Н. Н. АПУХТИНА А. Ю. МАЕВСКАЯ

ПРОБЛЕМЫ ТЕХНОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ И ГОРНО-ПРОМЫШЛЕННОЙ ЭКОЛОГИИ

Материалы и методические указания
для самостоятельной работы
студентов 2 курса дневного отделения
направлений подготовки 022000 «Экология и
природопользование», 280700 «Техносферная безопасность»

САНКТ-ПЕТЕРБУРГ
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Научный редактор:
кандидат филолог. наук, доцент кафедры иностранных языков
Национального минерально-сырьевого университета «Горный»
Ю.В. Борисова

Проблемы технологической безопасности и горно-промышленной экологии: Материалы и методические указания для самостоятельной работы студентов 2 курса дневного отделения направлений подготовки 022000 «Экология и природопользование», 280700 «Техносферная безопасность» / Сост. Н.Н. Апухтина, А.Ю. Маевская. – СПб., 2015. – 48 с.

Методические указания предназначены для студентов 2 курса дневного отделения горного факультета направлений подготовки 022000 «Экология и природопользование», 280700 «Техносферная безопасность», профилей подготовки «Природопользование», «Безопасность технологических процессов и производств». Методические указания составлены в соответствии с примерной программой по иностранному языку для неязыковых вузов и факультетов.

Методические указания содержат учебные и аутентичные тексты на английском языке с разработанным комплексом упражнений. Изучение предложенного материала направлено на развитие умений делать доклад и сообщение на английском языке по темам профессионального общения, совершенствование навыков и умений всех видов чтения (изучающего, ознакомительного, поискового и просмотрового) и перевода специальной научно-технической литературы для извлечения информации, ознакомление с узкоспециализированной горной терминологией на английском языке.

Методические указания состоят из 10 разделов, включающих разное количество текстов по горной тематике, а также для работы предлагаются разнообразные виды упражнений. Предложенные материалы предназначены как для самостоятельной работы, так и для работы в аудитории.

CONTENTS

UNIT I. THE PROBLEM OF POLLUTION

Task 1. Before reading the text discuss the major and specific types of pollution.

Task 2. Read the text and guess the meaning of words and word combinations from the context. If there are some problems, find their definitions in the dictionary. Pay a special attention to their pronunciation:

Environmental pollution, harmless form, air pollution, water pollution, land pollution, types of pollutants, noise pollution, light pollution, plastic pollution, radioactive waste, contaminants, anthropogenic source, human activity, human population, respiratory health of people, chronic bronchitis, respiratory tract infection.

Text 1. Pollution

Environmental pollution is the addition of any substance (solid, liquid, or gas) or any form of energy (such as heat, sound, or radioactivity) to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form. The major kinds of pollution (classified by environment) are air pollution, water pollution, and land pollution.

Modern society is also concerned about specific types of pollutants, such as noise pollution, light pollution, plastic pollution, and radioactive waste. Although environmental pollution can be caused by natural events such as forest fires and active volcanoes, use of the word *pollution* generally implies that the contaminants have an anthropogenic source—that is, a source created by human activities. Pollution has accompanied humankind ever since groups of people first congregated and remained for a long time in any one place. Indeed, ancient human settlements are frequently recognized by their pollutants—shell mounds and rubble heaps, for instance. Pollution was not a serious problem as long as there was enough space available for each individual or group. However, with the establishment of permanent settlements by great numbers of people, pollution became a problem, and it has remained one ever since.

Cities of ancient times were often noxious places, fouled by human wastes and debris. Beginning about 1000 ce, the use of coal for fuel caused considerable air pollution, and the conversion of coal to coke for iron

smelting beginning in the 17th century exacerbated the problem. In Europe, from the Middle Ages well into the early modern era, unsanitary urban conditions favored the outbreak of population-decimating epidemics of disease, from plague to cholera and typhoid fever. Through the 19th century, water and air pollution and the accumulation of solid wastes were largely problems of congested urban areas. But, with the rapid spread of industrialization and the growth of the human population to unprecedented levels, pollution became a universal problem.

Air pollution begins as emissions from sources such as industrial smokestacks. The pollutants released into the air may impact the respiratory health of people working in and living near such facilities.

