. General Conditions – lighting, housekeeping, ventilation, storage, etc.

2. Specific Hazards – tools, machinery, equipment, & materials.

Particular attention should be paid to the parts of an item most likely to become a serious hazard to health and safety. These parts often develop problems because of stress, wear, impact, vibration, heat, corrosion, chemical reaction and misuse. Items such as safety devices, guards, controls, work or wear point components, electrical and mechanical components and fire hazards tend to become unsafe first. For particular machine, critical parts would include the point of operation, moving parts and accessories.

What are planned and unplanned inspections?

Unplanned inspection or continuous, on-going inspection – is conducted by employees, supervisors, and maintenance personnel as part of their job responsibilities.

Planned inspection – a “real safety & health inspection”. It is deliberate, thorough, and systematic by design.

1. Periodic Inspection
2. Intermittent Inspection
3. General Inspection

Periodic inspections – include those inspections at regular intervals. They can target the entire facility, a specific area, a specific operation or a specific type of equipment. Management can plan this inspection weekly, monthly, semi-annually, annually or at other suitable intervals. Items such as safety guard mountings, scaffolds, elevator wire ropes (cables), two-hand controls, fire extinguishers and other items relied on for safety require frequent inspection. The more serious the potential for injury or damage might be, the more often the item should be inspected.

Intermittent inspections – are those made at irregular intervals. Sometimes the need for an inspection is indicated by accident tabulations and analysis. If a particular department or location shows an unusual number of accidents or if certain types of injuries occur with greater frequency, the supervisor or manager should call for an inspection. When construction or remodeling is going on within or around a facility, an unscheduled inspection may be needed to find and correct unsafe conditions before an accident occurs. The same is true when a department installs new equipment, institutes new processes or modifies old ones.
General inspection – is planned and covers places not inspected periodically. This includes those areas no one ever visits and where people rarely get hurt, such as parking lots, sidewalks, fencing and similar outlying regions. Many out-of-the-way hazards are located overhead, where they are difficult to spot. Overhead inspections frequently disclose the need for repairs to skylights, windows, cranes, roofs and other installations affecting the safety of both the employees and the physical facility. Overhead devices can require adjustment, cleaning, oiling and repairing. They should look for loose tools, bolts, pipelines, shafting and pieces of lumber, windows, electrical fixtures, and other objects that can fall from building structures, cranes, roofs and similar overhead locations.

What are the factors that determine the frequency of your inspection?

Factors on frequency of inspection

• What is the loss severity potential of the problem? The more severe the loss potential, the more often the item should be inspected.

• What is the potential for injury to employees? The greater the probability for injury to employees, the more often the item should be inspected.

• How quickly can the item or part become unsafe? It depends on the nature of the part and the conditions to which it is subjected.

• What is the history of failures? Maintenance and production records, and accident investigation reports can provide valuable information on this.
What are your preparations in the conduct of inspection?

In preparing for inspection, some of the general considerations are as follows:

- Must not interrupt normal operations
- Must consider a review of all accidents
- Must include a review of previous inspection report
- Must show awareness of any potential hazard
- Must check on wearing of Personal Protective Equipment by inspection personnel
- Must have a clearly formulated checklist

Before conducting an inspection, you or the inspector/inspection team should review all accidents that have occurred in the area. At this brief meeting, team members should discuss where they are going and what they will be looking for. During the inspection, before going into noisy areas, the team will need to discuss what they wish to accomplish in order to avoid arm waving, shouting and other unsatisfactory methods of communication.

What are the inspector’s tools?

As safety inspector, you should also be aware of any special hazards you may encounter. For example, because welding crews and other maintenance crews move from place to place, they may be encountered anywhere in the facility. Inspectors should know what precautions are required where these crews are working.

**Inspection Tools**

You should have the proper tools ready before the inspection to make the process more efficient and to gather more precise data. Common tools include:

- clipboards
- inspection forms
- pens/pencils
- lock-out/tag-out supplies
- measuring tape/ruler
- flashlight
Depending on the inspection area or type, the following equipment may also be useful:

- cameras
- tape recorder
- electrical testing equipment
- sampling devices (air, noise, light, temperature)
- sample containers
- calipers, micrometers, feeler gauges
- special personal protective equipment
- stop watch

How do you implement and monitor corrective actions?

### Rules in implementing corrective actions

- Correct the cause whenever possible. If all the resources needed to correct the cause are already available, improve the working condition.

- Immediately correct everything possible. All possible causes of accident should be corrected at once to prevent their recurrence. This will definitely be done if all measures are in place.

- Report conditions beyond one’s authority and suggest solutions. Safety is everybody’s job. Anyone should be involved in the prevention of accident. If you identify hazards in your place of work, report them at once to your supervisor. Give recommendation to correct the situation.

- Take intermediate action as needed. Time is an essence as far as safety is concern. If unsafe condition was identified and corrective measure is at hand, improve it at once.

Management must realize that employees are keenly interested in the attention paid to correcting faulty conditions and hazardous procedures. Recommendations approved and supported by management should become part of the organization’s philosophy and program. At regular intervals, supervisors should report progress in complying with the recommendations to the safety department, the company safety and health committee, or the person designated by management to receive such information. Inspectors should periodically check to see what progress toward corrective actions is being made. Unsafe conditions left uncorrected indicate a breakdown in management communications and program application.
Sometimes management will have to decide among several courses of action. Often these decisions will be based on cost effectiveness. For example, it may be cost-effective as well as practical to substitute a less toxic material that works as well to the highly toxic substance presently in use. On the other hand, replacing a costly but hazardous machine may have to wait until funds can be allocated. In this case, the immediate alternative taken or proposed must be communicated to all persons involved.

Conclusion

Safety and health inspection is everybody’s responsibility for it is an effective tool in identifying workplace hazard and help to sustain the program instituted by the safety and health committee in a workplace. Continuous application of such tool will not only eliminate accidents or illnesses, but will also encourage active participation of worker to follow standard procedure as required by their job.
Accident Investigation
Unit 5 – Responses to OSH Issues / Concerns

Module 14: Accident Investigation

After the efforts on prevention, and should there be a chance that hazards lead to accidents or injuries, a sound accident investigation needs to be conducted. This module aims to introduce you to the basic principles of accident investigation as a tool in preventing the recurrence of accidents, which is the number one objective of any workplace accident investigation. As OSH officers, you must understand the basic approaches in accident investigation.

