

Health and Occupational Physiology

Ratna Indriawati

Faculty of Medicine and Health Science, Universitas Muhammadiyah Yogyakarta
Email: ratna.indriawati@umy.ac.id

Pendahuluan

Occupational Health and Safety is an integral part of the labor system and human resources. Occupational Health and Safety is not only very important in improving the social security and welfare of its workers, but far from it. Occupational Health and Safety has a positive impact on the sustainability of work productivity. Data from the International Labor Organization (ILO) in 2018 states that, according to ILO estimates, more than 1.8 million work-related deaths occur annually in the Asia and Pacific region. At the global level, more than 2.78 million people die each year as a result of accidents or occupational diseases. There are approximately 374 million non-fatal work-related injuries and illnesses each year, many of which result in work absenteeism.¹

According to the National Safety Council on average, there are more than 10,000 fatal accidents and more than 2,000,000 cases occur every year with losses reaching more than 65 billion USD. From the problems of Occupational Health and Safety above, of course, it is a concern that Occupational Safety and Health is important to prevent work accidents and work safety. Thus this Occupational Safety and Health Guide was compiled, hopefully, this module can be used as a useful guide for workers and health workers Occupational Safety and Health.¹

Pembahasan

A. Concepts of Occupational Safety and Health

According to the International Labor Organization (ILO), Occupational Safety and Health is the promotion and maintenance of the highest degree of physical, mental and social well-being for all workers, preventing health problems caused by work, and also protecting workers from any risks that can interfere with health, placing and maintaining workers in a work environment that is in accordance with the physiological and psychological conditions of workers and creating harmony between work and workers and everyone with their duties.^{2 3}

Work safety includes efforts to create a safe work environment and minimize workers from all risks and threats that cause work accidents. While occupational health is an effort made in the work environment to anticipate workers from occupational diseases and ensure workers get health facilities in the workplace.²

B. Occupational Safety and Health Objectives

The main purpose of implementing occupational safety and health is to create a safe work environment by evaluating quality and quantity. In addition, it creates healthy conditions for employees, their families and the surrounding community through promotive, preventive, curative and rehabilitative efforts. The qualitative assessment of the work environment includes the physical, chemical, biological and psychological work environment, and ergonomics, while the quantitative assessment of the work environment compares the parameters that have been determined and standards.⁴

WHO states that health promotion in the workplace is a range of policies and activities in the workplace designed to assist workers and employers at all levels to improve and enhance well-being by involving the participation of workers, management and other stakeholders. Efforts to promote occupational safety and health are carried out by increasing health (health promotion) and special protection (specific protection). Improving health in the workplace is carried out through education and training such as counseling aimed at workers to be used in making innovations to prevent work accidents and occupational diseases in the work environment. While special protection is an effort to promote occupational safety and health in achieving certain goals, such as the current provision of the COVID-19 vaccine for workers to protect and improve the health status of workers.⁵

Preventive efforts in the workplace are carried out by having early diagnosis and treatment. Diagnosis is a series of examinations carried out by a health worker to detect the presence of a disease. Diagnosis is made by screening and medical examination. Part of prevention includes conducting regular health checks on workers at the beginning before work and repeated every few months so that they can find out the current health status of workers so that if anyone has a health problem, they can be immediately given treatment or referred to a health service facility. Curative occupational health is an effort made to limit the occurrence of disability due to work-related diseases or work accidents.

