ДОНСКОЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

УПРАВЛЕНИЕ ДИСТАНЦИОННОГО ОБУЧЕНИЯ И ПОВЫШЕНИЯ КВАЛИФИКАЦИИ

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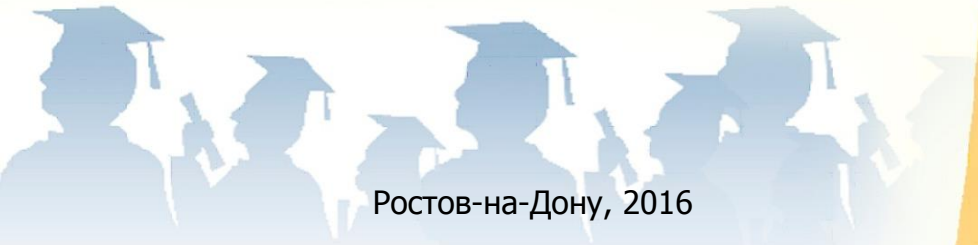
Авторы
Панкова В.В.,
Шелковникова С.В.



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Аннотация

Данное учебное пособие предназначено для студентов направления 20.03.01 «Техносферная безопасность», изучающих английский язык, а также для студентов, получающих дополнительное образование в сфере профессиональной коммуникации.

Цель пособия – расширение активного словарного запаса, приобретение навыков профессионально-ориентированного чтения и коммуникации на английском языке. Тексты, представленные в пособии, отражают современные взгляды на основные тенденции в сфере техносферной безопасности, защиты окружающей среды и взяты из аутентичных источников.

Авторы

к.филол.н., доцент В.В.Панкова
ст. преподаватель С.В.Шелковникова

Оглавление

PART 1 MAN AND ENVIRONMENT

Unit 1Air pollution

Text 1 Air pollution and pollutants

Air pollution is the introduction of particulates, biological molecules, or other harmful materials into Earth's atmosphere, causing diseases, death to humans, damage to other living organisms such as animals and food crops, or the natural or built environment. Air pollution may come from anthropogenic or natural sources.

The atmosphere is a complex natural gaseous system that is essential to support life on planet Earth. Stratospheric ozone depletion due to air pollution has been recognized as a threat to human health as well as to the Earth's ecosystems.

Indoor air pollution and urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. According to the 2014 WHO report, air pollution in 2012 caused the deaths of around 7 million people worldwide.

An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. The substance can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

Causes and effects of air pollution are: (1) greenhouse effect, (2) particulate contamination, (3) increased UV radiation, (4) acid rain, (5) increased ground level ozone concentration, (6) increased levels of nitrogen oxides. [6]

Smog Pollution in Taiwan

Answer the following questions to the text above.

1. What is air pollution**?**

2. What are the world's worst toxic pollution problems nowadays?

3. How can air pollutants be classified?

4. Is carbon monoxide gas a pollutant of natural origin?

Text 2 Sources of Air pollution

There are various locations, activities or factors which are responsible for releasing pollutants into the atmosphere. These sources can be classified into two major categories.

Anthropogenic (man-made) sources:

These are mostly related to the burning of multiple types of fuel.

• Stationary sources include smoke stacks of power plants, manufacturing facilities (factories) and waste incinerators, as well as furnaces and other types of fuel-burning heating devices. In developing and poor countries, traditional biomass burning is the major source of air pollutants; traditional biomass includes wood, crop waste and dung.

• Mobile sources include motor vehicles, marine vessels, and aircraft.

• Controlled burn practices in agriculture and forest management. Controlled or prescribed burning is a technique sometimes used in forest management, farming, prairie restoration or greenhouse gas abatement. Fire is a natural part of both forest and grassland ecology and controlled fire can be a tool for foresters. Controlled burning stimulates the germination of some desirable forest trees, thus renewing the forest.

• Fumes from paint, hair spray, varnish, aerosol sprays and other solvents

• Waste deposition in landfills, which generate methane. Methane is highly flammable and may form explosive mixtures with air. Methane is also an asphyxiantand may displace oxygen in an enclosed space. Asphyxia or suffocation may result if the oxygen concentration is reduced to below 19.5% by displacement.

• Military resources, such as nuclear weapons, toxic gases, germ warfare and rocketry

Naturalsources:

• Dust from natural sources, usually large areas of land with little or no vegetation

• Methane, emitted by the digestion of food by animals, for example cattle

• Radon gas from radioactive decay within the Earth's crust. Radon is a colorless, odorless, naturally occurring, radioactive noble gas that is formed from the decay of radium. It is considered to be a health hazard. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement and it is the second most frequent cause of lung cancer, after cigarette smoking.

• Smoke and carbon monoxide from wildfires

• Vegetation, in some regions, emits environmentally significant amounts of Volatile organic compounds (VOCs) on warmer days. These VOCs react with primary anthropogenic pollutants—specifically, NO_x, SO_2, and anthropogenic organic carbon compounds — to produce a seasonal haze of secondary pollutants.Black gum, poplar, oak and willow are some examples of vegetation that can produce abundant VOCs. The VOC production from these species result in ozone levels up to eight times higher than the low-impact tree species.

• Volcanic activity, which produces sulfur, chlorine, and ash particulates

Health effects

Air pollution is a significant risk factor for a number of health conditions including respiratory infections, heart disease, stroke and lung cancer. The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing, asthma and worsening of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency room visits, more hospital admissions and premature death. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and genetics. Children aged less than five years that live in developing countries are the most vulnerable population in terms of total deaths attributable to indoor and outdoor air pollution.

Historical disasters

The world's worst short-term civilian pollution crisis was the 1984 Bhopal Disaster in India. Leaked industrial vapours from the Union Carbide factory, belonging to Union Carbide, Inc., U.S.A. killed at least 3787 people and injured anywhere from 150,000 to 600,000. The United Kingdom suffered its worst air pollution event when the December 4 Great Smog of 1952 formed over London. In six days more than 4,000 died and more recent estimates put the figure at nearer 12,000. An accidental leak of anthrax spores from a biological warfare laboratory in the former USSR in 1979 near Sverdlovskis believed to have caused at least 64 deaths.The worst single incident of air pollution to occur in the US occurred in Donora, Pennsylvania in late October, 1948, when 20 people died and over 7,000 were injured.[6]

Answer the following questions to the text above.

1. How can the sources of air pollution be classified?
2. Is radon gas very harmful for human health?
3. What are the health effects caused by air pollution?
4. What age groups are more vulnerable?
5. Do you know any accidents connected with air pollution in our country?

UNIT 2Water pollution

Text 1Watercycle

1. Before you read the passage, talk about these questions.

1 What are some processes that happen in the water cycle?

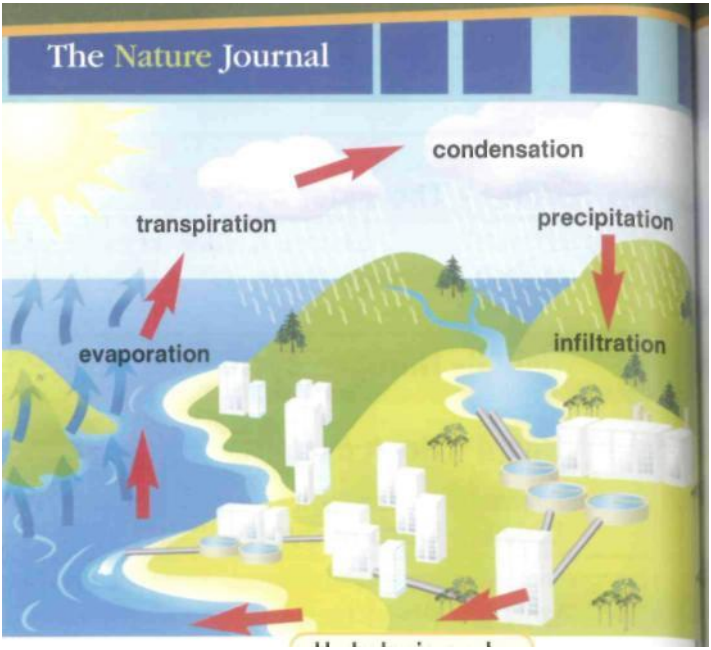
2 What is snow a form of?

2 . Read the article. Then, mark the following statements as true (T) or false (F).

1. Water carries pollution from one place to another.

2. Evaporation and transpiration produce thesame state of water.

3. Advection prevents water from precipitating.



Fresh water is a limited resource. All water is recycled in the atmosphere through the water cycle, or hydrologic cycle. Water pollution in one area can quickly reach other places around the globe.

