

Оглавление

Unit 1. ENVIRONMENTAL ENGINEERING. HAZARD ANALYSIS AND HAZARD PREVENTION.....	5
Unit 2. SAFETY IN TECHNOSPHERE	10
Unit 3. WHAT DOES A SAFETY ENGINEER DO?	15
Unit 4. FIRE SAFETY	20
Unit 5. SAFETY, HEALTH AND WELFARE ON THE CONSTRUCTION SITES	26
Unit 6. ROAD CONSTRUCTION.....	38
БИБЛИОГРАФИЧЕСКИЙ СПИСОК.....	51

**Unit 1. ENVIRONMENTAL ENGINEERING.
HAZARD ANALYSIS AND HAZARD PREVENTION**

1.1. Study the text about environmental engineers and make an outline of the article in the form of questions.

ENVIRONMENTAL ENGINEER

One of the main tasks of an environmental engineers is to protect public health by enhancing, protecting and preserving the environment. They also develop new forms of energy and study new ways to increase the efficiency of generating and using energy. The environmental engineers try to convert the energy consumption to environmentally friendly energy and products.

Environmental engineering is a field emphasizing several fields: environmental chemistry, process engineering, waste reduction, sanitary engineering and pollution prevention. It incorporates the following fields of knowledge and human activity: Agricultural Engineering; Biology; Chemical Engineering; Chemistry; Civil Engineering; Ecology; Geography; Geology; Hydrogeology; Public Health; Solid Waste; Hazardous Waste; Water Treatment; Wastewater Treatment; Statistics.

So, it offers lot of opportunities to work in any aspect of environmental protection. The major areas include air pollution control, hazardous waste management, industrial hygiene, land management, public health, radiation protection, solid waste disposal, storm water management, toxic materials control, water supply, wastewater management.

Working as an environmental engineer gives a stable salary, job awareness and personal satisfaction. Job of environmental engineers is always required, so, you will never be out of work. However, the work of an environmental engineer depends on the changes of government policy and the public's interests. You might work with wastewater, then for another time with solid waste and so on.

1.2. Learn more about the work of safety engineers. Before reading, find the English equivalents of these terms in the text and record them in your dictionary.

Определение потенциальных рисков, соблюдение стандартов безопасности, осмотр оборудования, порядок действий в аварийной ситуации, аварийные выключатели, система предупреждения об опасности, система сигнализации.

1.3. Match the parts of the sentences. Translate them into Russian.

A worksite analysis is	refers to both long-term and short-term risks associated with the work environment, and is an area of research in occupational safety and health and public health.
Workplace hazards	a combination of systematic activities to provide you with the information you need to recognize and understand the hazards and potential hazards of your workplace.

1.4. Read the text “Worksite analysis” and complete the task list by providing verbs with the nouns used in the text.

<i>Example: measure and identify</i>	<i>Exposures</i>
Reduce	
Isolate	
Eliminate	
Substitute	
Set up	

WORKINGSITE ANALYSIS

A work site analysis is an important first step that helps the industrial hygienist determine which jobs and workplaces are sources of potential problems. During the job site analysis, the industrial hygienist measures and identifies exposures, problem tasks, and risks. The most effective job site analysis includes all jobs, operations, and work activities. The industrial hygienist verifies, examines or analyzes how specific chemicals or physical hazards in that workplace affect worker health.

Industrial hygienists recognize that engineering, work practices, and administrative controls are the primary means of reducing workers' exposure to occupational hazards.

Engineering controls minimize employee exposure by reducing or eliminating hazards at the source or isolating the employee from the hazard. Engineering controls include eliminating toxic chemicals and replacing non-toxic chemicals, enclosing work processes or limiting work operations, and installing general and local ventilation systems.

Elements of **work practice controls** change the way the task is done. Some fundamental and easily implemented work practice controls include modifying existing work practices, regular inspection and maintenance of equipment, proper housekeeping procedures and supervision, prohibition of eating, drinking, smoking, gum or chewing tobacco, and use of cosmetics in regulated areas.

Administrative control includes controlling employee exposure by scheduling production and tasks, or both, in a way that minimizes exposure levels. For example, an employer may schedule operations with the greatest potential for exposure during periods when the least number of employees are present. When effective work practices or engineering controls are not possible, or as long as such controls are established, appropriate personal protective equipment must be used. Examples of personal protective equipment include gloves, safety glasses, helmets, safety shoes, protective clothing, and respirators.