Literally, curative occupational health means providing treatment. Appropriate treatment aims to stop the disease and prevent complications and permanent disability. The certainty of occupational health insurance is also a curative occupational health effort. Rehabilitation aims to optimize existing functions. Workers who experience disability due to work accidents or occupational diseases can still work fully.⁵

C. Term in Occupational Safety and Health

Some terms that are often encountered in work accidents are:

1. A hazard is a source that has the potential to cause damage such as injury, illness, property damage, the environment or a combination of these. Hazard is a characteristic that becomes one or attached to a material, condition, system and equipment. It is important to understand the concept of hazard. Danger is also related to the presence of energy. In order to cause an accident, there must be contact with energy or substance. When referring to this, danger is a form of energy. The types of hazards or energy that can be harmful classified into:
 - a) Mechanical hazards. Mechanical hazard. Mechanical hazards come from machine tools that move mechanically. Examples of mechanical hazards are wood cutting machines, packing machines, sawmills, grinding machines. Types of employees associated with mechanical hazards include wood cutter employees, employees in the production process
 - b) Electrical hazard. Electrical hazards come from electrical energy. Examples of electrical hazards short circuit, fire, electric shock.
 - c) Physical hazards. Sources of this physical hazard include noise, mechanical vibration, extreme temperatures, radiation, air pressure.
 - d) Biological hazards. Biological hazard. The source of this biological hazard can be the presence of viruses, bacteria, fungi, protozoa in the work environment. The source of this biological hazard can be the presence of viruses, bacteria, fungi, protozoa in the work environment. There are many sources of biological hazards in hospitals and laboratories. Employees are often exposed to biological hazards, namely those who work in tanneries, animal slaughter, laboratories
 - e) Chemical hazards. Sources of chemical hazards are chemicals with their own characteristics. Hazard characteristics of chemicals are corrosive, explosive, irritant, mutagen, carcinogen. Examples of chemicals are lead (Pb), H₂SO₄, carbon monoxide (CO₂), ammonia (NH₃)
2. Accident. Accident is an unwanted event that can cause harm to people, property and production processes. Based on the type, accidents can be divided into two, namely:
 - a) General accident is an unwanted event that can cause loss and does not refer to other than the provisions above. Examples of common accidents are traffic accidents, household fires, a child accidentally swallowing a toy and food poisoning.
 - b) Work accidents. A work accident is an unwanted event that can cause a loss. These accidents occur during working hours and at work. An accident can also be called a work accident even though it does not occur in the workplace, but the incident is on a routine route that is usually passed from and to the workplace. Some examples of work accident cases, for example the first case, a mechanic was working in a workshop. The doors and windows were closed due to the cold weather. The vehicle engine is running next to the mechanic who is working.
3. Near miss/near accident/incident. If the definition of an accident is an unwanted event that can cause losses, a near miss/near accident/incident is an unwanted event, but it does not cause a loss. An example of a near-miss incident is that a person is painting a building on the top floor, without realizing that his foot hits an object and causes it to slip. But because the person is wearing a seat belt, he can survive.
4. Risk is a combination of possibility and severity. The amount of risk can be known through a risk assessment. Risk assessment includes two stages of the process, namely risk analysis (risk analysis) and risk evaluation (risk evaluation).
5. Losses. Losses are part of the result of an accident. From the description of the definition of a work accident, the most visible losses are injury to humans, property damage and loss of production process time. Indirectly reduces performance and reduces profits.
6. Safety. Safety is defined as being free from loss, safe condition from injury, illness or loss (free from loss). Another definition expressed by ILCI is the notion relating to injuries, complaints, property damage and reduced production/processing time. Work safety is an effort to control hazards so as not to cause work accidents that can cause losses and provide guarantees for employees and a safe work system.^{6 7}

D. Cause of Work Accident

In general, there are two causes of work accidents, namely immediate causes and basic causes^{6 7}