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

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

Objectives

Working on this module should help you to
• discuss the importance of accident investigation
• explain the basic procedure in the conduct of accident investigation
• enumerate the types of accidents to be reported
• document and make recommendations based on the investigation

Views on accident investigation

Let us start with a quick assessment of your views on the subject matter by providing your responses to the items in this activity. This activity is meant to have the same frame of mind for you and your peers on the value of accident investigation as a tool to effectively prevent the recurrence of accidents in the workplace.

The positive views that can be gathered in this exercise can help you appreciate accident investigation better, giving you the confidence to use the tool as among your hazard identification and corrective action monitoring instruments.
Activity 1

😊 Think about it:

↗ What types of accidents happen in your company (if you’re not yet employed, think about your usual surroundings)?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

↗ Do these accidents occur repeatedly?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

↗ Are accidents reported? State reasons for action taken
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

↗ What actions did your company take in order to prevent the recurrence of similar accidents in the future?
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

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

Now let us try to understand the basic principle of accident prevention. Our basic concern on occupational safety and health is on the safety of the worker against accident and injury and health of a person against illnesses and diseases. In order for workers to be safe, we have to prevent or minimize direct contact. On the other hand, in order to be healthy in the workplace, we have to prevent or minimize their exposure to environmental hazards.

What is accident investigation?

**ACCIDENT INVESTIGATION**

- A methodological effort to collect and interpret the facts of accident
- An inquiry as to how and why the accident occurred in order to explore actions that should be taken to prevent or minimize recurrence of the accident

Earlier, it has been mentioned that a policy is needed in order that all incidents be reported so the appropriate investigation can be performed. A thorough policy would require reporting the following types of accidents:

- Fatal
- Injury
- Disease
- Dangerous occurrence
- Near-miss
**Fatal** - The Occupational Safety and Health Standards being implemented by DOLE require that accidents resulting in death should be reported to DOLE Regional Office within twenty four (24) hours after occurrence using the fastest available means of communication, and within forty eight (48) hours upon receipt of the initial report, be investigated.

**Injury** - Any injury that causes minor or first-aid treatment to serious, to permanently/totally incapacitate workers should be reported.

**Disease** - All work-related diseases/illnesses due to exposure to unsafe working environment should also be reported.

**Dangerous occurrences** - Any dangerous occurrences which may or may not cause serious bodily harm to workers, or seriously damage the premises of employment should be investigated and reported by the employer to DOLE Regional Office. These include fire, explosion of boiler and pressure vessels, collapse of equipment or structures, etc.

**Near miss** - Near miss in an incident where no injury or property damage has occurred but where a slight difference in position or timing could mean the occurrence of damage or injury.

**Why do you perform accident investigation?**

<table>
<thead>
<tr>
<th>PURPOSE OF ACCIDENT INVESTIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• To establish all facts</td>
</tr>
<tr>
<td>• To draw conclusion</td>
</tr>
<tr>
<td>• To make recommendations</td>
</tr>
<tr>
<td>• To prevent recurrence</td>
</tr>
</tbody>
</table>
What are the basic steps in accident investigation?

Steps in accident investigation

1. Control the Scene
2. Gather Information
3. Analyze Data
4. Write Report

Manage the accident scene

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

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

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

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

Isolate the site to protect people. In many cases, the accident scene is a dangerous place. The accident may have damaged electrical equipment, weakened structural supports or may have released radioactive or toxic materials. Isolating or barricading the accident scene must be particularly implemented to prevent the entry of workers.
Preserve the evidence. Immediate action should be made for the protection of evidence. Physical evidences are so important for the success of every accident investigation. Each investigation should be conducted as soon as possible after the accident. A delay of only a few hours may permit these important evidences to be destroyed or removed intentionally or unintentionally. Preservation techniques include photographs, sketches, maps, notes and witness statements. Depending upon the nature of the accident, preservation of evidence may also require additional action to ensure its security.

What or who are your sources of information?

**Sources of Information**

- time and location
- environment
- physical evidence
- witnesses
- existing records

**Time and location.** This is the time of the day and place where the accident happened. More or less you can get an idea of possible causes of the incident if you know whether it happened in the morning, afternoon or evening. Likewise, you can also identify causes if you have the idea of where the accident happened.

**Environment.** The evaluation of the environment will provide information regarding the causes of accident. Identify the environmental factors that might influence the accident such as weather conditions, illumination, temperature, noise, ventilation, etc.

**Physical Evidence.** As the investigator, you should exercise extreme care in handling, collecting, retrieving or otherwise identifying physical evidence. Investigators not familiar with the fragility of these evidences might destroy it during the investigation process. Examples of the physical evidence are equipment, tools and materials involved in the accident.

**Witnesses.** A witness can be defined simply as any person who has information relating to the accident. This includes anyone from those persons principally involved in the accident to those who have seen or heard about the accident, or observed the work environment at the time the accident occurred. A witness may also be someone who has knowledge of the events occurring during any of the three (3) stages of the accident namely the pre-contact, contact and post-contact.
**Existing Records.** These could be employee, equipment, job or task, and previous accident investigation records.

**Employee record.** Information regarding the victim’s age and gender, the department and occupation in which he or she worked, work status (whether a full-time, part-time, or seasonal employee), experience (how long has the victim been with the company, how long in current occupation, how often had the employee repeated the activity engaged in when the accident occurred), and employee’s training - should be reflected in the employee’s record.

**Equipment record.** The characteristics of the equipment associated with the accident include the type, brand, size, and any distinguishing features of the equipment, its condition, and the specific hazardous parts that may cause accident.

**Job or task record.** The characteristics of task being performed by the employee include his or her general task, the tools or equipment/machine he or she is using/operating. The description should include the posture or location of the employee in doing the task and whether the employee is working alone or with others.

**Record of previous accident investigation reports** An accident investigation report form is used to help investigators gather, at a minimum, the basic information that should be recorded about each accident. The minimum data recorded for every accident identifies the who, what, when, where, why and how (5W + 1H) of the accident.