In the second week of December 1952, a disastrous fog occurred in London. High levels of sulfur dioxide and particulate pollution (and probably also sulfuric acid) led to the deaths of more than 4,000 people during that week and over the subsequent three weeks. Many, but not all, of the victims already had chronic heart or lung disease.

The great London smog of 1952 led to the passage of legislation banning open coal burning, the factor most responsible for the pollution. This form of pollution, which is still known as "London smog," is common in many cities using coal as heating fuel, and it is associated with excess mortality and increased prevalence of chronic bronchitis, respiratory tract infections in the young and old, and possibly lung cancer. Today many industrial cities have legislation restricting the use of specific fuels and mandating emission-control systems in factories.

Task 3. Read the text and think of the questions you might ask about.

Task 4. With the help of additional material, make up a report about the ecological situation in your native town/city.

Text 2. The major kinds of pollution

Task 1. Read the following names of chemical elements and compounds. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

Nitrogen, oxygen, argon, carbon dioxide, methane, hydrogen, helium, water vapour, aerosol, fertilizer, pesticide, synthetic organic chemicals,

inorganic chemicals, radioactive substance, oil, arsenic, sulfuric acid, mercury.

Task 2. Read and translate the text paying attention to the meaning of the following words and word combinations. Use specialized dictionaries if needed.

Clean and safe atmosphere, municipal solid waste, construction and demolition waste, debris, garbage, rubbish, trash, sludge, chemical manufacturing company, petroleum refinery, paper mill, smelter, subsurface sewage disposal, septic tank, non-biological chemical compound, power-plant cooling water, point source pollutant, dispersed source pollutant, sewage discharge, outfall pipe, gritty materials, petroleum residues from automobile, road deicing chemicals.

Pollution in the air

Clean, dry air consists primarily of nitrogen and oxygen—78 percent and 21 percent, respectively, by volume. The remaining 1 percent is a mixture of other gases, mostly argon (0.9 percent), along with trace (very small) amounts of carbon dioxide, methane, hydrogen, helium, and more. Water vapor is also a normal, though quite variable, component of the atmosphere, normally ranging from 0.01 to 4 percent by volume; under very humid conditions the moisture content of air may be as high as 5 percent.

This fundamental resource—a clean and safe atmosphere—is under constant assault by the release of various gases, finely divided solids, or finely dispersed liquid aerosols at rates that exceed the natural capacity of the environment to dissipate and dilute or absorb them. These substances may reach concentrations in the air that cause undesirable health, economic, or aesthetic effects.

Pollution on land

All around the world solid or liquid waste materials are deposited on land or underground in a manner that can contaminate the soil and groundwater, threaten public health, and cause unsightly conditions and nuisances. The waste materials that cause land pollution are broadly classified as municipal solid waste (MSW, also called municipal refuse), construction and demolition (C&D) waste or debris, and hazardous waste. MSW includes nonhazardous garbage, rubbish, and trash from homes,

institutions (e.g., schools), commercial establishments, and industrial facilities. C&D waste (or debris) includes wood and metal objects, wallboard, concrete rubble, asphalt, and other inert materials produced when structures are built, renovated, or demolished.

Hazardous wastes include harmful and dangerous substances generated primarily as liquids but also as solids, sludge, or gases by various chemical manufacturing companies, petroleum refineries, paper mills, smelters, machine shops, dry cleaners, automobile repair shops, and many other industries or commercial facilities. In addition to improper disposal of MSW, C&D waste, and hazardous waste, contaminated effluent from subsurface sewage disposal (e.g., from septic tanks) can also be a cause of land pollution, as can the presence of non-biological chemical compounds in soils.

Pollution in the water

Water pollution is the release of substances into subsurface groundwater or into lakes, streams, rivers, estuaries, and oceans to the point where they interfere with beneficial use of the water or with the natural functioning of ecosystems. In addition to the release of substances such as chemicals or microorganisms, water pollution may also include the release of energy, in the form of radioactivity or heat, into bodies of water.

General types of water pollutants include pathogenic organisms, oxygen-demanding wastes, plant nutrients, synthetic organic chemicals, inorganic chemicals, sediments, radioactive substances, oil, and heat.