- a) Human/personal factors, among others due to:
 - Lack of physical, mental, and psychological abilities
 - Lack/weak of knowledge and skills.
 - Stress
 - Insufficient/wrong motivation
- b) Work/environmental factors, among others because:
 - Insufficient leadership and/or supervision
 - Not enough purchases/procurement of goods
 - Not enough maintenance (maintenance)
 - Insufficient tools, equipment and goods/materials.
 - Not enough work standards
 - Abuse
- c) Unsafe conditions, namely actions that will cause accidents, for example (4):
 - Inadequate or unqualified safety/protective/obstacle equipment.
 - Damaged materials, tools/equipment
 - Too cramped/narrow
 - Inadequate warning systems
 - Fire and explosion hazards
 - Poor tidiness/layout (housekeeping)
 - Hazardous/toxic environment: gas, dust, smoke, vapor, etc
 - Noisy
 - Radiation exposure
 - Insufficient ventilation and lighting
- d) Dangerous actions (unsafe acts) are behaviors, actions or actions that will cause accidents, for example:
 - Operate tools/equipment without authorization.
 - Failed to give a warning.
 - Failed to secure.
 - Works at wrong speed.
 - Causing safety devices to malfunction.
 - Move safety equipment.
 - Using a broken tool.
 - Using tools in the wrong way.
 - Failure to wear protective equipment/personal safety properly

E. Work Safety Management

1) Commitment and policy: There is the establishment of an OHS organization, provision of budget and manpower, and facilities in the field of OSH. In addition, there is also an initial review or identification of sources of danger.

2) Planning: In making plans, it is adjusted to the goals, objectives, and work indicators that can be measured by the timeframe of achievement

3) Implementation: Human resources, facilities, and funds are available. Officers must be equipped with knowledge of the OHS system that involves workers in its application, good communication skills in reporting and documentation systems, as well as being able to identify sources of hazards and control risks.

4) Measurement and evaluation: The OHS management system must be audited periodically to determine the effectiveness of the OHS management system implementation. Findings from audit results must be documented and used for the identification of corrective actions

5) Review: To ensure continued suitability and effectiveness in the achievement of occupational safety and health policies and objectives. The scope of the review of the OHS management system must be able to address the implications of occupational safety and health on all activities, products, goods, and services including their impact on company performance.⁸

F. Personal Protective Equipment

In the construction sector, there are several types of equipment used to protect someone from accidents or dangers that may occur in the construction process. This equipment must be used by someone working in a construction environment. Occupational safety and health are two very important things. Therefore, all contractor companies are required to provide all the necessary personal protective equipment (PPE) for all working employees, namely:⁹

a) Gloves

Gloves are indispensable for some types of work. The main purpose of using gloves is to protect hands from hard and sharp objects during their activities. One of the activities that require gloves is lifting reinforcing steel, wood. Repetitive work such as pushing the cast cart continuously can cause blisters on the hands that come into contact with the iron on the cart.

b) Helmet

Helmets are very important to use as head protection. Every construction worker must use them properly as mentioned in regulations. This helmet is used to protect the head from dangers that come from above, for example, there are goods, both equipment or construction materials that fall from above. Indeed, we often see the discipline of workers to use it is still low which of course can endanger themselves.

c) Earmuffs

This tool is used to protect the ears from the sounds emitted by a machine that has a fairly loud and noisy volume. Sometimes the effect is long-term if you hear this loud noise every day without earmuffs.

d) Mask

Respiratory protection is indispensable for construction workers considering the conditions of the project site itself. Various large to very small construction materials are leftover from an activity, for example, sawdust leftover from cutting, sanding, and shrinking wood.

G. Ergonomics

Ergonomics is the science of how to harmonize humans with their work and work environment in order to create comfort, safety, and prevention of injury or health problems with the aim of increasing work productivity and a better quality of human life. The application of ergonomics is as follows:^{10 11}

a) Working position: The working position consists of a sitting and standing position, a sitting position where the legs are not burdened with body weight, and a stable position during work. While the standing position where the position of the spine is vertical and the bodyweight rests equally on the two legs.

b) The work process, workers can reach work equipment according to the position at work and fit the anthropometric size. There must be a distinction between western and eastern anthropometric measurements.

c) The layout of the workplace, the display must be clearly visible when carrying out work activities. Meanwhile, symbols that apply internationally are used more than words.

d) Lifting weights, there are various ways of lifting weights, namely with the head, shoulders, hands, back, and so on. Loads that are too heavy can cause injury to the spine, muscle tissue, and joints due to excessive movement.