**What is the method of interviewing of witnesses?**

Since the value of a witness’ statements is highest when derived from testimony gathered immediately after the accident occurs, it is essential that interview of witnesses begins as soon as possible. Interviewing your witnesses can be a difficult assignment if not properly handled. The individual being interviewed after all may be fearful and reluctant to provide the interviewer with accurate facts about the accident. A witness may not want to provide information that might implicate friends, fellow workers, or the supervisors. To obtain the necessary facts during an interview, the interviewer must first eliminate or reduce an employee’s fear and anxiety by establishing good rapport with the individual. It is important that the interview of a witness occur in a comfortable area or atmosphere conducive to ensuring an accurate account of accident. An interview at the accident scene has several advantages and should be attempted. When selecting a suitable place to conduct interviews, you must ensure that the location is non-threatening to the witness. You must create a feeling of trust and establish open communication before beginning the actual interview. Once good rapport has been developed, the interviewer can follow this method:
THE INTERVIEW PROCESS

- Get written statement
- Reassure the witness
- Let the witness tell the story
- Begin with open-ended question
- Don’t ask leading question
- Summarize
- Ask for recommendation
- Close on a positive note

Analyze the accident

Finding the cause

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

The four (4) elements that interact together for successful business operations are the following:
- People
- Equipment
- Materials
- Environment

However, when something unplanned or undesired occurs within any of these elements, usually some adverse effects might happen.
People. Obviously, the people of any successful organization are its greatest resources. But unfortunately, statistics show that a high percentage of accidents have been attributed to human element. Influencing factors that can affect human behavior and performance must be examined and evaluated for cause.

Equipment. Equipment includes the tools and machines employees must work with in order to accomplish their assigned works. In more recent years, the improper design of controls and displays on complex power machines and equipment has been cited frequently as the primary source or cause of accident. The improper use of hand tools, calibrating instruments, gauges or even a ladder to accomplish a given task can also adversely affect the outcome of the job, to the point of accident. People can and often interact with equipment or vice versa to have an accident.

Material. The materials people use, work with or make provide another major source of accident causes. Materials can be sharp, heavy, hot, cold, toxic or defective. In all cases, materials can be a major source of energy contact that results in accident. Since people must interface regularly with materials in order to perform their tasks, an examination of the relationship between potential accident sources becomes extremely important in the accident investigation process. When one considers that people often use equipment to process materials in daily operation, the complexity of accident source relationship becomes even more evident.

Environment. Environment is the physical surrounding in which work must be performed. This includes the buildings that house the people and the air they breathe. It is also associated with lighting, noise level, and atmospheric conditions (temperature, air quality, humidity, etc.). The work environment represents the source of causes of an ever-increasing number of diseases and health-related conditions.
These four elements of business operation (people, equipment, material, and environment) either individually or in combination, produce the source of causes that contribute to the accident.

In the investigation of every accident, management must ensure the proper consideration of the potential for involvement of any or all of these four elements of business operation.

What should an accident investigation report answer?

All information gathered during the course of the investigation should be properly reported and formally recorded in an Accident Investigation Report. Although there are no established industry-standard formats for recording the accident investigation into a report form, there are several aspects of the processes which are common to most reports. Each company will generally develop its own format for the investigation report, one that is acceptable to management. The report should answer the 5W and 1H in reporting of accident.

5W & 1H in the Reporting of Accidents

- Who was injured?
- What happened?
- Where did the accident occur?
- When did the accident occur?
- Why did the accident occur?
- How can similar accident be prevented?

The Occupational Safety and Health Standard provides for an accident investigation report using the prescribed form (DOLE/ BWC/ OHSD/ IP-6a) which can be used by the companies on devising their company’s accident investigation report from.

Recommending and monitoring corrective actions

After all probable causes of accident have been established, your next step is to make recommendations and corrective actions for changes that will prevent a similar accident in the future. There are several specific changes that you can recommend that will involve any or a combination of the E’s of safety such as the following:
- Engineering Control
- Education
- Enforcement
Engineering. Engineering changes will probably be needed to improve working conditions. Perhaps the company will need to make some process changes in the workplace to prevent another accident. Job tasks need to be altered to eliminate a hazard. Sometimes there is a need for ergonomics adjustments, such as redesigning a machine or raising worktable heights or there is a need to install industrial ventilation system or improved maintenance system.

Education. After engineering control measures are put in place, training of all the workers of the organization is needed. Basically, educating the employees on how to work safety, reducing injuries and keeping worker’s compensation down should be the company’s concern. It is a practical move for the company to follow a plan on safety training.

Enforcement. After all control measures have been exhausted and in place and trainings have been conducted to educate the employees, accidents might still happen. Maybe, in this case, there is a need for a comprehensive implementation of the enforcement program to make sure workers will follow the basic rules and regulations on safety and health. The government takes extra effort in the enforcement of OSH Standards by DOLE inspectors. Enforcement of all safety and health rules and regulations must be given ample attention to ensure the smooth implementation of all OSH programs.

Accident investigation without follow-up is meaningless. After you perform an investigation and determine the causes of an accident, steps need to be taken to help ensure that the same accident does not occur again. Some managers fall short of this. They implement corrective actions, but they fail to make sure that the corrective measures are working. It’s important to constantly monitor the situation to make sure that whatever corrective action has been taken, it is doing what it’s supposed to do. Remember: Only when accidents are eliminated is an accident investigation really complete.

Conclusion

Accident investigation is really an important tool in the prevention of recurrence of accidents. All accidents, whether it is a near miss or injury/damage causing accident, should be reported. To be effective, you should always be at the scene of the accident as soon as possible and should follow the basic methods of accident investigation. Given the proper training, you or any of your workers can conduct an accident investigation.
Basic Occupational Safety and Health (BOSH) Training

OSH Programming
Unit 5 – Responses to OSH Issues / Concerns

Module 15: Development of an OSH Program

Introduction:

After understanding the basic concepts and principles of safety and health in the workplace, we will now proceed to the discussion on ensuring that OSH activities and interventions are appropriate and are sustained by the company. Organizations that are really concerned on OSH always plans and develop programs based on sound written policies that reflect the organization’s vision, mission, goals and objectives. Rule 1045 of the OSH Standards requires employers to develop and implement their respective safety and health policy and programs. This module will help you to design your own OSH programs specific to the unique conditions and situations of your company.

I. OSH Policy

Before you can design your company’s safety and health program, foremost is the necessity to ascertain your company’s S and H policy. What is your company’s commitment on safety and health? Do you have the strong leadership and the necessary mechanism to implement this?