Water travels around the Earth in different states. We are

most aware of water as a liquid. This is the form that fills oceans and rivers. During the water cycle, the liquid becomes a vapor. It then rises into the atmosphere. It does this through evaporation from the ground or transpiration from plants. Ice can become vapor through sublimation. Then, condensation turns it into a liquid again in the clouds. The liquid eventually falls back to the Earth as precipitation.

During the cycle, water constantly undergoes advection. Rising vapor in one area often precipitates somewhere else. If water contains any pollutants, they are likely to spread. Pollution gets into the groundwater through infiltration. During its residence time in aquifers, polluted water often contaminates surrounding soil.[5]

3.Match the words (1-7) with the definitions (A-G).

1	infiltration	5	condensation
2	sublimation	6	water cycle
3	evaporation	7	residence time
4	transpiration		

A the process of turning from solid ice into vapor

B the process of turning from vapor into liquid

C the process of purifying and distributing water around the Earth

D the process of being released as vapor from plants

E the period spent in a particular place

F the process of turning from groundwater to vapor

G the process of passing into the ground

4.**Place the words and phrases from the word bank under the correct heading.**

advectionaquifer liquid vapor hydrologic cycle

Forms of water	
Movement of water	
Storage of water	

Text 2Water pollution

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). This form of environmental degradation occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds.

Water pollution affects the entire biosphere – plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and population, but also to the natural biological communities.

Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels. It has been suggested that water pollution is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated 580 people in India die of water pollution related illness every day. About 90 percent of the water in the cities of China is polluted. As of 2007, half a billion Chinese had no access to safe drinking water. In addition to the acute problems of water pollution in developing countries, developed countries also continue to struggle with pollution problems. For example, in the most recent national report on water quality in the United States, 45 percent of assessed stream miles, 47% of assessed lake acres, and 32 percent of assessed bays and estuarine square miles were classified as polluted. The head of China's national development agency said in 2007 that one quarter the length of China's seven main rivers were so poisoned the water harmed the skin.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

Although interrelated, surface water and groundwater have often been studied and managed as separate resources. Surface water seeps through the soil and becomes groundwater. Conversely, groundwater can also feed surface water sources.[6]

The litter problem on the coast of Guyana, 2010

Answer the following questions:

1. What does water pollution affect?
2. Is it a global or mostly local problem?
3. What countries are the most polluted ones?
4. What influences the ecological status of water?
5. How is surface water connected with groundwater?

Grammar revision

The Participle

В английском языке различают два причастия: причастие I и причастие II. Причастие II является страдательным причастием прошедшего времени:

e.g. polluted – загрязненный. Причастие I имеет одну простую и три сложных формы.

	Active	Passive
Simple	growing (выращивая, выращивающий)	Beinggrown (выращиваемый, будучи выращенным)
Perfect	Havinggrown (вырастив)	Havingbeengrown (после того, как вырастили; когда вырас-или; так как вырастили)

Простая форма указывает на то, что действие, выраженное причастием, происходит одновременно с действием, выраженным сказуемым.

Перфектная форма причастия I указывает на то, что действие, выраженное причастием, предшествовало действию, выраженному сказуемым.

Причастие I в страдательном залоге выражает действие, которое испытывает на себе лицо или предмет. На русский язык обороты со сложными формами причастия переводятся обычно придаточными обстоятельственными предложениями с союзами *когда, так как, после того как* и т.д.

The Participial Constructions

Причастные обороты

Причастия вместе с относящимися к ним словами образуют причастные обороты. Сочетание существительного или местоимения в объектном падеже с причастием настоящего или прошедшего времени представляет собой объектный причастный оборот.

1. Объектныйпричастныйоборот – The Objective Participial Construction – употребляетсяпослеглаголов *to see, to hear, to feel, to find, to keep, to notice* и т.д.

В предложении этот оборот выступает в функции сложного дополнения и обычно переводится на русский язык придаточным предложением.

e.g. He saw the students working in the laboratory.

2. Абсолютный причастный оборот–

TheAbsoluteParticipialConstruction – представляет собой сочетание причастия с существительным в общем падеже, которое является субъектом действия, выраженного причастием. На русский язык данный оборот переводится придаточным предложением с союзами так как, после того, как, если, когда. Если оборот стоит в конце предложения, то он переводится самостоятельным предложением с союзами а, причем, в то время как.

e.g. Withresearchinvolvingmoreandmorepeople, theprofessionof a scientisthasbecomeoneofthemostpopularnowadays. – Так как научные исследования вовлекают все больше и больше людей, сегодня профессия ученого стала одной из самых популярных. [1]

Ex.1 Find Participles I and II in Texts 1 and 2above, define their forms and translate them into Russian.

Text 3 Types of Water Pollution

Pointsources

Point source water pollution refers to contaminants that enter a waterway from a single, identifiable source, such as a pipe or ditch. Examples of sources in this category include discharges from a sewage treatment plant, a factory, or a city storm drain. The U.S. Clean Water Act (CWA) defines point source for regulatory enforcement purposes. The CWA definition of point source was amended in 1987 to include municipal storm sewer systems, as well as industrial storm water, such as from construction sites.

Non-point sources

Nonpoint source pollution refers to diffuse contamination that does not originate from a single discrete source. NPS pollution is often the cumulative effect of small amounts of contaminants gathered from a large area. A common example is the leaching out of nitrogen compounds from fertilized agricultural lands. Nutrient runoff in storm water from "sheet flow" over anagricultural field or a forest are also cited as examples of NPS pollution.

Contaminated storm water washed off of parking lots, roads and highways, called urban runoff, is sometimes included under the category of NPS pollution. However, because this runoff is typically channeled into storm drain systems and discharged through pipes to local surface waters, it becomes a point source.

Groundwater pollution

Interactions between groundwater and

surface water are complex. Consequently, groundwater pollution, also referred to as groundwater contamination, is not as easily classified as surface water pollution.By its very nature, groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies, and the distinction of point vs. non-point source may be irrelevant. A spill or ongoing release of chemical or radionuclide contaminants into soil (located away from a surface water body) may not create point or non-point source pollution but can contaminate the aquifer below, creating a toxic plume. The movement of the plume, called a plume front, may be analyzed through a hydrological transport model or groundwater model. Analysis of groundwater contamination may focus on soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants.

Causes

The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese, etc.) the concentration is often the key in determining what is a natural component of water and what is a contaminant. High concentrations of naturally occurring substances can have negative impacts on aquatic flora and fauna.

Oxygen-depleting substances may be natural materials such as plant matter

(e.g. leaves and grass) as well as man-made chemicals. Other natural and anthropogenic substances may cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogs the gills of some fish species.

Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts. Alteration of water's physical chemistry includes acidity (change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases in the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia (oxygen depletion) and severe reductions in water quality may occur, affecting fish and other animal populations.

Pathogens

Disease- causing microorganisms are

referred to as pathogens. Although the vast majority of bacteria are either harmless or beneficial, a few pathogenic bacteria can cause disease. Coliform bacteria, which are not an actual cause of disease, are commonly used as a bacterial indicator of water pollution.

High levels of pathogens may result from on-site sanitation systems (septic tanks, pit latrines) or inadequately treatedsewage discharges. This can be caused by a sewage plant designed with less than secondary treatment (more typical in less-developed countries). In developed countries, older cities with aging infrastructure may have leaky sewage collection systems (pipes, pumps, valves), which can cause sanitary sewer overflows. Some cities also have combined sewers, which may discharge untreated sewage during rain storms.Pathogen discharges may also be caused by poorly managed livestock operations.

Thermal pollution

Thermal pollution is the rise or fall in the temperature of a natural body of water caused by human influence. Thermal pollution, unlike chemical pollution, results in a change in the physical properties of water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen levels, which can kill fish and alter food chain composition, reduce species biodiversity, and foster invasion by new thermophilic species.Urban runoff may also elevate temperature in surface waters.Thermal pollution can also be caused by the release of very cold water from the base of reservoirs into warmer rivers.[6]

Ex.1 Answer the following questions.

1. What are point sources of water pollution?
2. What are non-point sources of water pollution?
3. What do the specific contaminants leading to pollution in water include?
4. Do high concentrations of naturally occurring substances have positive or negative impactson aquatic flora and fauna?
5. What may high levels of pathogens result from?
6. How can thermal pollution be defined?
7. How can it be caused?