1) Carrying load: The load lifted does not exceed the rules set by the ILO, is

- Adult Male 40 kg
- Adult Female 15-20 kg
- Male (16-18) 15-20 kg
- Female (16-18) 12-15 kg

2) Work for organization

Work should be organized in various ways:

- Mechanical aids
- Minimized movement frequency
- Reduced load-lifting distance
- In carrying loads, keep in mind that the field is not slippery and
- Lifting is not too high.

3) Weight lifting method

All workers must be taught to lift weights. The kinetic method of handling guidelines should be used which is based on two principles:

- Arm muscles are used more than the back muscles.

To start a horizontal movement, we use heavy momentum body.

Metode ini termasuk lima faktor dasar:

- Correct foot position
 - Strong and stocky back
 - The position of the arms close to the body
 - Lifting properly
 - Using bodyweight
- 4) Medical supervision: All workers must continuously receive regular medical supervision.
- Pre-work inspection to suit the workload
 - Periodic checks to ensure workers are fit for work and detect any abnormality.
 - Advice should be given on hygiene and health, especially for young and old women
- Understanding the principles of ergonomics makes it easier to evaluate each task/job, even though science in ergonomics continues to advance and the technology used in the workplace continues to change. Ergonomics principles are guidelines in applying ergonomics in the workplace, within that principle. There are 12 principles, namely:
- Work in a normal position or posture
 - Reduce overload
 - Keep equipment within reach
 - Work according to the height of the body dimensions
 - Reduce repetitive and redundant movements
 - Minimize static movement
 - Minimize load points
 - Includes space distance

H. Occupational Health

Occupational health is an effort to maintain the health of workers through the development and organization of work in a direction that supports health in the workplace in order to create a conducive work environment so as to increase company productivity. While occupational diseases are all disorders or diseases caused by the work environment or work. This disease has a specific cause or has a strong relationship with work, which generally consists of one recognized causative gene.^{12 13}

I. Cause of Occupational Disease

- 1) Physical factor
Consists of noise, lighting vibration, radiation, air pressure, and air climate.
 - a) Noise is unwanted sound at a high level of sound intensity, repeated and chronic exposure to noise will cause nerve deafness.
 - b) Vibration is generated from the use of mechanical devices and part of this mechanical force is transmitted to the employee's body in the form of mechanical vibration. This mechanical effect causes tissue cells to be damaged or their metabolism disturbed and even causes changes in bone structure in spinal joints and changes in nerve conduction velocity.
 - c) Radiation consisting of electromagnetic radiation (heat radiation, ultraviolet light, laser radiation, and infrared light) and radioactive radiation (rays from radioactive substances). Radiation can cause burns or wounds to the skin and even high exposure can interfere with the reproductive system which results in infertility.
 - d) Air pressure is divided into two, namely high air pressure and low air pressure. High or hyperbaric air pressure is commonly encountered under the sea and workers at risk of exposure are pearl divers and underwater mine diggers. While low air pressure or hypobaric is usually in workers who are at an altitude such as mountains. This has the risk of causing physiological changes in the body associated with a decrease in the partial pressure of oxygen so that the pulse/cardiovascular system increases as compensation.
 - e) This climate also affects workers and can cause work-related illnesses with various complaints, such as heat stroke, namely the temperature rise to 45.50° C and there is a decrease in consciousness but this is rare. There are also heat cramps or the body loses a lot of salt so that it spasms in the arm or leg muscles. In addition, heat exhaustion is caused by dehydration or lack of fluids, causing nausea, cold, paleness, and increased pulse. As well as heat syncope where there is the accumulation of blood in the blood vessels of the lower skin and is usually marked fainting when too long in the sun.
- 2) Diseases due to work of biological factors are caused by viruses, bacteria, protozoa, fungi, worms, fleas, maybe even large animals or plants. Diseases caused by viruses such as the one that is currently happening, namely the Corona Virus. Sporotrichosis is an example of an occupational disease caused by a fungus. Candida albicans is a disease that usually attacks workers in humid areas. Worm parasites such as Ancylostoma often attack mining workers.