1.5. Make an outline of the article in the form of questions.

1.6. Write a detailed summary of the article "Analysis of the worksite".

1.7. You are about to read the text "Chemical hazards". Learn the following terms before you read.

Particle — частица.

Solid — твердое тело.

Evaporation — испарение.

Liquid — жидкость.

Solvent — растворитель.

Contaminant — загрязняющее вещество.

CHEMICAL HAZARDS

They are usually classified as particulate matter or gaseous and vapor pollutants. The most common particulate pollutants include dust, vapors, mists, aerosols, and fibers. **Dust** is solid particles that are formed or derived from solid organic or inorganic materials by reducing their size through mechanical processes such as crushing, grinding, drilling, abrasion, or blasting.

Vapors are formed when material from vaporized solids condenses in cold air. In most cases, the solids produced by condensation react with air to form an oxide.

Fibers are solid particles that are several times longer than their diameter.

The term **fog** is applied to a finely divided liquid suspended in the atmosphere. Fogs are formed by liquids condensing from vapor back into a liquid or by the breakdown of a liquid into a dispersed state, such as splashing, foaming, or spraying. Aerosols are also a form of mist characterized by highly inhalable, tiny liquid particles.

Gases are formless liquids that expand to occupy the space or enclosure in which they are enclosed. Examples are welding gases such as acetylene, nitrogen, helium, and argon; and carbon monoxide produced in internal combustion engines or when used as a reducing gas in a heat treatment operation. Another example is hydrogen sulfide, which is produced wherever sulfur-containing materials are decomposed under reducing conditions.

Liquids are converted to vapor and mixed with the surrounding atmosphere by evaporation. Vapors are a volatile form of substances that are usually in a solid or liquid state at room temperature and pressure. They are formed by evaporation from a liquid or solid and can be found wherever parts are cleaned and painted and where solvents are used.

Airborne chemical hazards exist in the form of concentrations of mists, vapors, gases, vapors or solids. Some are toxic through breathing and some are irritating to the skin on contact; some may be toxic when absorbed through the skin or ingested, and some are corrosive to living tissue.

The extent of a worker's risk from exposure to any given substance depends on the nature and effectiveness of the toxic effects, as well as the magnitude and duration of the exposure.

1.8. Read about the biohazard and write out information about term of biohazard, occupations exposed to biohazards, methods to prevent biohazards.

BIOHAZARDS

The subject includes bacteria, viruses, fungi and other living organisms that can cause acute and chronic infections by entering the body either directly or through skin tears. Occupations that deal with plants or animals or their products, or with food products and the food industry, can expose workers to biological hazards. Laboratory and medical personnel may also be exposed to biohazards. Any occupations that bring workers into contact with body fluids pose a risk to workers because of biohazards.

In professions where animals are involved, biological hazards are addressed by preventing and controlling disease in the animal population.

As the proper care and handling of infected animals. In addition, effective personal hygiene, especially proper attention to minor cuts and scratches, especially on the hands and forearms, helps to minimize the worker's risks.

In occupations where there is potential exposure to biohazards, workers should observe proper personal hygiene, especially hand washing. Hospitals should provide adequate ventilation, proper personal protective equipment such as gloves and respirators, adequate systems for disposal of infectious waste, and proper controls, including isolation in cases of highly contagious disease.

1.9. Read about the physical hazards and fill in the chart.

The type of physical hazards	Methods to ensure the safety of workers

PHYSICAL HAZARDS

These include excessive levels of ionizing and non-ionizing electromagnetic radiation, noise, vibration, lighting and temperature.

In professions where there is exposure to ionizing radiation, time, distance, and shielding are important tools in keeping workers safe. The danger from radiation increases with the amount of time a person is exposed to it; therefore, the shorter the exposure time, the less the radiation danger.

Distance is also a valuable tool in controlling exposure to both ionizing and non-ionizing radiation. Radiation levels from some sources can be estimated by comparing the squares of the distances between the worker and the source.

Shielding is also a way to protect against radiation. The greater the shielding mass between the radioactive source and the worker, the lower the radiation exposure.