Ex.2 Review the text above.

Text 4 Control of pollution

Decisions on the type and degree of treatment and control of wastes, and the disposal and use of adequately treated wastewater, must be based on a consideration all the technical factors of each drainage basin, in order to prevent any further contamination or harm to the environment.

Sewagetreatment

In urban areas of developed countries, domestic sewage is typically treated by centralized sewage treatment plants. Well-designed and operated systems can remove 90 percent or more of the pollutant load in sewage. Some plants have additional systems to remove nutrients and pathogens.

Cities with sanitary sewer overflows or combined sewer overflows employ one or more engineering approaches to reduce discharges of untreated sewage, including:

- utilizing a green infrastructure approach to improve storm water management capacity throughout the system, and reduce the hydraulic overloading of the treatment plant
- repair and replacement of leaking and malfunctioning equipment
- increasing overall hydraulic capacity of the sewage collection system.

A household or business not served by a municipal treatment plant may have an individual septic tank, which pre-treats the wastewater on site and infiltrates it into the soil.

Industrial wastewater treatment

Some industrial facilities generate ordinary domestic sewage that can be treated by municipal facilities. Industries that generate wastewater with high concentrations of conventional pollutants (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or other non-conventional pollutants such as ammonia, need specialized treatment systems. Some of these facilities can install a pre-treatment system to remove the toxic components, and then send the partially treated wastewater to the municipal system. Industries generating large volumes of wastewater typically operate their own complete on-site treatment systems. Some industries have been successful at redesigning their manufacturing processes to

reduce or eliminate pollutants, through a process called pollution prevention.

Heated water generated by power plants or manufacturing plants may be controlled with:

- cooling ponds, man-made bodies of water designed for cooling by evaporation, convection, and radiation
- cooling towers, which transfer waste heat to the atmosphere through evaporation and/or heat transfer
- cogeneration, a process where waste heat is recycled for domestic and/or industrial heating purposes.

Agricultural waste water treatment

Sediment (loose soil) washed off fields is the largest source of agricultural pollution in the United States. Farmers may utilizeerosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian buffers.

Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercial fertilizer, animal manure, or spraying of municipal or industrial wastewater (effluent) or sludge. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, and atmospheric deposition. Farmers can develop and implement nutrient management plans to reduce excess application of nutrientsand reduce the potential for nutrient pollution.

To minimize pesticide impacts, farmers may use Integrated Pest Management (IPM) techniques (which can include biological pest control) to maintain control over pests, reduce reliance on chemical pesticides, and protect water quality.

Farms with large livestock and poultry operations, such as factory farms, are called *concentrated animal feeding operations* or *feedlots* in the US and are being subject to increasing government regulation. Animal slurries are usually treated by containment in anaerobic lagoons before disposal by spray or trickle application to grassland. Constructed wetlands are sometimes used to facilitate treatment of animal wastes. Some animal slurries are treated by mixing with straw and composted at high temperature to produce a bacteriologically sterile and friable manure for soil improvement.[6]

Mark the following statements as true (T) or false (F).

1. In urban areas of developed countries, domestic sewage is typically treated by centralized sewage treatment plants.
2. Well-designed and operated systems can

remove 80 percent or more of the pollutant load in sewage.

3. Industries that generate wastewater with high concentrations of conventional pollutants , toxic pollutants or other non-conventional pollutants such as ammonia, do need specialized treatment systems.

4. Sediment washed off fields is the largest source of agricultural pollution in the United States.

5. Constructed wetlands are sometimes used to facilitate treatment of animal wastes.

6. Cooling towers are used for cooling by evaporation, convection, and radiation.

Grammar revision

The Gerund

Герундий – одна из неличных форм глагола, которая образуется с помощью добавления суффикса **– ing**к инфинитиву.

to write – writing

to swim – swimming

Формы герундия

Tense/Voice	**Active**	**Passive**
Non-Perfect	reducing	being reduced
Perfect	having reduced	having been reduced

Герундий может переводиться на русский язык существительным, инфинитивом, деепричастием, глаголом в личной форме и придаточным предложением. [1]

e.g. **Recycling** materials help stoprotecttheenvironment. – Переработка материалов помогает защищать окружающую среду.

I like **doing** research. - Я люблю проводить исследования.

Youcan'tbreedthisspeciesinthispondwithout**carrying**outchemical analysisofthewater. – Вынеможетеразводитьэтотвидвэтомводоеме, непроведяхимическогоанализаводы.

Ex.1. Find the examples of gerund in text 2. Translate them into Russian.

UNIT 3 Environmental issues in Russia

Text 1 Main environmental problems in Russia.

There are numerous environmental issues in Russia. Many of the issues have been attributed to policies during the Soviet Union, a time when officials felt that pollution control was an unnecessary hindrance to economic development and industrialization. As a result, 40% of Russia's territory began demonstrating symptoms of significant ecological stress by the 1990s, largely due to a diverse number of environmental issues, including deforestation, energy irresponsibility, pollution, and nuclear waste.

Several species, such as the Siberian tiger, are at risk of extinction.

Wildlife

Russia has many protected areas, such as zapovedniks(conservation areas) and natural parks, which are made to preserve the natural state of environments. There are currently 101 zapovedniks that cover a total of over 33.5 million hectares.However, some animals, such as the Amur tiger, polar bear and Caucasian leopard, are facing extinction. The Russian government is attempting to revive those populations.A tiger summit was held in St. Petersburg in 2010 to discuss how to save the dwindling tiger population, which is threatened by deforestation and poaching in Russia.

Deforestation

Excessive logging is causing the widespread deforestation of certain areas of Russia.Despite efforts of Russian authorities to preserve forests using nature reserves and parks, funding for park rangers is lacking, limiting the protection of forests. Illegal logging is also widespread, especially in the north-west and in the Far East parts of Russia. It is estimated that Russia loses $1 billion every year due to illegal logging. According to the Center for Russian Environmental Policy, 16 million hectares of forest are lost each year to a variety of causes, including logging, pollution and fires. Inefficient logging and clear cutting strategies result in 40% of harvested trees never being used, and the implementation of forest protection policies has been slow.

Energy

Inefficient energy usage and the use of fossil fuels is another environmental issue that Russia faces. The Ministry of Fuels and Energy stated that upgrading energy sector equipment could cut carbon emissions by 25%, and the Energy Research Institute predicts that such measures could save up to $1 billion of fuel every year. 68% of Russia's energy is produced by polluting fossil fuels, and it is a large producer of those fuels.[6]

Nuclear energy

Nuclear power plants (such as the pictured Novovoronezh Nuclear Power Plant (NPP) near the city of Novovoronezh) in Russia present many dangers to Russia's environment.

Nuclear energy is widely used in Russia, and there are currently 31 operating nuclear reactors. However, several of these, such as the one at the Kola NPP, are past their lifespanand have a higher probability of nuclear accidents. Instead of being decommissioned, they are still being used. The disposal of nuclear waste is also an issue, due to a lack of funding. Unsafe dumping methods are sometimes used to get rid of nuclear waste, which was dumped into the Sea of Japan until 1993.The Commission of Ecological Security, founded in 1994, helped bring the dumping of nuclear waste into ocean to the public's attention. It is estimated that bringing nuclear safety levels to official standards would cost $26 billion.

The testing and production of nuclear weapons also had an effect on the environment, such as at the Mayak nuclear weapons production plant near Chelyabinsk.

Water pollution

Water pollution is a serious problem in Russia, and 75% of surface water and 50% of all water in Russia is now polluted. This has caused health issues in many cities as well as in the countryside,

as only 8% of wastewater is fully treated prior to being returned to waterways. Obsolete and inefficient water treatment facilities, as well as a lack of funding, have caused heavy pollution, and has also resulted in waterborne disease spread, such as an outbreak of cholera spread by the Moskva River in 1995. Industrial and chemical waste is often dumped into waterways, including hydrogen sulfide, which has been linked to the large-scale death of fish in the Black and Caspian seas. Lake Baikal was previously a target of environmental pollution from paper plants, but cleanup efforts since then have greatly reduced the ecological strain on the lake.