3) Work-related diseases due to ergonomics are diseases caused by the wrong work position and are carried out continuously while working, causing several healthy.

problems such as eye pain due to too long staring at the screen, low back pain in workers who sit up too much in front of the computer, as well as carpal tunnel syndrome in the hands of workers because they are too often.

4) Occupational illness due to psychological factors can be caused by various kinds, such as mistakes and violations. Errors can occur such as human error (human factor/forgetting), management error (stressful work environment), and technical error (inadequate condition of machine/equipment). Meanwhile, a violation is an error that is committed if the worker knows what to do but decides not to do what he knows.^{14 15 16}

J. Occupational Health Management

Occupational health surveillance is a process of continuous and systematic observation of the health of all employees and conditions in the work environment that increase the risk of occupational diseases by collecting data, analyzing, and disseminating information as well as follow-up efforts so that effective disease prevention and efforts can be carried out. improvement of working environment conditions. The purpose of occupational health surveillance is the availability of epidemiological data or information as a basis for research on occupational health and occupational health management for decision making in planning, implementing, monitoring, and evaluating occupational health programs and increasing awareness of occupational diseases.⁸

Surveillance in carrying out its duties has a system known as the Occupational Health Management Information System. For the development of an effective and efficient occupational health program in Indonesia, accurate, timely data and information are needed in an integrated and complete occupational health information system to support the planning process in the occupational health sector and determine further policy steps.

Some important elements in occupational health services are

- 1) Implementation of the main tasks of service
 - a) Pre-employment health checks, periodic and special
 - Pre-employment health checks include a complete physical examination, physical fitness, radiology, and routine laboratories as well as other examinations deemed necessary according to the type of work to be carried out.
 - Periodic health examinations. This health check aims to assess as early as possible the effects of the work or work environment. In addition, health checks on a regular basis are also aimed at assessing the effectiveness of the prevention efforts that have been carried out by the company. Periodic health checks should be held at least once a year.
 - Special health examination (specific health examination). This special health check needs to be carried out for workers who have just recovered from an illness or accident that requires more than a week of treatment, female workers, disabled workers, and young workers who do certain jobs. In addition, special occupational health checks are also given to workers whose health begins to be disturbed, workers who are about to enter retirement age with the aim of knowing whether there are health problems due to work.
 - b) Work Supervision
 - c) Guidance and supervision of the work environment (there are also facilities for workers who are breastfeeding in the form of breastfeeding rooms)
 - d) Guidance and supervision of sanitation equipment (there are clean water facilities, bathrooms, toilets, and sinks that are adapted to the location and number of workers)
 - e) Prevention and treatment of common diseases and occupational diseases (there are first aid kits and health workers or workers who have an understanding of first aid in the workplace)
 - f) Health education for the workforce (in the form of health education and promotion as well as the socialization of the company's occupational health program)
 - g) Provide advice on the planning and construction of the workplace
 - h) Selection of personal protective equipment
- 2) Implementation of occupational health services

The establishment and method of providing occupational health services depends on the number of workers and the level of danger in the workplace

- The number of workers is more than 500 people, health services are in the form of clinics. This clinic must be led by a doctor who practices every working day

- The number of workers is 200-500 people with a low level of danger, health services are in the form of clinics. Clinics must be open every working day, served by paramedics, and led by a doctor. Company doctors practice at least once every two days.