Firstly, let us define what a policy is. The American Heritage Dictionary defines policy as a plan or course of action, as of a government, political party, or business, intended to influence and determine decisions, actions, and other matters. It is central in any organization inasmuch as this gives the direction for which the company operates its business. It embodies the company’s principles and guidelines in accomplishing its goals and objectives.

Consequently, a safety and health policy is a document stating the top management’s safety objectives, the level of safety that can be performed by the organization, and the responsibility of the organization’s members for executing the policy and ensuring safety. For example, if the company policy states that safety and health is primordial in its operations, then this becomes the impetus for OSH programs and activities to be implemented. The policy is the basis for planning and budgeting of OSH-related activities of the company.
Characteristics of an OSH Policy

An OSH policy is characterized by the following:
1. Specific to the organization, concise, clearly written, dated, and signed.
2. Indicates management commitment, support and accountability.
3. Includes principle and objectives of protecting SH of all members of the organization.
4. States compliance with OSHS and related laws.
5. States objectives to continually improve the OSH MS
6. Employees are aware of the Policy (communicated/posted)
7. Covers all workers and community

The OSH policy should be company-specific and should be formulated based on its distinct nature. It should be clearly written so that all employees will understand its tenets. The policy should state management’s resolve to promote safety and health in the workplace. The date and the signature of the company president of chief executive officer are equally important since this signifies accountability of said policy. It should highlight the participation of both the employees and management so everybody shall be solidarity responsible and accountable in its implementation.

Here is an example of an OSH Policy:

*ABC Corporation ensures a safe and healthy workplace for employees conducive to greater productivity.*

*The Corporation is committed to continually improve its occupational safety and health management systems and comply with all relevant safety legislation and requirements to prevent accidents resulting in personal injury and illnesses, damage to equipment and materials, and operational interruption.*

*Concern for occupational safety and health is a shared responsibility between the Corporation and its employees.*

*All managers, supervisors and employees are enjoined to ensure that safety programs and practices are in place in their areas of responsibility.*

*October 8, 2011*  
*Juan Dela Cruz*  
*General Manager*
II. Safety and Health Program Defined

The approved OSH policy lays the foundation of all programs and activities that will be conducted by the company.

A Safety and Health Program is a plan or outline of activities conducted to promote safety and health consciousness among management and workers in order that accidents and/or illnesses can be eliminated or minimized to the lowest reducible level. It is a written document that spells out management’s commitment to protect its workers by undertaking measures to control exposures to hazards in the workplace.

A Safety and Health program contains an organized set of ideas, principles and procedures designed to be followed to achieve safety and health excellence. It is a detailed blueprint of standards and procedures reflecting workplace-specific accepted industry practices which is supported by both the management and the workers.

It has been found out that effective management of worker safety and health programs:

- Reduces the extent and severity of work related injuries and illnesses – the safety and health programs that are in place and followed by all concerned employees would include implementation of appropriate control measures to reduce workplace accidents and illnesses. Hence, if these are operational the cases of accidents and illnesses will be minimized.

- Improves employee morale and productivity – knowing that you are working in a company that values your overall wellness gives you security and peace of mind. This will result to greater productivity and efficiency among workers.

- Reduces workers’ compensation costs – if accidents and illnesses are prevented then the costs for paying worker’s compensation will be reduced.

III. Safety and Health Program Criteria

In designing the company’s S and H program, the following criteria shall be considered, namely:

1. Workplace specific – as mentioned earlier on, the design of the safety and health should be responsive to the specific hazards and exposures brought about by the work processes and conditions of the company. One company’s OSH program will not be exactly the same with other companies.

2. Must have commitment from the employer and senior management - management commitment is critical in the success of a program since they reflect the company’s resolve to protect its worker and to ascertain that programs are carried out with no exceptions.
3. Must have input from the workers – while management leadership in implementing OSH programs is important, the concerns of the workers should be considered in the development of OSH programs and policies since they are the once directly involve and exposed to work hazards. They should be consulted in the course of developing respective programs.

4. Must assign clear responsibilities and accountabilities – the OSH program should spell out and clarify the specific responsibilities and accountabilities of all those who have a stake in company’s OSH program to avoid confusion. Senior management must be accountable in implementing the programs while the supervisors and employees have the responsibility for carrying out specific elements of the program.

5. Each of the program’s elements must be in writing – it is important that the OSH programs should be clearly written so that it cannot be misinterpreted and can be used as ready reference by everybody. If there is a written document then it would be easy for the employees to evaluate its compliance or suggest for some improvement.

6. Must address the safety and health of contractors – the OSH programs should not be limited to workers directly employed by the company but should also extend the same to its contractors and service providers. This will ensure that everybody is following a common S and H standards.

7. Be available and effectively communicated – everyone should be made aware of the company’s OSH programs and policy so they can abide on it. This can be done through the use of safety bulletins and orientations.

8. Must have an evaluation mechanism – the OSH program and policy is dynamic, hence, should be regularly monitored, reviewed and updated to make it responsive to the current situations and conditions of the company as well as applicable laws/orders of the DOLE and relevant agencies.

IV. Safety and Health Committee

In order to effectively implement the OSH programs, it is required that companies should have their own Safety and Health Committee. This is provided for in Rule 1040 of the OSH Standards.

The Safety and Health Committee is the planning and policy making group of the company in matters relating to safety and health. This is composed of employer and employee representatives such as the following:

- CEO/Manager or his representative
- Workers’ Representatives (union members if organized)
- Company Physician, nurse or first-aider
- Safety Officer
This is the minimum requirements on the composition of the S and H committee. Depending on the actual needs, the company can increase its membership. The CEO or his representative chairs the Committee. This is to show the company’s commitment in implementing the programs and activities that will be identified. It will give a strong signal that the company is sincere in its support. In cases where the company is not unionized / organized, the workers’ representative shall be selected from among the workers through a majority vote. If there is a Labor Management Council (LMC), the worker representative sits in the committee.

The Safety Officer acts as the secretary and is the employer’s focal person in the implementation of the safety and health programs. His specific duties are stipulated in Rule 1047.

V. Functions of the Safety and Health Committee

Being the focal group on workplace safety and health, the functions of the committee includes:

- Plans and develops accident prevention programs for the establishment
- Directs the accident prevention programs of the establishment
- Conducts safety and health meetings at least once a month
- Reviews report of inspection, accident investigations and implementation of programs
- Initiates and supervises safety training
- Develops and maintains disaster contingency plans.