Air pollution

Russia's air is among the most polluted in the world, although its quality has been improving since the 1990s. 43.8 million tons of pollutants were released into open air in 1993, of which 24.8 million came from industry and 19 million came from vehicles. Moscow, St. Petersburg, Yekaterinburg and Volgograd, as well as other major industrial and population centers, are the highest concentrations of air pollution. Overall, over 200 cities in Russia exceed pollution limits, and this is increasing as more vehicles appear on the roads. Before the 1990s, most air pollution came from industries. When industrial production declined, emissions of air pollutants from those sources also declined, although the amount of motor vehicles on the roads skyrocketed. Currently, vehicle emissions exceed industry emissions in most Russian cities. Air pollution is attributed to 17% of childhood and 10% of adult diseases, as well as 41% of respiratory and 16% of endocrine diseases. [6]

Ex.1 Answer the following questions.

1. How many conservation areas are there in Russia?
2. How is the Russian government trying to revive the population of rare animals?
3. What damage is done byillegal logging every year?
4. How much of Russia's energy is produced by polluting fossil fuels?
5. Is nuclear energy widely used in Russia?
6. What have caused heavy water pollution?
7. What are the causes of the large-scale death of fish in the Black and Caspian seas?
8. What Russian cities have the highest concentrations of air pollution?
9. Are industry emissions the greatest cause of

air pollution in most Russian cities?

Ex.2 Review Text 1

Text 2 Other forms of pollution

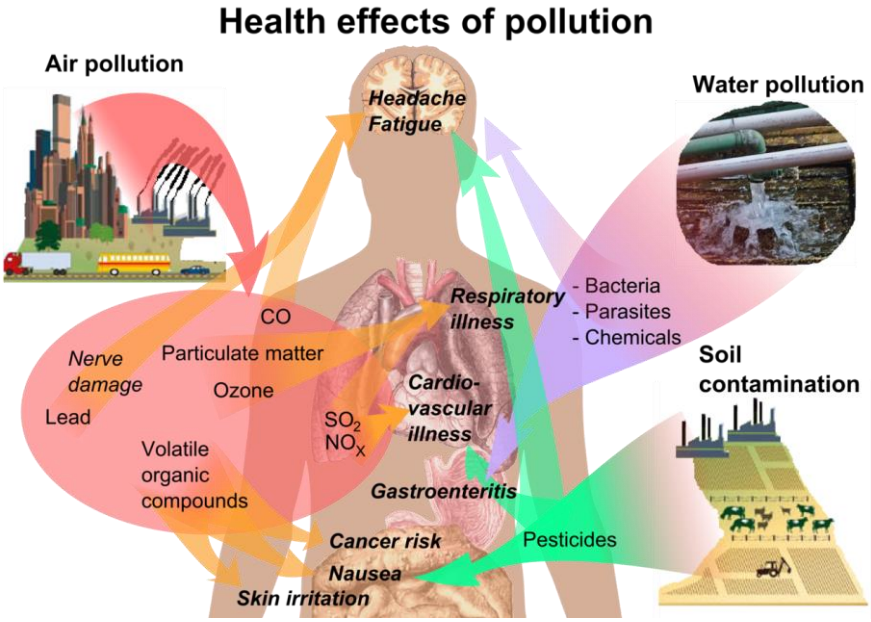
Ex.1 Read the following text and give its summary in 3-4 sentences.

Soil erosion

Snow run-off has caused substantial erosion in pastures and croplands in northern Russia, particularly near the Ural Mountains. In parts of southern Russia, overgrazing and deforestation has resulted in large plots of bare soil which are highly susceptible to wind erosion.

While Russia possesses vast mineral and energy wealth, this does not come without some price both to Russia and to the greater globe. Particularly, oil and gas extraction exacts a heavy cost to the health of the land and people. Drilling waste water, mud, and sludges are accumulated, annual volumes have been estimated at 1.7 million tons of chemical reagents contaminating 25 million cubic meters of topsoil. Considerable geomechanical disturbances, contamination of soils and water, and multiple increases of contaminated waste water ejected into surface water streams, is a serious problem offsetting Russia's profits from the industry. It has been estimated that between 1991-1999 the volume of contaminated waste waters from the Russian oil industry amounted to 200 million cubic meters. Complete utilization of co-extracted gas in oil extraction does not exceed 80% in Russia, it has been variously estimated that annually 5-17 billion cubic meters of un-utilized gas extracted alongside oil is burnt in "gas torches," with 400,000 tons or more hazardous substances released into the atmosphere from this each year, creating the double impact of wasted resource and negative environmental effect. 560 million tons of methane is estimated to leak annually into the atmosphere from oil and gas extraction, not counting accidental outbursts and pipe breakage.Other valuable industries also have their costs, such as the coal industry's release of vast quantities of hazardous, toxic, and radioactive materials. Also the Russian gold industry, with Russia being the only nation for at least a century with high extraction of gold from placer deposits, and having 4000 large deposits, inevitably creates problems for the river systems. The associated pollution from using mass explosions in mining also can be a problem.Overall, the extensive mineral wealth and riches, brings with it both great benefit to the Russian economy & people, and the greater globe and all people, yet also several difficult problems to be dealt with. [6]

Ex.2 Study the following chart and prepare a short talk on health effects of pollution.



Grammar revision
The Passive Voice
to be + Past Participle

Present Simple	**am** **is** **are**	
Past Simple	**was** **were**	
Future Simple	**Will be**	
Present Progressive	**am being** **is being** **are being**	
Past Progressive	**Was being** **Were being**	

Present Perfect	**Have been** **Has been**	**Participle II** **(Verb-ed; Verb 3)**
Past Perfect	**Had been**	

1. Make the following sentences Passive.

1. World industry pollutes the atmosphere with dust and chemical waste.
2. People kill millions of animals everyyear:
3. For thousands of years humans have tried falcons to hunt other birds.
4. Now the Chinese government protects the panda, so itshould survive.
5. 159 countries have set up environmental agencies. .
6. All students in Britain study the course of environmental protection.
7. People cut down rainforests to provide land, paper, wood, medicines.

2. Make the following sentences Active.

1. The complex interrelations between living organisms and the environment are studied by ecology.
2. Nature is compared to a complex household in which every one has a specific job.
3. Some 40 percent of tropical rainforests have already been destroyed by people.
4. Ecological problems were specially discussed by scientists at the last congress.
5. It cannot be denied that the price for industrial development is very high: the ecological balance of the planet is disturbed.
6. The falcon is stillnot protected in some European countries.
7. The Baltic Sea is surrounded by seven industrial countries.

3. Fill in the blanks with the suitable words in the following list.

animals, pollute, environment, waste, pollution, substances,

ecological,
danger

1. We are doing enough to protect ... frompollution.
2. The huge amounts of chemical fertilizers and pesticides used on these farms ... the water.
3. People should be more concerned about the continuing ... of the environment.
4. The Japanese recycle more than half of their industrial ....
5. Harmful ... are found in many rivers.
6. The destruction of the rainforests is an ... disaster that threatens the future of the Earth.
7. About 60,000 different species of plants are in ... today.
8. Today the giant panda is one ofthe rarest ... in the world.

4. Find in the list below the words corresponding to the following definitions.

wildlife, to pollute, fauna, flora, atmosphere, ecology, civilization, energy

1. The mixture of gases that surrounds some planets, such as the Earth;
2. To make (air, water, earth, etc.) dirty or harmful to people, animals and plants, especially by adding harmful substances; .
3. The relationships between the air, land, water, animals, plants, etc., ora scientific study of this;
4. The power from something such as electricity or oil, which can do work, such as providing light and heat;
5. Animals and plants that grow independently of people, usual1y in natural conditions;
6. A human society with its highly developed organizations, or the culture and the way of the life ofa society or country at a particular period in time;

7. All the plants of a particular place;
8. All the animals that live wild in a particular area .

5.Insert prepositions where necessary.

1. Pollution affects ... everyoneevery day.
2. Pollution ... air is a result ... many factors.
3. The explosion ... the Chernobyl Nuclear Power Station is the greatest tragedy ... the 20th century.
4. Many large cities are polluted ... industrial waste.
5. Some factories and plants discharge harmful substances ... the atmosphere.
6. Enormous damage has been done ... the country's agriculture.
7. Today about 60,000 different species of plants are ... danger.
8. Animalsare killed ... men... their fur or skin.
9. We must protect our environment ... the sake ... future generations.

6.Here are *some* of the ways to solve ecological problems.

Do you think theyare helpful? .

1. Factories must be removed from cities.
2. Green zones mustbe created.
3. The greenery must be protected and increased.
4. New pollution control systems should be introduced.
5. Purifying systems for cleaning harmful substances must be widely used.