Sewage is the primary source of the first three types. Farms and industrial facilities are also sources of some water pollutants. Sediment from eroded topsoil is considered a pollutant because it can damage aquatic ecosystems, and heat (particularly from power-plant cooling water) is considered a pollutant because of the adverse effect it has on dissolved oxygen levels and aquatic life in rivers and lakes. Water pollutants may originate from point sources or from dispersed sources.

A point-source pollutant is one that reaches water from a single pipeline or channel, such as a sewage discharge or outfall pipe. Dispersed sources are broad, unconfined areas from which pollutants enter a body of water. Surface runoff from farms, for example, is a dispersed source of pollution, carrying animal wastes, fertilizers, pesticides, and silt into nearby streams. Urban storm water drainage—which may carry sand and other gritty materials, petroleum residues from automobiles, and road deicing

chemicals—is also considered a dispersed source because of the many locations at which it enters local streams or lakes.

Task 3. Work in pairs. Describe the* major kinds of pollution *mentioned in the text and discuss with your partner what substances may cause undesirable health, economic, or aesthetic effects.

Task 4. Sum up the main information given in the text using the following examples:

1. Introduction:
The subject of the text / the passage / the extract is …
The text / the passage / the extract tells us about / describes / is devoted to …
The text / the passage / the extract is about …
This text / the passage / the extract deals with …
2. Text structure analysis:
The text / the passage / the extract can be (sub)divided / split into … logical parts.
The text / the passage / the extract falls into … logical parts.
The first / the second / the third part is about / describes / is devoted to / analyses / points out …
In the first / the second / the third part the author writes about / analyses the problem of / gives his point of view on …
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3. Conclusion:
By way of summing up, …
In conclusion, I can say that … .
I want to say that … .
The text / the passage / the extract is of great interest as … .
It is very informative / entertaining / interesting … .

Task 5. Write a summary of the text.

Text 3. Other forms of pollution

Task 1. Skim through the text to get the general idea of it. Find key words that you can use to speak about the other forms of pollution.

Task 2. Read and translate the text paying attention to the meaning of the following words and word combinations. Use specialized dictionaries if needed.

Deleterious effect, combustion of fossil fuels, fossil-fueled power plant emissions, synthetic plastic resins, drainage system, large-scale pollutant, nuclear power plant, reactor core, nuclear fission, nucleus, coolant, turbine, radioactive decay, gamma rays, X-rays, neutrons, electrons, positron, nuclear fuel cycle.

Task 3. Read the text and choose from the list, A-D, the headline which best summarises each paragraph (1-4). Translate the text.

A. *Plastic pollution*

B. *Radioactive waste*

C. *Noise pollution*

D. *Light pollution*

In addition to being defined by the environment (air, water, and land) that is being despoiled, pollution can be identified by the material or energy that is being projected into the environment. Such is the case with noise pollution, light pollution, plastic pollution, and radioactive waste—forms of pollution that are being encountered with greater frequency in modern life and that periodically have aroused great public concern.

(1) Noise pollution is unwanted or excessive sound that can have deleterious effects on human health and environmental quality. Commonly generated inside many industrial facilities and some other workplaces, noise pollution also comes from highway, railway, and airplane traffic and from outdoor construction activities.

(2) Like noise pollution, light pollution—unwanted or excessive artificial light—is a form of waste energy that can cause adverse effects and degrade environmental quality. Moreover, because light (transmitted as electromagnetic waves) is typically generated by electricity, which itself is usually generated by the combustion of fossil fuels, it can be said that there is a connection between light pollution and air pollution (from fossil-fueled power plant emissions).

Control of light pollution therefore will help to conserve fuel (and money) and reduce air pollution as well as mitigate the more immediate problems caused by the excessive light. Although light pollution may not appear to be as harmful to public health and welfare as pollution of water resources or the atmosphere, it is an environmental quality issue of no small significance.

(3) In 1907 the invention of Bakelite brought about a revolution in materials by introducing truly synthetic plastic resins into world commerce. By the end of the 20th century, however, plastics were found to be persistent polluters of many environmental niches, from Mount Everest to the bottom of the sea. Whether being mistaken for food by animals, flooding low-lying areas by clogging drainage systems, or simply causing significant aesthetic blight, plastics have attracted increasing attention as a large-scale pollutant.