VI. Components of an OSH Policy

The OSH policy can now be translated into various program interventions. It should cover a holistic approach and package of programs and activities. The OSHC adopts a framework in defining the components of an OSH policy. The same framework is used by the Center in selecting winners of its biennial Gawad Kaligtasan at Kalusugan (GKK) awards.
The OSH Policy Framework identifies the following components:

1. **Safety Control and Emergency Preparedness.** These include policies and programs to mitigate exposures of workers to direct physical hazards in the organization. Examples of these are programs relating to:
   a) Housekeeping
   b) Material handling and storage
   c) Electrical safety
   d) Machine guarding
   e) Personal protective equipment
   f) Fire safety orientations and exit drills
   g) Maintenance of firefighting facilities
   h) Incident/accident investigation analysis, recording and reporting
   i) Safety inspections
   j) Emergency preparedness plans and related training

The policy on Emergency Preparedness is very relevant in view of the situations that can suddenly happen which can adversely affect the company and/or the community in general. Therefore, a fast and efficient response to emergencies is necessary.

Emergency preparedness encompasses all activities that are necessary to prepare people and organizations to respond to emergencies and disasters which include typhoons, floods, industrial fire, chemical leaks, earthquakes and oil spills, among others.

The importance of an effective workplace safety and health program cannot be overemphasized. There are many benefits from such a program including increased productivity, improved employee morale, reduced absenteeism and illness. However, incidents still may occur in spite of efforts to prevent them. Therefore, proper planning for emergencies is necessary to minimize employee injury and property damage. These include areas on:

- declaring an emergency
- evacuating workers
- obtaining internal emergency resources
- obtaining help from external resources
- initiating emergency rescues
- tending to casualties

There are elements of an Emergency Preparedness Program that should be considered, namely:

a) Review the hazards – identify the hazards and risks that can happen in the organization or community

b) Evaluate resources – assess the available resources you have including the presence of trained manpower to respond to emergencies
c) Develop emergency plan and procedure - develop plans and procedures that should be observed before, during and after the emergency
d) Conduct training – train the right people who will respond to emergencies
e) Conduct drills and exercises - simulation of possible emergency scenarios through drills and exercise will prepare the employees in the event disasters and calamities will happen.
f) Educate public – conduct awareness programs for the general public so that they too will be prepared and will be a source of your support system
g) Integrate in community plan – it is important that the company keeps close coordination with the locality/community in order to have a synchronized response

2. **Industrial Hygiene Program** – this includes programs of the company that covers

- Inventory of chemicals
- Emergency contingency plan
- Capability building program for chemical users
- Materials handling and storage procedures
- Abatement of physical hazards

The company has to define the guidelines on how it will conduct its industrial hygiene program - who should be involved in terms of the IH activities, how these will be done, and what and to whom are the capability building interventions that will be conducted, etc.

3. **Occupational Health Program** – this include programs on

- Employment or hiring of medical staff
- Availability of clinical, dental and medical equipment
- Preparation and submission of Annual Medical Report
- Compilation of medical records of employees, including analysis of the data
- HMO or in-house health services or both
- Medical services and other programs implemented

4. **Environmental Protection and Community Relations** – aside from safety and health, the company programs should also cover the following:

- Data on classification and volume of waste generated
- Pollution prevention facilities (e.g. wastewater treatment)
- Employment of a Pollution Control Officer (PCO)
- List of outreach programs and description
5. **Social Accountability Programs** – these programs take into account the involvement of the company on issues such as
   - Policy on gender
   - Policy on Child Labor
   - Policy on PWDs
   - Other corporate social responsibility programs

6. **Capability Building on OSH** – this involves compliance by the company to mandated/specialized OSH training courses and conduct of activities to promote OSH. This includes
   - List of required orientations/ trainings on OSH provided (BOSH, CST, Drugs, HIV/AIDS, Gender/S&H, Anti-Sexual Harassment, Family Welfare, OSH-MS and others)
   - Training calendar of the company; other staff development activities
   - Plans on communicating OSH
   - Information program, materials and dissemination strategies
   - Monitoring and evaluation

As mentioned earlier, it is important to communicate the OSH programs to all the employees to generate their involvement. This could be done through:

a. Some Promotional Methods
   - Safety Meetings – conducted regularly to remind workers on OSH
   - Safety Contests – can include injury rate contest, non-injury rate contest e.g., safety slogan, poster, housekeeping
   - Use of posters, bulletin boards, displays to publicize safety
   - Other activities like safety campaigns, safety courses and demonstrations, public address systems, publications, suggestion systems

**VII. Monitoring**

It is necessary for any organization to monitor and evaluate the effectiveness of all its safety and health policies and programs. In doing this the company will be able to:

- Improve the performance of the program.
- Know if changes or revisions/improvements are necessary.
- Check areas that have to be prioritized.
- Assess program effectiveness
  - Number of accidents and injuries are trending downward
  - Cost of accidents and injuries is trending downward
  - Time lost due to work-related injuries or illnesses is reduced

Examples of indicators/areas to look at when monitoring the OSH program:
- 100% compliance on helmet and safety shoes
- Presence of signages and directional signs
- Zero unprotected wall and floor openings
Monitoring of compliance and effectiveness of the OSH programs can be done through the conduct of safety inspections/assessments, conduct of Work Environment Measurement and Annual Medical Check-up.

In closing, unless an organization has a written, well-defined, company-specific safety plan in which everyone in the organization logically understands their roles and responsibilities, all of the hard work, all of the expense, and all of the hopes for a successful program will be useless.

The greatest responsibility a person can have during his lifetime is to be accountable for another person’s safety and health and for the protection of the environment.
OSH Legislation
Unit 5 – Responses to OSH Issues / Concerns

Module 16: OSH Legislation

This module thus aims to familiarize you about the various government regulations regarding OSH and other responses to existing and potential OSH hazards.

OSH legislation and enforcement are key components of the government program to protect workers from work accidents and illnesses; and

Here’s something else: Legislation and enforcement are not the only approaches used in improving OSH in the Philippines. We have developmental strategies like the Zero Accident Program (ZAP), information drives and the like in order to put a positive note in OSH administration. In cases of work disabilities, there is also the Employees Compensation Program (ECP).