PART 2 MAN AND TECHNOLOGY

This painting depicts a woman examining her work on a lathe at a factory in Britain during World War II. Her eyes are not protected. Today, such practice would not be permitted in most industrialized countries that adhere to occupational health and safety standards for workers. In many countries however, such standards are still either weak or nonexistent.

Unit 1 Occupational health and safety

Text 1 Process safety

Process safety focuses on preventing fires, explosions and accidental chemical releases in chemical process facilities or other facilities dealing with hazardous materials such as refineries, and oil and gas (onshore and offshore) production installations.

Process safety involves, for example, the prevention of leaks, spills, equipment malfunction, over-pressures, over-

temperatures, corrosion, metal fatigue and other similar conditions. Process safety programs focus on design and engineering of facilities, maintenance of equipment, effective alarms, effective control points, procedures and training.

Occupational safety and health (OSH) also commonly referred to as *occupational health and safety (OHS) orworkplace health and safety (WHS)* is an area concerned with the safety, health and welfare of people engaged in work or employment. The goals of occupational safety and health programs include to foster a safe and healthy work environment.OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment.

As defined by the World Health Organization (WHO) "occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards." Health has been defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Occupational health is a multidisciplinary field of healthcare concerned with enabling an individual to undertake their occupation, in the way that causes least harm to their health.

Since 1950, the International Labour Organization (ILO) and the World Health Organization (WHO) have shared a common definition of occupational health. It was adopted by the Joint ILO/WHO Committee on Occupational Health at its first session in 1950 and revised at its twelfth session in 1995. The definition reads:

"The main focus in occupational health is on three different objectives: (i) the maintenance and promotion of workers' health and working capacity; (ii) the improvement of working environment and work to become conducive to safety and health and (iii) development of work organizations and working cultures in a direction which supports health and safety at work and in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings. The concept of working culture is intended in this context to mean a reflection of the essential value systems adopted by the undertaking concerned. Such a culture is reflected in practice in the managerial systems, personnel policy, principles for participation, training policies and quality management of the undertaking."

Those in the field of occupational health come from a wide range of disciplines and professions

including medicine, psychology, epidemiology, physiotherapy and rehabilitation, occupational therapy, occupational medicine, human factors and ergonomics, and many others. Professionals advise on a broad range of occupational health matters. These include how to avoid particular pre-existing conditions causing a problem in the occupation, correct posture for the work, frequency of rest breaks, preventative action that can be undertaken, and so forth.[3]

Answer the following questions.

1. What does process safety focus on?
2. What does process safety involve?
3. What are the goals of occupational safety and health programs?
4. How does the World Health Organization (WHO) define "occupational health"?
5. Does the field of occupational health come from a wide range of disciplines and professions? What are they?
6. How big is the range of occupational health matters?

Grammar revision

The Infinitive

1. Инфинитив - это неличная форма глагола, которая выражает действие, но без указания на число, лицо, наклонение.

В русском языке инфинитиву соответствует неопределенная форма глагола. Инфинитив имеет признаки существительного и глагола.

Как и существительное, инфинитив может выполнять в предложениях те же функции, что и существительное, т.е. функцию подлежащего, дополнения, обстоятельства, именной части составного именного сказуемого:

Nellie closed her eyes and tried not to think. Нелли закрыла глаза и пыталась не думать.

Quickly she dressed, and went into the other room to prepare their breakfast. Она быстро оделась и вышла в другую комнату, чтобы приготовить завтрак.

Как и глагол, инфинитив имеет формы времени и залога и может определяться наречием, а в предложении инфинитив может входить в состав сказуемого (простого, составного глагольного или составного именного, являясь его смысловой частью).

Our observatory could still be used for training purposes, but the re-search had to move into the space. Нашу обсерваторию (все) еще можно было использовать для тренировочных целей, но исследование нужно было выносить в открытое пространство.

He wanted to get there early, but he failed. Он хотел рано попасть туда, но это ему не удалось.

Формальным признаком инфинитива является частица *to*. Однако частица *to* перед инфинитивом в некоторых случаях опускается.

2. Чаще всего инфинитив употребляется без частицы *to* в следующих случаях:

a. После модальных глаголов:

He can speak English. Он умеет говорить по-английски.

b. Вобороте «Сложное дополнение» после глаголов *to let, to make, to feel, to hear, to see, to notice, to watch:*

I'll make him tell me the truth. Я заставлю его сказать мне правду.

c. Если в предложении стоят два инфинитива, соединенные союзом *and* или *or*, частица *to* обычно опускается перед вторым из них:

He promised to telephone or write. Он обещал позвонить по телефону или написать. [1]

The Infinitive forms

Voice/ Tense	**Indefinite**	**Continuous**	**Perfect**	**Perfect Continuous**
Active	to build	to be building	to have built	to have been building
Passive	to be built	-	to have been built	-

Find the Infinitives in Text 1, identify their forms and translate into Russian.

Text 2 Workplace hazards

Although work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include but are not limited to, "chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks," and a broad

range of psychosocial risk factors. Personal protective equipment can help protect against many of these hazards.

Physical hazards affect many people in the workplace. Occupational hearing loss is the most common work-related injury in the United States, with 22 million workers exposed to hazardous noise levels at work and an estimated $242 million spent annually on worker's compensation for hearing loss disability. Falls are also a common cause of occupational injuries and fatalities, especially in construction, extraction, transportation, healthcare, and building cleaning and maintenance. Machines have moving parts, sharp edges, hot surfaces and other hazards with the potential to crush, burn, cut, shear, stab or otherwise strike or wound workers if used unsafely.

Biological hazards (biohazards) include infectious microorganisms such as viruses and toxins produced by those organisms such as anthrax. Biohazards affect workers in many industries; influenza, for example, affects a broad population of workers. Outdoor workers, including farmers, landscapers, and construction workers, risk exposure to numerous biohazards, including animal bites and stings, urushiol from poisonous plants, and diseases transmitted through animals such as the West Nile virus and Lyme disease. Health care workers, including veterinary health workers, risk exposure to blood-borne pathogens and various infectious diseases.

Dangerous chemicals can pose a chemical hazard in the workplace. There are many classifications of hazardous chemicals, including neurotoxins, immune agents, dermatologic agents, carcinogens, reproductive toxins, systemic toxins, asthmagens, pneumoconiotic agents, and sensitizers. Psychosocial hazards include risks to the mental and emotional well-being of workers, such as feelings of job insecurity, long work hours, and poor work-life balance.

Specific occupational safety and health risk factors vary depending on the specific sector and industry. Construction workers might be particularly at risk of falls, for instance, whereas fishermen might be particularly at risk of drowning. The United States Bureau of Labor Statistics identifies the fishing, aviation, lumber,metalworking, agriculture, mining and tra nsportation

industries as among some of the more dangerous for workers. Similarly psychosocial risks such as workplace violence are more pronounced for certain occupational groups such as health care employees, police, correctional officers and teachers.[4]

Answer the following questions.

1. What are the main workplace hazards?
2. How many American workers are exposed to hazardous noise levels at work?
3. Why do machines present a workplace hazard?
4. How do biohazards affect workers?
5. Are there many classifications of hazardous chemicals?
6. What dopsychosocial hazards include?
7. What are the most dangerous industries for workers?

Text 3

Read the following text and the chart and speak on the problems of workplace fatalities in different countries.

Workplace fatalities statistics

European Union

In most countries males comprise the vast majority of workplace fatalities. In the EU as a whole, 94% of death were of males.In the UK the disparity was even greater with males comprising 97.4% of workplace deaths. In the UK there were 171 fatal injuries at work in financial year 2011-2, compared with 651 in calendar year 1974; the fatal injury rate declined over that period from 2.9 fatalities per 100,000 workers to 0.6 per 100,000 workers.

United States

The Bureau of Labor Statistics of the United States Department of Labor compiles information about workplace fatalities in the United States. In 1970, an estimated 14,000 workers were killed on the job – by 2010, the workforce had doubled, but workplace deaths were down to about 4,500. Between 1913 and 2013, workplace fatalities dropped by approximately 80%.

Number of occupational fatal work injuries in the U.S. from 1992 until 2014.

The Bureau also compiles information about the most dangerous jobs. The most recent information comes from the census of occupational injuries in 2014, during which 4,679 people died on the job.