(4) Some 20 percent of the electricity generated in the United States originates in nuclear power plants. At the core of a nuclear power plant is the nuclear reactor, a device that can initiate and control a self-sustaining series of nuclear fissions. Fission is the process in which a heavy nucleus splits into two smaller fragments. A large amount of energy is released in this process, and this energy is the basis of the power plant. The heat released by fission is removed from the reactor core by a coolant circulated through the core. Some of the thermal energy in the coolant is used to heat water and convert it to high-pressure steam. This steam drives a turbine, and the turbine's mechanical energy is then converted into electricity by means of a generator.

Most of the energy of fission—about 85 percent of it— is released within a very short time after the process occurs. The rest of the energy comes from the radioactive decay of fission products. Radioactive decay continues when the fission reaction has been stopped, and its energy must be dealt with in any proper reactor design. In particular, significant measures must be taken to prevent the exposure of living tissue to the products of radioactive decay—namely, gamma rays, X-rays, and such high-energy particles as neutrons, electrons, and positrons—at all stages in the nuclear fuel cycle, from fabrication of fuel rods through controlled fission in the reactor core to the storage and disposal of spent fuel and other forms of radioactive waste.

Task 4. Work in pairs. Describe the forms of pollution mentioned in the text and discuss with your partner the following problems:

1. Where do noise pollution and light pollution come from?

2. Which form of pollution is more harmful to public health?

3. What measures can help to reduce noise pollution and light pollution?

Task 5. With the help of additional material, explain why plastics and radioactive waste are found to be persistent polluters of many environmental niches, from Mount Everest to the bottom of the sea, and make up a report on this problem.

UNIT II. ENVIRONMENTAL IMPACT OF MINING

Task 1. Before reading the texts, discuss the environmental impact of mining. What do you know about this problem?

The environmental impact of mining includes erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater, surface water by chemicals from mining processes. In some cases, additional forest logging is done in the vicinity of mines to increase the available room for the storage of the created debris and soil. Besides creating environmental damage, the contamination resulting from leakage of chemicals also affects the health of the local population. Mining companies in some countries are required to follow environmental and rehabilitation codes, ensuring the area mined is returned to close to its original state. Some mining methods may have significant environmental and public health effects.

Erosion of exposed hillsides, mine dumps, tailings dams and resultant siltation of drainages, creeks and rivers can significantly impact the surrounding areas, a prime example being the giant Ok Tedi Mine in Papua New Guinea. In areas of wilderness mining may cause destruction and disturbance of ecosystems and habitats and in areas of farming it may disturb or destroy productive grazing and croplands. In urbanized environments mining may produce noise pollution, dust pollution and visual pollution.

Text 1. Water pollution

Task 1. Before reading the text, discuss the problem of* water pollution. *What sources and causes of water pollution do you know?

Task 2. Skim through the text to get the general idea of it. Find key words that you can use to speak about the problem of groundwater and surface water contamination by chemicals from mining processes.

Task 3. Read and translate the text paying attention to the meaning of the following words and word combinations. Use specialized dictionaries if needed.

Protective measures, subsurface, rock debris, submarine tailings disposal, land storage, damaging compound, mine drainage, mine cooling, aqueous extraction, bioleaching.

Mining can have bad effects on surrounding surface and ground water if protective measures are not taken. The result can be unnaturally high concentrations of some chemicals, such as arsenic, sulfuric acid, and mercury over a significant area of surface or subsurface. Runoff of mere soil or rock debris -although non-toxic also devastates the surrounding vegetation. The dumping of the runoff in surface waters or in forests is the worst option here. Submarine tailings disposal is regarded as a better option (if the soil is pumped to a great depth). Mere land storage and refilling of the mine after it has been depleted is even better, if no forests need to be cleared for the storage of the debris.

There is potential for massive contamination of the area surrounding mines due to the various chemicals used in the mining process as well as the potentially damaging compounds and metals removed from the ground with the ore. Large amounts of water produced from mine drainage, mine cooling, aqueous extraction and other mining processes increases the potential for these chemicals to contaminate ground and surface water. In well-regulated mines, hydrologists and geologists take careful measurements of water and soil to exclude any type of water contamination that could be caused by the mine's operations.

The reducing or eliminating of environmental degradation is enforced in modern American mining by federal and state law, by restricting operators to meet standards for protecting surface and ground water from contamination. This is best done through the use of non-toxic extraction processes as bioleaching. If the project site becomes nonetheless polluted, mitigation techniques such as acid mine drainage (AMD) need to be performed.