Objectives

Working on this module should help you to
• identify laws and policies which govern OSH administration in the Philippines;
• determine government agencies which administer such laws;
• explain the various strategies for OSH administration

OSH Administration Framework in the Philippines

- Occupational Safety and Health Center
  • Training
  • Technical assistance to clients, ECC, BWC, workers & employers
  • Clearing house of information on OSH
  • Research
  No. of staff - 100

- Labor inspectors / LLCOs thru 16 ROs
  • 252 Inspectors

- Employees’ Compensation Commission
  No. of staff - 82

- Bureau of Working Conditions – develops, prescribes OSH standards

To know more about these agencies, you may follow the links provided below:

- Department of Labor & Employment (DOLE) — www.dole.gov.ph
- Occupational Safety & Health Center (OSHC) — www.oshc.dole.gov.ph
- Employees’ Compensation Commission (ECC) — www.ecc.gov.ph
- Bureau of Working Conditions (BWC) — www.bwc.dole.gov.ph

Policy Framework

The focus of our discussion will be on those laws which are specifically administered by the Department of Labor and Employment (DOLE) under the Labor Code of the Philippines (LCP).

1. Labor Code of the Philippines

   • Article 162 – Safety and health standards. The Secretary of Labor and Employment shall, by appropriate orders, set and enforce mandatory occupational safety and health standards to eliminate or reduce occupational safety and health hazards in all workplaces and institute new, and update existing, programs to ensure safe and healthful working conditions in all places of employment.

   • Article 164 – Training programs. The DOLE shall develop and implement training programs to increase the number and competence of personnel in the field of occupational safety and industrial health.

   • Article 164 – Administration of safety and health laws.
     a. The DOLE shall be solely responsible for the administration and enforcement of occupational safety and health laws, regulations and standards in all establishments and workplaces wherever they may be located; however, chartered cities may be allowed to conduct industrial safety inspections of establishments within their respective jurisdictions where they have adequate facilities and competent personnel for the purpose as determined by the DOLE and subject to national standards established by the latter.

     b. The Secretary of DOLE may, through appropriate regulations, collect reasonable fees for the inspection of steam boilers, pressure vessels and pipings and electrical installations, the test and approval for safe use of materials, equipment and other safety devices and the approval of plans for such materials, equipment and devices. The fee so collected shall be deposited in the national treasury to the credit of the occupational safety and health fund and shall be expended exclusively for the administration and enforcement of safety and other labor laws administered by the DOLE.
• **Article 128 Visitorial and Enforcement Power.**  
  
  a. The Secretary of Labor and Employment or his duly authorized representatives, including labor regulation officers, shall have access to employer’s records and premises at any time of the day or night whenever work is being undertaken therein, and the right to copy there from, to question any employee and investigate any fact, condition or matter which may be necessary to determine violations or which may aid in the enforcement of this Code and of any labor law, wage order or rules and regulations issued pursuant thereto.

  b. Notwithstanding the provisions of Articles 129 and 217 of this Code to the contrary, and in cases where the relationship of employer-employee still exists, the Secretary of DOLE or his duly authorized representatives shall have the power to issue compliance orders to give effect to the labor standards provisions of this Code and other labor legislation based on the findings of labor employment and enforcement officers or industrial safety engineers made in the course of inspection. The Secretary or his duly authorized representatives shall issue writs of execution to the appropriate authority for the enforcement of their orders, except in cases where the employer contests the findings of the labor employment and enforcement officer and raises issues supported by documentary proofs which were not considered in the course of inspection. (As amended by Republic Act No. 7730, June 2, 1994).

  An order issued by the duly authorized representative of the Secretary of Labor and Employment under this Article may be appealed to the latter. In case said order involves a monetary award, an appeal by the employer may be perfected only upon the posting of a cash or surety bond issued by a reputable bonding company duly accredited by the Secretary of Labor and Employment in the amount equivalent to the monetary award in the order appealed from. (As amended by Republic Act No. 7730, June 2, 1994).

  c. The Secretary of Labor and Employment may likewise order stoppage of work or suspension of operations of any unit or department of an establishment when non-compliance with the law or implementing rules and regulations poses grave and imminent danger to the health and safety of workers in the workplace. Within twenty-four hours, a hearing shall be conducted to determine whether an order for the stoppage of work or suspension of operations shall be lifted or not. In case the violation is attributable to the fault of the employer, he shall pay the employees concerned their salaries or wages during the period of such stoppage of work or suspension of operation.
d. It shall be unlawful for any person or entity to obstruct, impede, delay or otherwise render ineffective the orders of the Secretary of DOLE or his duly authorized representatives issued pursuant to the authority granted under this Article, and no inferior court or entity shall issue temporary or permanent injunction or restraining order or otherwise assume jurisdiction over any case involving the enforcement orders issued in accordance with this Article.

e. Any government employee found guilty of violation of, or abuse of authority, under this Article shall, after appropriate administrative investigation, be subject to summary dismissal from the service.

f. The Secretary of DOLE may, by appropriate regulations, require employers to keep and maintain such employment records as may be necessary in aid of his visitorial and enforcement powers under this Code.

2. **Presidential Decree 626**
   You may click this link - [http://www.ecc.gov.ph/pd626.htm](http://www.ecc.gov.ph/pd626.htm)

3. **Presidential Decree 856 – Code on Sanitation**
   You may click this link - [http://www.chanrobles.com/presidentialdecreeno856.htm](http://www.chanrobles.com/presidentialdecreeno856.htm)

4. **Republic Act 8504** – An act promulgating policies and prescribing measures for the prevention and control of HIV/AIDS in the Philippines, instituting a nationwide HIV/AIDS information and educational program, establishing a comprehensive HIV/AIDS monitoring system, strengthening the Philippine National Aids Council, and for other purposes.
   You may click this link - [http://www.chanrobles.com/presidentialdecreeno856.htm](http://www.chanrobles.com/presidentialdecreeno856.htm)

5. **Republic Act 9165** - An act instituting the Comprehensive Dangerous Drugs Act of 2002 repealing Republic Act No 6425, otherwise known as the Dangerous Drugs Act of 1972, as amended, providing funds therefore, and for other purposes.