Job	Fatalities	Fatalities per 100,000 employees
Fishermen	22	80.8
Pilots	81	63.2
Timber cutter	77	109.5
Structural metal workers	15	25.2
Waste collectors	27	35.8
Farmers and ranchers	263	26.0
Power-line workers	25	19.2
Construction workers and miners	130	17.9
Roofers	81	46.2
Truck drivers and other drivers	835	23.4
All occupations	**4,679**	**3.3**

Because different countries take different approaches to ensuring occupational safety and health, areas of OSH need and focus also vary between countries and regions. Similar to the findings of the ENHSPO survey conducted in Australia, the Institute of Occupational Medicine found that in the UK, there is a need to put a greater emphasis on work-related illness. In contrast, in Australia and the USA a major responsibility of the OHS professional is to keep company directors and managers aware of the issues that they face in regards to Occupational Health and Safety principles and legislation. However, in some other areas of Europe, it is precisely this which has been lacking: "Nearly half of senior managers and company directors do not have an up-to-date understanding of their health and safety-related duties and responsibilities."

World Day for Safety and Health at Work

On April 28 The International Labour Organisation celebrates "World Day for Safety and Health"to raise awareness of safety in the workplace. Occurring annually since 2003, each year it focuses on a specific area and bases a campaign around the theme.[6]

TEXT 4 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities. "Protective clothing" is applied to traditional categories of clothing, and "protective gear" applies to items such as pads, guards, shields, or masks, and others.

The purpose of personal protective equipment is to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective to reduce these risks to acceptable levels. PPE is needed when there are hazards present. PPE has the serious limitation that it does not eliminate the hazard at source and may result in employees being exposed to the hazard if the equipment fails.

Any item of PPE imposes a barrier between the wearer/user and the working environment. This can create additional strains on the wearer; impair their ability to carry out their work and create significant levels of discomfort. Any of these can discourage wearers from using PPE correctly, therefore placing them at risk of injury, ill-health or, under extreme circumstances, death. Good ergonomic design can help to minimize these barriers and can therefore help to ensure safe and healthy working conditions through the correct use of PPE.

Types

Personal protective equipment can be categorized by the area of the body protected, by the types of hazard, and by the type of garment or accessory. A single item, for example boots, may provide multiple forms of protection: a steel toe cap and steel insoles for protection of the feet from crushing or puncture injuries, impervious rubber and lining for protection from water and chemicals, high reflectivity and heat resistance for protection from radiant heat, and high electrical resistivity for protection from electric shock. The protective attributes of each piece of equipment must be compared with the hazards expected to be found in the workplace.

Respirators

Respirators serve to protect the user from breathing in

contaminants in the air, thus preserving the health of one's respiratory tract. There are two main types of respirators. One type functions by filtering out chemicals and gases, or airborne particles, from the air breathed by the user. The filtration may be either passive or active (powered). Gas masks and particulate respirators are examples of this type of respirator. A second type protects users by providing clean, respirable air from another source. This type includes airline respirators and self-contained breathing apparatus (SCBA). In work environments, respirators are relied upon when adequate ventilation is not available or other engineering control systems are not feasible or inadequate.In the United Kingdom, an organization that has extensive expertise in respiratory protective equipment is the Institute of Occupational Medicine. This expertise has been built on a long-standing and varied research programme that has included the setting of workplace protection factors to the assessment of efficacy of masks available through high street retail outlets.In the United States, The National Institute for Occupational Safety and Health (NIOSH) provides recommendations on respirator use, in accordance to NIOSH federal respiratory regulations 42 CFR Part 84. The National Personal Protective Technology Laboratory (NPPTL) of NIOSH is tasked towards actively conducting studies on respirators and providing recommendations

Leather craftsman gloves, safety goggles, and a properly fitted

hardhat are crucial for proper safety in a construction environment.

Skin protection

Occupational skin diseases such as contact dermatitis, skin cancers, and other skin injuries and infections are the second-most common type of occupational disease and can be very costly. Skin hazards, which lead to occupational skin disease, can be classified into four groups. Chemical agents can come into contact with the skin through direct contact with contaminated surfaces, deposition of aerosols, immersion or splashes. Physical agents such as extreme temperatures and ultraviolet or solar radiation can be damaging to the skin over prolonged exposure.Mechanical trauma occurs in the form of friction, pressure, abrasions, lacerations and contusions. Biological agents such as parasites, microorganisms, plants and animals can have varied effects when exposed to the skin.

Any form of PPE that acts as a barrier between the skin and the agent of exposure can be considered skin protection. Because much work is done with the hands, gloves are an essential item in providing skin protection. Some examples of gloves commonly used as PPE include rubber gloves, cut-resistant gloves, chainsaw gloves and heat-resistant gloves. For sports and other recreational activities, many different gloves are used for protection, generally against mechanical trauma.

Other than gloves, any other article of clothing or protection worn for a purpose serve to protect the skin. Lab coats for example, are worn to protect against potential splashes of chemicals. Face shields serve to protect one's face from potential impact hazards, chemical splashes or possible infectious fluid.

Eye protection

Each day, about 2000 US workers have a job-related eye injury that requires medical attention. Eye injuries can happen through a variety of means. Most eye injuries occur when solid particles such as metal slivers, wood chips, sand or cement chips get into the eye. Smaller particles in smokes and larger particles such as broken glass also account for particulate matter-causing eye injuries. Blunt force trauma can occur to the eye when excessive force comes into contact with the eye. Chemical burns, biological agents, and thermal agents, from sources such as welding torches and UV light, also contribute to occupational eye injury.

While the required eye protection varies by occupation, the safety provided can be generalized. Safety glasses provide protection from external debris, and should provide side protection via a

wrap-around design or side shields.

Goggles provide better protection than safety glasses, and are effective in preventing eye injury from chemical splashes, impact, dusty environments and welding.Goggles with high air flow should be used to prevent fogging.

• Face shields provide additional protection and are worn over the standard eyewear; they also provide protection from impact, chemical, and blood-borne hazards.

• Full-facepiece respirators are considered the best form of eye protection when respiratory protection is needed as well, but may be less effective against potential impact hazards to the eye.

• Eye protection for welding is shaded to different degrees, depending on the specific operation.

Hearing protection

Industrial noise is often overlooked as an occupational hazard, as it is not visible to the eye. Overall, about 22 million workers in the United States are exposed to potentially damaging noise levels each year. Occupational hearing loss accounted for 14% of all occupational illnesses in 2007, with about 23,000 cases significant enough to cause permanent hearing impairment. About 82% of occupational hearing loss cases occurred to workers in the manufacturing sector. The Occupational Safety and Health Administration establishes occupational noise exposure standards. NIOSH recommends that worker exposures to noise be reduced to a level equivalent to 85 dBA for eight hours to reduce occupational noise-induced hearing loss.

PPE for hearing protection consists of earplugs and earmuffs. Workers who are regularly exposed to noise levels above the NIOSH recommendation should be furnished hearing protection by the employers, as they are a low-cost intervention.

Protective clothing and ensembles

This form of PPE is all-encompassing and refers to the various suits and uniforms worn to protect the user from harm. Lab coats worn by scientists and ballistic vests worn by law enforcement officials,which are worn on a regular basis, would fall into this category. Entire sets of PPE, worn together in a combined suit, are also in this category.

Ensembles

Below are some examples of ensembles of personal protective equipment, worn together for a specific occupation or task, to provide maximum protection for the user.

• Chainsaw protection (especially a helmet with face

guard, hearing protection, kevlar chaps, anti-vibration gloves, and chainsaw safety boots). Bee-keepers wear various levels of protection depending on the temperament of their bees and the reaction of the bees to nectar availability. At minimum most bee keepers wear a brimmed hat and a veil made of hardware cloth similar to window-screen material. The next level of protection involves leather gloves with long gauntlets and some way of keeping bees from crawling up one's trouser legs. In extreme cases, specially fabricated shirts and trousers can serve as barriers to the bees' stingers.

• Diving equipment, for underwater diving, constitute of equipment such as a diving mask, an underwater breathing apparatus, a diving suit or wetsuit, and flippers.

• Firefighters wear PPE designed to provide protection against fires and various fumes and gases. PPE worn by firefighters include bunker gear, self-contained breathing apparatus, a helmet, safety boots, and a PASS device.[4]

Answer the following questions:

1. What does personal protective equipment (PPE) referto?
2. What is the purpose of personal protective equipment?
3. Why is good ergonomic design important?
4. How can PPE be classified?
5. Are there different types of respirators?
6. How can skin hazards be classified?
7. What forms of PPE are used for skin protection?
8. When do eye injuries occur?
9. What PPE is used for eye protection?
10. Why isn't industrial noise paid enough attention to?
11. What is a recommended noise level?
12. What protective clothing and ensembles do you know?