The five principal technologies used to monitor and control water flow at mine sites are diversion systems, containment ponds, groundwater pumping systems, subsurface drainage systems, and subsurface barriers. In the case of AMD, contaminated water is generally pumped to a treatment facility that neutralizes the contaminants.

Task 4. Sum up the main information given in the text.

Task 5. Write a summary of the text.

Text 2. Effects of mining activity on biodiversity

Task 1. Before reading the text, discuss the main causes of biodiversity losses.

Task 2. Skim through the text to get the general idea of it. Find key words that you can use to speak about some effects of mining activity on biodiversity.

Task 3. Read and translate the text paying attention to the meaning of the following words and word combinations. Use specialized dictionaries if needed.

Exploitation site, mine-waste residuals, anthropogenic substance, biodiversity, habitat, direct/indirect poisoning,, mine extracted material, endemics species, bioavailability of the contaminant, food chain, anthropogenic disturbance, remediation.

The implantation of a mine is a major habitat modification, and smaller perturbations occur on a larger scale than exploitation site, mine-waste residuals contamination of the environment for example. Adverse effects can be observed long after the end of the mine activity. Destruction or drastic modification of the original site and anthropogenic substances release can have majors impact on biodiversity in the area.

Destruction of the habitat is the main component of biodiversity losses, but direct poisoning caused by mine extracted material, and indirect poisoning through food and water can also affects animals, vegetals and microorganisms. Habitat modification such as pH and temperature modification disturb communities in the area. Endemics species are especially sensitive, since they need really specific environmental conditions. Destruction or slight modification of their habitat put them at the risk of

extinction. Habitats can be damaged as well by non-chemicals products, such as large rocks from the mines that are discarded in the surrounding landscape with no concern for impacts on natural habitat.

Concentration of heavy metals is known to decrease with distance from the mine, and effects on biodiversity follow the same pattern. Impacts can vary a lot depending on mobility and bioavailability of the contaminant: less mobile molecules will stay inert in the environment while highly mobile molecules will easily move into another compartment or be taken up by organisms. For example, speciation of metals in sediments could modify their bioavailability, and thus their toxicity for aquatic organisms.

Bioaccumulation plays an important role in polluted habitats: mining impacts on biodiversity should be, assuming that concentration levels are not high enough to directly kill exposed organisms, greater on the species on top of the food chain because of this phenomenon.

Adverse mining effects on biodiversity depends on a great extent on the nature of the contaminant, the level of concentration at which it can be found in the environment, and on the nature of the ecosystem itself. Some species are really resistant to anthropogenic disturbances, while some other will completely disappear from the contaminated zone. Time alone does not seem to allow the habitat to recover completely from the contamination. Remediation takes time, and in most of the cases will not enable the recovery of the diversity present before the mining activity.

Task 4. With the help of additional material, make up a report about the measures that should be taken to eliminate direct poisoning caused by mine extracted material, and indirect poisoning through food and water that can affect animals, vegetals and microorganisms.

Task 5. Sum up the main information given in the text using the following examples:

1. Introduction:
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The text / the passage / the extract tells us about / describes / is devoted to …
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In the first / the second / the third part the author writes about / analyses the problem of / gives his point of view on …
In the first / the second / the third part the author writes about / analyses the problem of / gives his point of view on …
3. Conclusion:
By way of summing up, …
In conclusion, I can say that … .
I want to say that … .
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It is very informative / entertaining / interesting … .

Text 2a. Aquatic organisms

Task 1. Before reading the text, discuss what factors can impact aquatic biodiversity.

Task 2. Skim through the text to get the general idea of it.

Task 3. Read and translate the text paying attention to the meaning of the following words and word combinations. Use specialized dictionaries if needed.

Mine drainage, aquatic organisms, microorganism, algae biomass, solubilization, pyrite, acidophil bacteria, acidic water, diatom, phytoplankton and zooplankton mass, planktonic species, planktonic diatom community, cyst, crustacean community, predator, invertebrates, pH diminution, trophic completeness.