6. **Republic Act 6969** - An act to control toxic substances and hazardous and nuclear wastes, providing penalties for violations thereof, and for other purposes.
7. **Local Government Act** - decentralizes some national government functions to LGUs. Ex. Inspection of buildings, health care provisions, etc.

8. **Executive Order 307** – An Executive Order issued during President Corazon C. Aquino’s term, establishing the Occupational Safety and Health Center in the Employees’ Compensation Commission” attached agency of the Department of Labor and Employment as the national focal point on OSH trainings, researches, information and technical services.

For further readings, you may click this link - [http://www.oshc.dole.gov.ph/121/](http://www.oshc.dole.gov.ph/121/)

**The Occupational Safety and Health Standards (OSHS)**

OSHS is actually a codification of all safety and health rules and regulations, including safety orders then in existence at the time.

OSHS has many provisions. To some extent, many of its provisions have already been discussed in the technical discussions that have been undertaken in the previous modules.

**Selected OSHS Provisions**

What will be discussed instead are the significant and major provisions. These are significant in the sense that these are the most often-asked questions and which relates to items that will seriously affect the operations of the company. These are:

**Rule 1001 - Purpose and Scope**

1. The objective of this issuance is to protect every workingman against the dangers of injury, sickness or death through safe and healthful working conditions, thereby assuring the conservation of valuable manpower resources and the prevention of loss or damage to lives and properties, consistent with national development goals and with the State’s commitment for the total development of every worker as a complete human being.

2. This standards shall apply to all places of employment except as otherwise provided in this Standards.

**Rule 1005 - Duties of Employers, Workers and other Persons**

1. Each employer covered by the provisions of this Standards shall:
   a. Furnish his workers a place of employment free from hazardous conditions that are causing or are likely to cause death, illness or physical harm to his workers.
b. Give complete job safety instructions to all his workers, especially to those entering the job for the first time, including those relating to the familiarization with their work environment, hazards to which the workers are exposed to and steps taken in case of emergency;
c. Comply with the requirements of this Standards; and
d. Use only approved devices and equipment in his workplace.

2. Every worker shall cooperate with the employer in carrying out the provisions of this Standards. He shall report to his supervisor any work hazard that may be discovered in his workplace.

3. Every worker shall make proper use of all safeguards and safety devices furnish in accordance with the provisions of this Standards for his protection and that of others, and shall follow all instructions given by the employer in compliance with the provision of this Standards.

4. It shall be the duty of any person, including any builder or contractor or enforcement agent, who visits, builds, renovates, or installs devices, or conducts business in any establishment or workplace, to comply with the provisions of this Standards and all regulations of the employer issued thereunder as well as with other subsequent issuances of the Secretary.

Rule 1012.02 – Abatement of Imminent Danger

1. An imminent danger is a condition or practice that could reasonably be expected to cause death or serious physical harm before abatement under the enforcement procedure can be accomplished.

2. When an enforcement officer finds that an imminent danger exists in a workplace, he shall inform the affected employer and workers of the danger and shall recommend to the Regional Director the issuance of an Order for stoppage of operation or other appropriate action for the abatement of the danger. Pending the issuance of the Order the employer shall take appropriate measures to protect the workers.

3. Upon receipt of such recommendation, the Regional Director shall immediately determine whether the danger exists and is of such a nature as to warrant the issuance of a Stoppage Order or other appropriate action to minimize the danger.
4. The Order shall require specific measures that are necessary to avoid, correct or remove such imminent danger and to prohibit the presence of any worker in such location where such danger exists, except those whose presence are necessary to avoid, correct or remove such danger or to maintain a continuous process or operation. Where stoppage of operation is ordered, the Order shall allow such correction, removal or avoidance of danger only where the same can be accomplished in a safe and orderly manner.

5. Immediately after the issuance of Stoppage Order, the Regional Director shall furnish the Secretary, through the Director, within forty-eight (48) hours a copy of the Order and all pertinent papers relating thereto, together with a detailed description of the work conditions sought to be corrected, the safety and health rule violated by the employer and the corrective measures imposed. The Secretary shall review the Order issued by the Regional Director and within a period of not more than five (5) working days, issue a final Order either lifting or sustaining the Order of the Regional Director.

6. The Order shall remain in effect until danger is removed or corrected.

Rule 1013 - Hazardous Workplaces

For purposes of this Standards, the following are considered “hazardous workplaces:”

a. Where the nature of work exposes the workers to dangerous environmental elements, contaminants or work conditions including ionizing radiation, chemicals, fire, flammable substances, noxious components and the like;
b. Where the workers are engaged in construction work, logging, firefighting, mining, quarrying, blasting, stevedoring, dock work, deep sea fishing, and mechanized farming;
c. Where the workers are engaged in the manufacture or handling of explosives and other pyrotechnic products;
d. Where the workers use or are exposed to power driven or explosive powder actuated tools;
e. Where the workers are exposed to biologic agents like bacteria, fungi, viruses, protozoas, nematodes, and other parasites.
Rule 1043.01 - Health and Safety Committee

The Health and Safety Committee is the planning and policy making group in all matters pertaining to safety and health. The principal duties of the Health and Safety Committee are:

1. Plans and develops accident prevention programs for the establishment.
2. Directs the accident prevention efforts of the establishment in accordance with the safety programs, safety performance and government regulations in order to prevent accidents from occurring in the workplace.
3. Conducts safety meetings at least once a month.
4. Reviews reports of inspections, accident investigations, and implementation of programs.
5. Submits reports to the manager on its meetings and activities.
6. Provides necessary assistance to government inspecting authorities in the proper conduct of their activities such as the enforcement of the provisions of this Standards.
7. Initiates and supervises safety training for employees.
8. Develops and maintains a disaster contingency plan and organizes such emergency service units as may be necessary to handle disaster situations pursuant to the emergency preparedness manual for establishments of the Office of Civil Defense.