Unit 2 Occupational hygiene

TEXT 1 OCCUPATIONAL HYGIENE

Occupational (or "industrial" in the U.S.) hygiene (IH) is the anticipation, recognition, evaluation, control and prevention of hazards from work that may result in injury, illness, or affect the well-

being of workers. These hazards or stressors are typically divided into the categories - biological, chemical, physical, ergonomic and psychosocial. The risk of a health effect from a given stressor is a function of the hazard multiplied by the exposure to the individual or group.For chemicals, the hazard can be understood by the dose response profile most often based on toxicological studies or models. Occupational hygienists work closely with toxicologists for understanding chemical hazards, physicists for physical hazards, and physicians and microbiologists for biological hazards. Environmental and occupational hygienists are considered experts in exposure science and exposure risk management. Depending on an individual's type of job, a hygienist will apply their exposure science expertise for the protection of workers, consumers and/or communities.

The British Occupational Hygiene Society (BOHS) defines that "occupational hygiene is about the prevention of ill-health from work, through recognizing, evaluating and controlling the risks".The International Occupational Hygiene Association (IOHA) refers to occupational hygiene as *the discipline of anticipating, recognizing, evaluating and controlling health hazards in the working environment with the objective of protecting worker health and well-being and safeguarding the community at large.* The term "occupational hygiene" (used in the UK and Commonwealth countries as well as much of Europe) is synonymous with *industrial hygiene* (used in the US, Latin America, and other countries that received initial technical support or training from US sources). The term "industrial hygiene" traditionally stems from industries with construction, mining or manufacturing and "occupational hygiene" refers to all types of industry such as those listed for "industrial hygiene" as well as financial and support services industries and refers to "work", "workplace" and "place of work" in general. *Environmental hygiene* addresses similar issues to *occupational hygiene*, but is likely to be about broad industry or broad issues affecting the local community, broader society, region or country.

The profession of **occupational hygiene** uses strict and rigorous scientific methodology and often requires professional judgment based on experience and education in determining the potential for hazardous exposure risks in workplace and environmental studies. These aspects of occupational hygiene can often be referred to as the "art" of occupational hygiene and is used in a similar sense to the "art" of medicine. In fact "occupational

hygiene" is both an aspect of preventative medicine and in particular occupational medicine, in that its goal is to prevent industrial disease, using the science of risk management, exposure assessment and industrial safety. Ultimately, professionals seek to implement "safe" systems, procedures or methods to be applied in the workplace or to the environment.[6]

Answer the following questions:

1. How can occupational hygiene be defined?
2. What categories are hazards or stressors typically divided into?
3. What specialists work in this sphere?
4. What does the profession of occupational hygiene require?
5. What is the goal of occupational hygiene ?

Text 2 The social role of occupational hygiene

Occupational hygienists have been involved historically with changing the perception of society about the nature and extent of hazards and preventing exposures in the workplace and communities. Many occupational hygienists work day-to-day with industrial situations that require control or improvement to the workplace situation however larger social issues affecting whole industries have occurred in the past e.g. since 1900, asbestos exposures that have affected the lives of tens of thousands of people. Occupational hygienists have become more engaged in understanding and managing exposure risks to consumers from products with new regulations such as REACh (Registration, Evaluation, Authorisation and Restriction of Chemicals).

More recent issues affecting broader society are, for example in 1976, legionnaires' disease or legionellosis, more recently again in the 1990s radon and in the 2000s the effects of mold from indoor air quality situations in the home and at work. In the later part of the 2000s concern has been raised about the health effects of nanoparticles.

Many of these issues have required the coordination over a number of years of a number of medical and paraprofessionals in detecting and then characterizing the nature of the issue, both in terms of the hazard and in terms of the risk to the workplace and ultimately to society. This has involved occupational hygienists in research, collection of data and to develop suitable and satisfactory control methodologies.

Workplace assessment methods

Although there are many aspects to occupational hygiene work the most known and sought after is in determining or estimating potential or actual exposures to hazards. For many chemicals and physical hazards, occupational exposure limits have been derived using toxicological, epidemiological and medical data allowing hygienists to reduce the risks of health effects by implementing the "Hierarchy of Hazard Controls". Several methods can be applied in assessing the workplace or environment for exposure to a known or suspected hazard. Occupational hygienists do not rely on the accuracy of the equipment or method used but in knowing with certainty and precision the limits of the equipment or method being used and the error or variance given by using that particular equipment or method.

The main steps outlined for assessing and managing occupational exposures:

- Basic Characterization (identify agents, hazards, people potentially exposed and existing exposure controls)
- Exposure Assessment (select occupational exposure limits, hazard bands, relevant toxicological data to determine if exposures are "acceptable", "unacceptable" or "uncertain")
- Exposure Controls (for "unacceptable" or "uncertain" exposures)
- Further Information Gathering (for "uncertain" exposures)
- Hazard Communication (for all exposures)
- Reassessment (as needed) / Management of Change.[6]

Mark the following statements as true or false.

1. A lot of occupational hygienists work with industrial situations that require control or improvement to the workplace situation.
2. They have become more engaged in understanding and managing exposure risks to consumers from products with old regulations.
3. In the later part of the 2000s concern has been raised about the health effects of radon.
4. Nowadays occupational hygienists are also involved in research, collection of data and developing suitable and satisfactory control methodologies.
5. One single method can be applied in assessing the workplace or environment for exposure to a known or suspected hazard.

Text 3 Basic characterization, hazard identification and walk-through surveys

Read Text 3 and make its review.

The first step in understanding health risks related to exposures requires the collection of "basic characterization" information from available sources. A traditional method applied by occupational hygienists to initially survey a workplace or environment is used to determine both the types and possible exposures from hazards (e.g. noise, chemicals, radiation). The **walk-through survey** can be targeted or limited to particular hazards such as silica dust, or noise, to focus attention on control of all hazards to workers. A full walk-through survey is frequently used to provide information on establishing a framework for future investigations, prioritizing hazards, determining the requirements for measurement and establishing some immediate control of potential exposures. The Health Hazard Evaluation Program from the National Institute for Occupational Safety and Health is an example of an industrial hygiene walk-through survey. Other sources of basic characterization information include worker interviews, observing exposure tasks, material safety data sheets, workforce scheduling, production data, equipment and maintenance schedules to identify potential exposure agents and people possibly exposed.

The information that needs to be gathered from sources should apply to the specific type of work from which the hazards can come from. As mentioned previously, examples of these sources include interviews with people who have worked in the field of the hazard, history and analysis of past incidents, and official reports of work and the hazards encountered. Of these, the personnel interviews may be the most critical in identifying undocumented practices, events, releases, hazards and other relevant information. Once the information is gathered from a collection of sources, it is recommended for these to be digitally archived (to allow for quick searching) and to have a physical set of the same information in order for it to be more accessible. One innovative way to display the complex historical hazard information is with a historical hazards identification map, which distills the hazard information into an easy to use graphical format.

Sampling survey equipment

An occupational hygienist may use one or a number of commercially available electronic measuring devices to measure

noise, vibration, ionizing and non-ionizing radiation, dust, solvents, gases, et cetera. Each device is often specifically designed to measure a specific or particular type of contaminant. Such devices are often subject to multiple interferences. Electronic devices need to be calibrated before and after use to ensure the accuracy of the measurements taken and often require a system of certifying the precision of the instrument.Measurements of noise levels using a sound level meter is a component of the occupational hygiene assessment.

Dust sampling

Nuisance dust is considered to be the total dust in air including inhalable and respirable fractions.Various dust sampling methods exist that are internationally recognised.

Inhalable dust is determined using the modern equivalent of the Institute of Occupational Medicine (IOM) MRE 113A monitor. Inhalable dust is considered to be dust of less than 100 micrometers aerodynamic equivalent diameter (AED) that enters through the nose and or mouth.

Respirable dust is sampled using a cyclone dust sampler design to sample for a specific fraction of dust AED at a set flow rate. The respirable dust fraction is dust that enters the 'deep lung' and is considered to be less than 10 micrometers AED.

Nuisance, inhalable and respirable dust fractions are all sampled using a constant volumetric pump for a specific sampling period. By knowing the mass of the sample collected and the volume of air sampled a concentration for the fraction sampled can be given in milligrams (mg) per metre cubed (m3). From such samples the amount of inhalable or respirable dust can be determined and compared to the relevant occupational exposure limits.