Mining industry can impact aquatic biodiversity through different ways. Direct poisoning is the first one, and risks are higher when contaminants are mobile in the sediment or bioavailable in the water. Mine drainage can modify water pH, and it is hard to differentiate direct impact on organisms from impacts caused by pH changes. Effects can nonetheless be observed and proved to be caused by pH modifications. Contaminants can

also affect aquatic organisms through physical effects: streams with high concentrations of suspended sediment limit light, thus diminishing algae biomass. Metal oxide deposition can limit biomass by coating algae or their substrate, thereby preventing colonization.

Factors that impact communities in acid mine drainage sites vary temporally and seasonally: temperature, rainfall, pH, salinization and metal quantity all displays variations on the long-term, and can heavily affect communities. Changes in pH or temperature can affect metal solubilization, and thereby the bioavailable quantity that directly impact organisms. Moreover, contamination persists over time: ninety years after a pyrite mine closure, water pH was still really low and microorganisms' populations consisted mainly of acidophil bacteria.

Microorganisms

Algae communities are less diverse in acidic water containing high zinc concentration, and mine drainage stress decrease their primary production. Diatoms community is greatly modified by any chemical change. pH phytoplankton assemblage and high metal concentration diminishes the abundance of planktonic species. Some diatom species may however grow in high metal concentration sediments. In sediments close to the surface, cysts suffer from corrosion and heavy coating. In really polluted conditions, total algae biomass is really low, and the planktonic diatom community missing. In case of functional complementarity however, it is possible that phytoplankton and zooplankton mass remains stable.

Macroorganisms

Water insect and crustacean communities are modified around a mine, resulting in a low trophic completeness, community being dominated by predators. However, biodiversity of macro invertebrates can remain high, if sensitive species are replaced with tolerant ones. When diversity is on the contrary reduced, there is sometimes no effect of stream contamination on abundance or biomass, suggesting that tolerant species fulfilling the same function take the place of sensible species in polluted sites. pH diminution in addition of elevated metal concentration can also have adverse effects on macro invertebrates behavior, showing that direct toxicity is not the only issue. Fishes are also affected by pH, temperature variations and chemical concentrations.

Task 4. Work in pairs and discuss with your partner the factors that can impact aquatic biodiversity.

Task 5. Sum up the main information given in the text.

Task 6. Write a summary of the text.

Text 2b. Terrestrial organisms

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

Terrestrial organism, vegetal, forbs, shrubs, waste-material reject, perturbation, physiology, non-native species, ecological niche, arsenic, bryophytes, nutrient availability, acreage, cultivated crop, neighborhood, aerial organ, cadmium and zinc, copper, lead, antimony, ants species, gene, microbial biomass, arbuscular mycorrhiza fungi, biodisponibility, microbes, hydrogen sulfide, toxin.

Task 3. Read the text and think of the questions you might ask about.

Vegetals. Soils texture and water content can be greatly modified in disturbed sites, leading to plants communities changes in the area. Most of the plants have a low concentration tolerance for metals in the soil, but sensitivity differs among species. Grass diversity and total cover is less affected by high contaminant concentration than forbs and shrubs. Mines waste-material rejects or traces due to mining activity can be found in the vicinity of the mine, sometimes pretty far away from the source. Established plants cannot move away from perturbations, and will eventually die if their habitat is contaminated by heavy metals or metalloids at concentration too elevated for their physiology. Some species are more resistant and will survive these levels, and some non-native species that can tolerate these concentrations in the soil, will migrate in the mine surrounding lands to occupy the ecological niche.

Plants can be affected through direct poisoning, for example arsenic soil content reduces bryophyte diversity. Soil acidification through pH diminution by chemical contamination can also lead to a diminished species number. Contaminants can modify or disturb microorganism, thus modifying

nutrient availability, causing a loss of vegetation in the area. Some tree roots avoid the deeper soil layer in order to avoid the contaminated zone, and thus miss acreage and might be uprooted by the wind when their height and shoot weight increase. In general, root exploration is reduced in contaminated areas compared to non-polluted ones. Even in reclaimed habitats, plant species diversity is lower than in undisturbed areas.

Cultivated crops might be a problem in mines neighborhood. Most of our crops can grow on weakly contaminated sites, but yield is generally lower than it would have been in regular growing conditions. Plants also tend to accumulate heavy metals in their aerial organs, possibly leading to human intake through fruits and vegetables. Regular consumptions might lead to health problems caused by long-term metal exposure. Cigarettes made from tobacco growing on contaminated sites might as well have adverse effects on human population, as tobacco tends to accumulate cadmium and zinc in its leaves.