Noise, another significant physical hazard, can be controlled by various measures. Noise can be reduced by installing equipment and systems that have been designed, engineered, and built for quiet operation. Replacing noisy methods with quiet operation is another important way to reduce noise. In addition, treating floors, ceilings, and walls with acoustic material can reduce reflected or reverberant noise. In addition, erecting sound barriers at neighboring workstations around noisy operations will reduce the impact of noise generated by workers at neighboring workstations.

Noise exposure can also be reduced by increasing the distance between source and receiver, isolating workers in acoustic booths, limiting the time workers are exposed to noise, and providing hearing protection.

Radiant heat exposure in plants such as steel mills can be controlled by installing reflective screens and providing protective clothing.

1.10. Read about ergonomic hazards and write out information about types of ergonomic hazards, conditions that causing ergonomic hazards, measures preventing ergonomic hazards.

ERGONOMIC HAZARDS

Ergonomics studies and evaluates the full range of tasks, including lifting, holding, pushing, walking, and reaching. Many ergonomic problems result from technological changes, such as increased assembly line speed, the addition of specialized tasks, and increased repetition; some problems arise from poorly planned work tasks. Any of these conditions can cause ergonomic hazards such as excessive vibration and noise, eye strain, repetitive motion, and heavy lifting problems. Improperly designed tools or work areas can also be ergonomic hazards. Repetitive movements or repetitive shocks over long periods of time, as in jobs involving sorting, assembling and data entry, can often cause irritation and inflammation of the hands and arms.

Ergonomic hazards are avoided primarily through effective job or work site design and better-designed tools or equipment that meet the needs of workers in terms of the physical environment and work tasks. Through a thorough analysis of the work site, employers can establish procedures to correct or control ergonomic hazards through appropriate engineering controls; training in proper work practice; applying proper administrative controls, reducing production demands, and increasing Evaluating working conditions from an ergonomic perspective includes considering the general physiological and psychological demands of the job on the worker.

In general, industrial hygienists note that the benefits of a well-designed, ergonomic work environment can include increased efficiency, fewer accidents, lower operating costs, and more efficient use of personnel.

1.11. Read the text and prepare a brief summary of the text below.

AIR POLLUTION

Air pollution is the introduction of chemicals, particulate matter, or biological materials that harm or discomfort people or other living organisms or damage the natural environment into the atmosphere.

The atmosphere is a complex, dynamic natural gaseous system that is necessary to sustain life on planet Earth. The depletion of stratospheric ozone due to air pollution has long been recognized as a threat to human health as well as to Earth's ecosystems.

An air pollutant is known as a substance in the air that can harm people and the environment. Pollutants can be in the form of particulate matter, liquid droplets, or gases. They can also be natural or man-made.

Pollutants can be classified as primary or secondary pollutants. Typically, primary pollutants are substances directly emitted by a process, such as ash from a volcanic eruption, carbon monoxide gas from automobile exhaust, or sulfur dioxide emitted from factories.

Major primary pollutants from human activities include Sulfur oxides, Nitrogen oxides, Carbon dioxide, Volatile organic compounds, Particulate matter, Toxic metals, Ammonia, Odors and Radioactive contaminants.

1.12. Translate phrases into Russian. Mind prefixes.

Intercontinental communication, many unsolved problems, under unusual conditions, wrong shape, overcooling the substance, inaccurate quantity, impossible situation, misunderstanding the drawing, reassemble the model, reread the article, supernatural phenomenon, overheating the alloy, semiconductor materials, semiautomatic machine tools.

1.13. Use prefixes to form new words. Translate the words.

Sub	group, way, normal, tropical, divide
super	man, critical, cool, heat
inter	national, atomic, act, change, communication
over	work, boil, produce, value, to pay, pressure
semi	automatic, conductor, official, circle
re	construct, make, build, heat, produce
in	efficient, dependent, visible, complete, definite

1.14. Use suffixes given below to form nouns. Translate the words.

physics, social telegraph, special	ist
generate, escalate, construct, translate, act	or
transform, design, build, read, report, lecture	er
design, engineer, build, read, draw	ing
construct, illustrate, express	ion

1.15. Use the suffixes below to form adjectives. Translate the words.

use, help, power, motion, weight	less
help, wonder, use, power	ful
period, metre, atmosphere, base	ic
value, change, measure, compare	able
physics, nature, experiment, mathematics	al
import, resist	ant
differ, insist	ent

Unit 2. SAFETY IN TECHNOSPHERE

2.1. Read the definition of technosphere and decide which of two statements below characterizes this system.

Technosphere is the part of the physical environment affected through building or modification by humans.