Rule 1050 – Notification and Keeping of Records of Accidents and/or Occupational Illnesses

1053 Report Requirements

1053.01: All work accidents or occupational illnesses in places of employment, resulting in disabling condition or dangerous occurrence as defined in 1053.02 shall be reported by the employer to the Regional Labor Office or duly authorized representative in duplicate and a copy furnished the employee of his duly authorized representative using form DOLE/BWC/HSD-IP-6. The formal report shall be submitted by the employer on or before the 20th day of the month following the date of occurrence of the accident or when the illness is established and an investigation report in the prescribed form shall be submitted by the Regional Office or duly authorized representative on or before the 30th day of the same month. In case of temporary total disability where the injured or ill employee has not reported back to duty on the closing date of reporting, an estimate of the probable days of disability shall be made and entered in the report and corrected after the return of the injured, the corrected days of absence shall be used.
2. Where the accident or illness results in death or permanent total disability, the employer, in addition to the written report required under sub-paragraph (1) above, shall initially notify the Regional Labor Office or duly authorized representative within twenty four (24) hours after occurrence using the fastest available means of communication.

3. All deaths and permanent total disabilities shall be investigated by the Regional Office or duly authorized representative within forty eight (48) hours after receipt of the initial report of the employer, prepared in duplicate using the prescribed form DOLE/BWC/OHSD-IP-6a.

**Reporting Forms**
In summary, the following are the reporting requirements of the OSHS, which you can download at this link:

- registration of establishments-IP-3
- report of safety and health organization- IP-5
- employer’s work accident/illness report-IP-6
- annual work accident/illness exposure data report-IP-6B; and
- annual medical report form 47-A.

**Rule 1070 – Occupational Health and Environmental Control**

It is the basis for the conduct of work environment measurements (WEM) by the OSHC. It provides for certain values on the permissible level exposures of many contaminants and other physical hazards.

You may read the whole content of Rule 1070 at the Occupational Safety and Health Standards.

*For additional information, you can download DOLE Memorandum Circular #1, series of 2000 entitled Implementing Guidelines for the Conduct of Workplace Environment Assessment (WEA) in Hazardous Establishments and Work Processes (see Appendix Number)*
Rule 1080 - Personal Protective Equipment

1081 – General Provision
1081.01: Every employer as defined in 1002:

5. Shall at his own expense furnish his workers with protective equipment for the eyes, face, hands and feet, protective shields and barriers whenever necessary by reason of the hazardous nature of the process or environment, chemical or radiological or other mechanical irritants or hazards capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.


1081.02: All personal protective equipment shall be of the approved design and construction appropriate for the exposure and the work to be performed.

1081.03: The employer shall be responsible for the adequacy and proper maintenance of personal protective equipment used in his workplace.

1081.04: No person shall be subjected or exposed to a hazardous environmental condition without protection.

Rule 1980 - Authority of Local Government

1981.01: Types of Inspection:
For the purpose of this Standards, inspection activities shall be divided into Technical Safety Inspection and General Safety Inspection.
1. Technical Safety Inspection – shall refer to inspection for the purpose of safety determination of boilers, pressure vessels, internal combustion engines, electrical installations, elevators, hoisting equipment and other mechanical equipment.

2. General Safety Inspection – shall refer to inspection of the work environment, including the location and operation of machinery other than those covered by technical safety inspections, adequacy of work space, ventilation, lighting, conditions of work environment, handling, storage or work procedures, protection facilities and other safety and health hazards in workplace.

All violations of the provisions of this Standards shall be subject to the applicable penalties provided for in the Labor Code, PD 442 as amended.

Please read the links on http://www.chanrobles.com/legal4labor4.htm

Government responses aside from enforcement

With regards to government legislation as a whole, instructor reminds participants that enforcement is only one response but not the only response of the government. Such approaches include:

• Zero Accident Program (ZAP)
• Employees’ Compensation Program (ECP)
• Work Improvement in Small Enterprises (WISE)
• Program on OSH in the Informal sector
• OSH in Schools
• Child Labor
• Quick Reaction Teams like Work ALERT, medical surveillance on SJS, and many others.

For the DOLE as a whole, voluntary compliance is still the best, where organizations implement OSH measures because they know that it will be to their great benefit. The OSHC flagship program of ZAP is an example of such program which emphasizes the spirit of voluntarism. Another key DOLE program is the Employees Compensation Program (ECP), the preventive aspect of which is implemented by OSHC.

Most Commonly-Asked Questions

1. How can participants get a copy of the OSHS?

The BOSH training participants can get a copy free-of-charge from the Occupational Safety and Health Center (OSHC). The standards can also be downloaded at the OSHC website. External clients can also avail of the book through OSHC with a fee of Php 100.00 / each.

2. What happens when a company is found to have an “imminent danger situation”?

A Stoppage Order can be issued by the Secretary of the DOLE, through the Regional Director concerned, in the work area where the imminent danger situation is located. It can only be lifted after the company has corrected the situation.
3. Why should companies comply with the OSHS?

They should do so in order to prevent stoppage of company operations due to imminent danger situations. It also makes good public relations for a company to be known as taking care of its workers. But the most important reason for all is profits- a safe, healthy and contented worker is also a productive worker.

4. How are OSH Standards, say, TLV limits set?

OSH Standards are set just like all government regulations- the office- in-charge (the BWC in this case) of the concern drafts the proposal based on: studies made; data/ feedbacks from inspection activities; or clamor from interest groups. The proposal goes through a review and evaluation process. These are then presented to the Secretary for approval and eventual implementation.

5. How are OSHS updated to ensure adequacy of protection for workers?

Same procedure as mentioned above.

6. How do our standards compare with international standards?

Standards per country are set based on the internal needs of each country. The Philippines compared to our Asian neighbors, has better-developed labor laws including the OSHS. But the standards involving highly hazardous materials leaves much to be desired – the basis for our TLVs is still the 1978 TLVs of the American Conference of government Industrial Hygienists (ACGIH). These must be updated to make it at least at par with other countries.
Department of Labor and Employment

OCCUPATIONAL SAFETY AND HEALTH CENTER
North Avenue corner Agham Road, Diliman, Quezon City
Trunkline: 929-6036 to 39 Fax No.: 929-6030
Email Address: oshc_dole@yahoo.com
Website: www.oshc.dole.gov.ph

CEBU BRANCH
6th Floor, DOLE Building
Gorordo Avenue corner General Maxilom Avenue, Cebu City
Tel. Nos.: (032) 266-8382 / 266-9580
Email: oshccebub@yahoo.com

CAGAYAN DE ORO BRANCH
c/o DOLE Building
Monte Carlo Building, RER Subdivision, Kauswagan Highway, Cagayan de Oro City
Tel. Nos.: (08822) 721-316 / (088) 851-1233
Email: oshccdo@gmail.com