By use of inhalable, respirable or other suitable sampler (7 hole, 5 hole, et cetera) these dust sampling methods can also used to determine metal exposure in the air. This requires collection of the sample on a methyl-cellulose ester (MCE) filter and acid digestion of the collection media in the laboratory followed by measuring metal concentration though an atomic absorption (or emission) spectrophotometery. Both the UK Health and Safety Laboratory and NIOSH Manual of Analytical Methods have specific methodologies for a broad range of metals in air found in industrial processing (smelting, foundries, et cetera).

A further method exists for the determination of asbestos, fibreglass, synthetic mineral fibre and ceramic mineral fibre dust in

air. This is the membrane filter method (MFM) and requires the collection of the dust on a grided filter for estimation of exposure by the counting of 'conforming' fibres in 100 fields through a microscope. Results are quantified on the basis of number of fibres per millilitre of air (f/ml). Many countries strictly regulate the methodology applied to the MFM.

Chemical sampling

Two types of chemically absorbent tubes are used to sample for a wide range of chemical substances. Traditionally a chemical absorbent 'tube' (a glass or stainless steel tube of between 2 and 10 mm internal diameter) filled with very fine absorbent silica (hydrophilic) or carbon, such as coconut charcoal (lypophylic), is used in a sampling line where air is drawn through the absorbent material for between four hours (minimum workplace sample) to 24 hours (environmental sample) period. The hydrophilic material readily absorbs water-soluble chemical and the lypophylic material absorbs non water-soluble materials. The absorbent material is then chemically or physically extracted and measurements performed using various gas chromatograph or mass spectrometry methods. These absorbent tube methods have the advantage of being usable for a wide range of potential contaminates. However, they are relatively expensive methods, are time consuming and require significant expertise in sampling and chemical analysis. A frequent complaint of workers is in having to wear the sampling pump (up to 1 kg) for several days of work to provide adequate data for the required statistical certainty determination of the exposure.

It is a critical part of the exposure determination that the method of sampling for the specific contaminate exposure is directly linked to the exposure standard used. Many countries regulate both the exposure standard, the method used to determine the exposure and the methods to be used for chemical or other analysis of the samples collected.[3]

Text 4 Exposure management and controls

The hierarchy of control defines the approach used to reduce exposure risks protecting workers and communities. These methods include elimination, substitution, engineering controls (isolation or ventilation), administrative controls and personal protective equipment. Occupational hygienists, engineers, maintenance, management and employees should all be consulted for selecting and designing the most effective and efficient controls based on the hierarchy of control.

General activities

The occupational hygienist may be involved with the assessment and control of physical, chemical, biological or environmental hazards in the workplace or community that could cause injury or disease. Physical hazards may include noise, temperature extremes, illumination extremes, ionizing or non-ionizing radiation, and ergonomics. Chemical hazards related to dangerous goods or hazardous substances are frequently investigated by occupational hygienists. Other related areas including indoor air quality (IAQ) and safety may also receive the attention of the occupational hygienist. Biological hazards may stem from the potential for legionella exposure at work or the investigation of biological injury or effects at work, such as dermatitis may be investigated.

As part of the investigation process, the occupational hygienist may be called upon to communicate effectively regarding the nature of the hazard, the potential for risk, and the appropriate methods of control. Appropriate controls are selected from the hierarchy of control: by elimination, substitution, engineering, administration and personal protective equipment (PPE) to control the hazard or eliminate the risk. Such controls may involve recommendations as simple as appropriate PPE such as a 'basic' particulate dust mask to occasionally designing dust extraction ventilation systems, work places or management systems to manage people and programs for the preservation of health and well-being of those who enter a workplace.

The hierarchy of controls is an important tool to determine how to control hazards most efficiently and effectively in a workplace.

Education

The basis of the technical knowledge of occupational hygiene is from competent training in the following areas of science and management.

- Basic Sciences (Biology, Chemistry, Mathematics (Statistics), Physics);
- Occupational Diseases (Illness, injury and health surveillance (biostatistics, epidemiology, toxicology));
- Health Hazards (Biological, Chemical and Physical hazards, Ergonomics and Human Factors);
- Working Environments (Mining, Industrial, Manufacturing, transport and storage, service industries and offices);
- Programme Management Principles (professional and business ethics, work site and incident investigation methods, exposure

guidelines, Occupational exposure limits, jurisdictional based regulations, hazard identification, risk assessment and risk communication, data management, fire evacuation and other emergency responses);

- Sampling, measurement and evaluation practices (instrumentation, sampling protocols, methods or techniques, analytical chemistry);
- Hazard Controls (elimination, substitution, engineering, administrative, PPE and Air Conditioning and Extraction Ventilation);
- Environment (air pollution, hazardous waste).

However, it is not rote knowledge that identifies a competent occupational hygienist. There is an "art" to applying the technical principles in a manner that provides a reasonable solution for workplace and environmental issues. In effect an experienced "mentor", who has experience in occupational hygiene is required to show a new occupational hygienist how to apply the learned scientific and management knowledge in the workplace and to the environment issue to satisfactorily resolve the problem.

To be a professional occupational hygienist, experience in as wide a practice as possible is required to demonstrate knowledge in areas of occupational hygiene. This is difficult for "specialists" or those who practice in narrow subject areas. Limiting experience to individual subject like asbestos remediation, confined spaces, indoor air quality, or lead abatement, or learning only through a textbook or "review course" can be a disadvantage when required to demonstrate competence in other areas of occupational hygiene.

Academic programs offering industrial hygiene bachelor's or master's degrees in United States may apply to the Accreditation Board for Engineering and Technology (ABET) to have their program accredited. As of October 1, 2006, 27 institutions have accredited their industrial hygiene programs. Accreditation is not available for Doctoral programs.In the U.S. the training of IH professionals is supported by National Institute for Occupational Safety and Health through their NIOSH Education and Research Centers.

Professional societies

The development of industrial hygiene societies originated in the United States, beginning with the first convening of members for the American Conference of Governmental Industrial Hygienists in 1938, and the formation of the American Industrial Hygiene Association in 1939. In the United Kingdom, the British Occupational Hygiene Society started in 1953. Through the years, professional

occupational societies have formed in many different countries, leading to the formation of the International Occupational Hygiene Association in 1987, in order to promote and develop occupational hygiene worldwide through the member organizations. The IOHA has grown to 29 member organizations, representing over 20,000 occupational hygienists worldwide, with representation from countries present in every continent.[6]

Complete the following sentences with the information from the text.

1. To reduce exposure risks protecting workers and communities the following methods are used…. .
2. The occupational hygienist may be involved with the assessment and control of ……. hazards in the workplace or community that could cause …….. .
3. Appropriate controls are selected from the hierarchy of control: by ……..to control the hazard or eliminate the risk.
4. To be a professional occupational hygienist, ……..is required to demonstrate knowledge in areas of occupational hygiene.
5. In the U.S. the training of IH professionals is supported by ……...
6. Through the years, professional occupational societies have formed in many different countries, leading to the formation of ……

ЛЕКСИЧЕСКИЕ МОДЕЛИ, КОТОРЫЕ МОЖНО ИСПОЛЬЗОВАТЬ ПРИ РЕФЕРИРОВАНИИ ТЕКСТОВ НА АНГЛИЙСКОМ ЯЗЫКЕ: [2]

The article/ text is headlined…. The headline of the article I have read is… The author of the article is… The article is written by… . It's published in… It's printed in…	Статья/текст называется… Название статьи, которую я прочитал… Автор статьи… Статья написана… Она опубликована… Она напечатана…
The main idea of the article is… The article is about… The article is devoted to… The article deals with…. The article touches upon…. The purpose of the article is to give the reader some information on…	Основная мысль этой статьи… Статья о… Статья посвящена… Статья связана с … Статья затрагивает… Цель статьи – ознакомить читателя с…

The aim of the article is to provide the reader with some material (data) on…. The author starts by telling the reader that… The author writes (states, stresses, thinks, points out) that … The article describes … According to the text ... Further the author reports (says)… It is important to note (stress, underline)… In conclusion…. The author comes to the conclusion that… I found the article interesting (important, dull, of no value, too hard to understand) because…	Цель статьи ознакомить читателя с материалами/данными о… В начале статьи автор пишет … Автор пишет, (утверждает, подчеркивает,полагает, выделяет),что… Статья описывает, … Согласно тексту… Далее автор сообщает… Важно отметить, (подчеркнуть)… В заключение… Автор приходит к заключению, что… Статья показалась мне интересной, (важной, скучной, не представляет для меня интереса, слишком трудная для понимания), так как…

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