- Evolution has resulted in efficient use of materials and energy in systems to build and break down functional materials in a steady state.
- Resources are exploited and unusable waste streams to soil, water, and air are produced.

2.2. Read the text “Emergency”. Before that, find English equivalents for these terms in the text and write them down into your dictionary.

Представлять непосредственную угрозу для здоровья, жизни, собственности или окружающей среды; срочное вмешательство; предотвращать ухудшение ситуации; уменьшение ущерба; последствия; реагирование в чрезвычайной ситуации.

2.3. Read the text and explain what the term “emergency” means is according to the text.

EMERGENCY

An emergency is a situation that poses an immediate risk to health, life, property or the environment. Most emergencies require urgent intervention to prevent the situation from worsening, although in some situations mitigating damage may not be possible, and agencies may only be able to offer assistance in coping.

While some emergencies are self-evident, many smaller incidents require the subjective opinion of an observer to decide whether it qualifies as an emergency. The exact definition of an emergency, the agencies involved, and the procedures used vary from jurisdiction to jurisdiction, and this is usually established by the government whose agencies (emergency services) are responsible for emergency planning and management.

To be defined as an emergency, an incident must be one of the following:

- immediate threat to life, health, property, or the environment;
- have already caused damage to life, health, property or the environment;
- have a high probability of escalating to cause an immediate threat to life, health, property, or the environment.

While most emergency services agree on the protection of human health, life, and property, the impact on the environment is not considered important enough for some agencies. This also extends to areas such as animal welfare, where some emergency agencies cover this element through the definition of “property”, where human-owned animals are at risk (although this does not extend to wildlife). This means that some agencies will not take emergency responses where it threatens wildlife or the environment, although others will **respond to** such incidents (e.g., oil spills at sea that pose a threat to marine life). The attitudes of the agencies involved are likely to reflect the prevailing view of the area government.

2.4. Make a summary of the text from exercise 2.3.

2.5. Read the text “Technogenic hazards”.

TECHNOGENIC HAZARDS

Technogenic hazards are a growing source of risk for people and their environment. This is a consequence of the globalization of production, the growth of industrialization and a certain level of risk of accidents related to production, processes, transportation and waste management. There have been serious accidents that have affected thousands of people. They have found expression in the public demand for technical and organizational tools to prevent and **mitigate the consequences of disasters**.

Structural collapse

Structural collapses are often caused by **engineering failures**. Bridge failures can be caused in several ways, such as **poor design**, corrosion, or aerodynamic deck flutter. Dam failures were not uncommon in the Victorian era, such as the failure of the Dale Dike Dam in Sheffield, England, in the 1860s, which caused the Great Flood. Other failures include the collapse of balconies or the collapse of buildings such as the World Trade Center.

Power outage

A power outage is an interruption of normal power supply sources. Short-term power outages (up to a few hours) are common and have no effect, as most businesses and **medical facilities** are prepared to deal with them. However, prolonged power outages can disrupt personal, business, and medical and rescue services, resulting in business losses and medical emergencies. A prolonged loss of power can lead to **civil unrest**, as in New York City in 1977. Power outages are often associated with other types of disasters, such as hurricanes and floods, which complicate relief **actions**.

Fire

Forest fires, wildfires, and mine fires are usually started by lightning, but also by **human carelessness or arson**. They can burn thousands of square kilometers. If the fire intensifies enough to produce its own winds and “weather”, it will turn into a firestorm.

Casualties from fires, regardless of their source or initial cause, can be exacerbated by inadequate **emergency preparedness**. Hazards such as lack of **accessible emergency exits**, poorly marked **escape routes**, or improperly maintained **fire extinguishers** can result in far more deaths and injuries than can occur with such protection.

Radiation contamination

When nuclear weapons are detonated or nuclear deterrence **systems are abused**, radioactive particles in the air (nuclear fallout) can disperse and irradiate large areas. This is not only deadly, but also has long-term effects on the next generation for those who are contaminated. Ionizing radiation is dangerous to living things, in which case much of the affected area may not be safe for human habitation.

Chemical contamination

Many technological risks are associated with **the release of hazardous substances** that can affect human health or the environment through contamination in an emergency or with the production of such substances under certain conditions, such as fire.