- - The number of workers is 200-500, the level of danger is high, health services are in the form of a clinic led by a doctor. Doctors are required to practice every working day.
- - The number of workers is 100-200 people, the level of danger is low. Health services are in the form of a clinic, open every working day, served by paramedics led by a doctor. Company doctors can practice every three days.
- - The number of workers is 100-200 people, the level of danger is high. Health services are in the form of a clinic, open every weekday, served by paramedics, led by a doctor, practicing every two days.
- - The number of workers is less than 100, health services together with other companies.¹⁷

Penutup

Occupational Health and Safety is an integral part of the labor system and human resources. Occupational Health and Safety is not only very important in improving the social security and welfare of its workers, but far from it. Occupational Health and Safety has a positive impact on the sustainability of work productivity.

Daftar Rujukan

1. Elvidge CD, Baugh KE, Anderson SJ, Sutton PC, Ghosh T. The Night Light Development Index (NLDI): A spatially explicit measure of human development from satellite data. *Soc Geogr.* 2012;7(1):23–35.
2. Kankaanpää E, Tulder M Van, Aaltonen M, Greef M De. Occupational safety and health. *Eng Min J.* 2007;(SUPPL.):14–6.
3. Suparmi, Kusumawardani N, Nambiar D, Trihono, Hosseinpoor AR. Subnational regional inequality in the public health development index in Indonesia. *Glob Health Action* [Internet]. 2018;11(sup1). Available from: <https://doi.org/10.1080/16549716.2018.1500133>
4. Molamohamadi Z. The Relationship between Occupational Safety, Health, and Environment, and Sustainable Development: A Review and Critique. *Int J Innov Manag Technol.* 2014;5(3).
5. Parks CI, Chikotas NE, Olszewski K. A Comprehensive Review of the Healthy People 2020 Occupational Safety and Health Objectives . *Workplace Health Saf.* 2012;60(1):33–42.
6. Mischke C, Verbeek JH, Job J, Morata TC, Alvesalo-Kuusi A, Neuvonen K, et al. Occupational safety and health enforcement tools for preventing occupational diseases and injuries. *Cochrane Database Syst Rev.* 2013;2013(8).
7. Clarke S, Robertson I. An examination of the role of personality in work accidents using meta-analysis. *Appl Psychol.* 2008;57(1):94–108.
8. Loushine TW, Hoonakker PLT, Carayon P, Smith MJ. Quality and safety management in construction. *Total Qual Manag Bus Excell.* 2006;17(9):1171–212.
9. World Health Organization. Laboratory Biosafety Manual, fourth edition, Monograph Personal protective equipment. 2020.
10. Shikdar AA, Sawaqed NM. Ergonomics, and occupational health and safety in the oil industry: A managers' response. *Comput Ind Eng.* 2004;47(2–3):223–32.
11. Anjum Munir, Muhammad Adeel Ashraf, Abdul Nasir, Oliver Hensel, Muhammad Iqbal. Ergonomics and Occupational Health in Sugar Industry of Pakistan. *Pakistan J Life Soc Sci.* 2012;10(1):74–9.
12. Peckham TK, Baker MG, Camp JE, Kaufman JD, Seixas NS. Creating a Future for Occupational Health. *Ann Work Expo Heal.* 2017;61(1):3–15.
13. Indriawati R, Darmawati I. Promosi kesehatan kerja pada pengrajin tenun. 2021;4(April):104–7.
14. Lastovkova A, Carder M, Rasmussen HM, Sjoberg L, De Groene GJ, Sauni R, et al. Burnout syndrome as an occupational disease in the European union: An exploratory study. *Ind Health.* 2018;56(2):160–5.
15. Dan K, Kerja K. Penerapan Zero Accident Melalui Penyuluhan. 2019;02(03):287–93.
16. Indriawati R, Syaifudin S. Relationship between Demographic Factors and Body Mass Index with the Prevention of Hypertension in Adolescents. *J Heal Promot Behav.* 2020;5(2):72–8.
17. Kerja M, Sikap DAN, Duduk K, Nyeri T. Masa Kerja Dan Sikap Kerja Duduk Terhadap Nyeri Punggung. *J Kesehat Masy.* 2013;9(1):9–14.