Given the number and distribution of facilities using hazardous materials around the world and the risks they pose to society and the environment, this should be considered a growing global problem.

Transportation accidents

Road accidents are the leading cause of death, and road pollution poses a significant health hazard, especially in large agglomerations. The greenhouse effect of automobile transportation is a large part of the effect of anthropogenic warming, and the rapid consumption of fossil fuels is accelerating Hubbard's peak.

2.5. Find the English equivalents of these terms in the text and put them into your dictionary.

Столкновение на дороге, смертельные или тяжелые травмы, разлив нефти, разрыв трубопровода, взрыв, выброс опасных материалов, доступные аварийные выходы, пути эвакуации, огнетушители, готовность к чрезвычайным ситуациям, инженерная ошибка, медицинские учреждения и оборудование, усилия по оказанию помощи, недостаточный запас прочности, отключение электроэнергии, неправильная эксплуатация системы, серьезная авария, предотвращение катастроф, снижение ущерба.

2.6. Match the words from list (1–12) to the words from list (a–l).

- | | |
|----------------|-----------------|
| 1) escape | a) substances |
| 2) urgent | b) risk |
| 3) emergency | c) facilities |
| 4) civil | d) intervention |
| 5) hazardous | e) negligence |
| 6) engineering | f) response |
| 7) human | g) collision |
| 8) accessible | h) exit |
| 9) immediate | i) disorder |
| 10) health | j) route |
| | k) failure |
| | l) extinguisher |

2.8. Complete the sentences using key words in the gaps.

1. A situation that presents _____ to people or the environment is called an emergency.
2. _____ can reduce damage and save lives.
3. Emergency agencies are organized to provide quick and efficient _____.
4. The collapse of the Tay Bridge was caused by _____.
5. _____ can lead to many serious accidents such as fires and equipment failure.
6. Chemical pollution is due to the release of _____.
7. Every building must have _____ for people to escape in case of fire emergency.
8. The main cause of traffic accidents is _____.
9. _____ is an active fire protection device used to control small fires, often in emergency situations.
10. Sometimes emergencies can be caused by _____.

2.9. Speak about causes and consequences of man-made accidents.

2.10. Write a summary of the text (see exercise 2.6).

2.11. Study the following the text.

EMERGENCY MANAGEMENT

Specialists determine 4 phases in emergency management.

Mitigation

Mitigation efforts are attempts to prevent hazards from escalating into disasters in general or to reduce the effects of disasters. The mitigation phase differs from the other phases in that it focuses on long-term measures to reduce or eliminate risk. Mitigation measures can be structural or nonstructural. Structural measures use technological solutions, such as flood dams. Non-structural measures include legislation, land use planning (e.g., excluding non-essential land such as parks for use as flood zones), and insurance. Mitigation is the most cost-effective method of reducing the impact of hazards, although it is not always the most appropriate. Mitigation includes providing rules regarding evacuation, sanctions against those who refuse to obey the rules, and informing the public about the risks.

Readiness

Readiness is a continuous cycle of planning, managing, organizing, training, equipping, implementing, creating, monitoring, evaluating, and improving the ability of organizations to prevent, protect, respond to, and recover from natural disasters, terrorist attacks, and other man-made disasters. Another aspect of readiness is predicting casualties, examining how many deaths or injuries to expect for a given type of event. This gives planners an idea of what resources need to be in place to respond to a particular type of event.

Response

The response phase involves mobilizing the necessary emergency services and first responders in the disaster area to provide first aid and rapid rescue. This is likely to include the first wave of primary emergency services such as fire, police and ambulance crews. These may be supported by a number of secondary emergency services, such as specialized rescue teams. There is a need for both discipline (structure, doctrine, process) and agility (creativity, improvisation, adaptability) in responding to a disaster.

Recovery

The goal of the recovery phase is to restore the affected area to its former state. It differs from the response phase in its focus; recovery efforts relate to the issues and decisions that must be made after immediate needs are met. Recovery efforts are primarily concerned with actions to restore destroyed property, reemployment, and repair other necessary infrastructure. An important aspect of effective recovery efforts is to use the window of opportunity to implement mitigating measures that might otherwise be unpopular. Citizens of the affected area are more likely to accept more mitigating changes when the recent disaster is fresh in their minds.

2.12. Write a summary of the text from exercise 2.11.

2.13. Fill in the table with the information about the text.

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