Animals. Habitat destruction is one of the main issues of mining activity. Huge areas of natural habitat are destroyed during mine construction and exploitation, forcing animals to leave the site.

Animals can be poisoned directly by mine products and residuals. Bioaccumulation in the plants or the smaller organisms they eat can also lead to poisoning: horses, goats and sheep are exposed in certain areas to potentially toxic concentration of copper and lead in grass. They are fewer number of ants species in soil containing high copper levels, in the vicinity of a copper mine. If fewer ants are found, chances are great that other organisms leaving in the surrounding landscape are strongly affected as well by these high copper levels, since ants are a good environmental control: they live directly in the soil and are thus pretty sensible to environmental disruptions.

Microorganisms. Because of their size, microorganisms are extremely sensitive to environmental modification, such as modified pH, temperature changes or chemicals concentration. For example, the presence of arsenic and antimony in soils led to a diminution in total soil bacteria. Moreover, as in water, a small change in the soil pH can provoke the remobilization of contaminants, in addition of direct impact on pH-sensitive organisms.

Microorganisms have a wide variety of genes among their total population, so there is a greater chance of survival of the species due to the existence of resistance or tolerance genes in some colonies, as long as

modifications are not too extreme. Nevertheless, survival in these conditions will imply a big loss of gene diversity, resulting in reduced potential adaptations to subsequent changes.

The presence of few developed soil in heavy metal contaminated areas could be a sign of reduced activity by soils micro fauna and microflora, indicating a reduced number of individuals or reduced activity. Twenty years after disturbance, even in rehabilitation area, microbial biomass is still greatly reduced compared to undisturbed habitat.

Arbuscular mycorrhiza fungi are especially sensitive to the presence of chemicals, and the soil is sometimes so disturbed that they are no longer able to associate with root plants. Some fungi possess however contaminant accumulation capacity, soil cleaning capacity by changing the biodisponibility of contaminants, and can protect plants from damages caused by chemicals. Their presence in contaminated sites could prevent loss of biodiversity due to mine-waste contamination, or allow bioremediation, that is, the removal of undesired chemicals from contaminated soils. On the contrary, some microbes can deteriorate the environment: elevated SO4 in the water can also increase microbial production of hydrogen sulfide, a toxin for many aquatic plants and organisms.

Task 4. Work in pairs and discuss with your partner the factors that can impact aquatic biodiversity.

Task 5. Sum up the main information given in the text.

Task 6. Write a summary of the text.

UNIT III. MINING AND WATER POLLUTION

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed.

Prerequisite development, processing ore, mine effluent, seepage from tailings, waste rock, waste rock impoundment, low grade ore, open-pit mining, target mineral, acid-generating sulphides, free-draining pile, bedrock.

Task 3. Read the text and think of the questions you might ask about.

Text 1. “Mining’s most common casualty”

Water is essential to life on our planet. A prerequisite of sustainable development must be to ensure uncontaminated streams, rivers, lakes and oceans. There is growing public concern about the condition of fresh water in the world. Mining affects fresh water through heavy use of water in processing ore, and through water pollution from discharged mine effluent and seepage from tailings and waste rock impoundments. Increasingly, human activities such as mining threaten the water sources on which we all depend. Water has been called “mining’s most common casualty” (James Lyon, interview, Mineral Policy Center, Washington DC). There is growing awareness of the environmental legacy of mining activities that have been undertaken with little concern for the environment. The price we have paid for our everyday use of minerals has sometimes been very high. Mining by its nature consumes, diverts and can seriously pollute water resources.

Negative impacts can vary from the sedimentation caused by poorly built roads during exploration through to the sediment, and disturbance of water during mine construction. Water pollution from mine waste rock and tailings may need to be managed for decades, if not centuries, after closure. These impacts depend on a variety of factors, such as the sensitivity of local terrain, the composition of minerals being mined, the type of technology employed, the skill, knowledge and environmental commitment of the company, and finally, our ability to monitor and enforce compliance with environmental regulations. One of the problems is that mining has become more mechanized and therefore able to handle more rock and ore material than ever before. Therefore, mine waste has multiplied enormously. As mine technologies are developed to make it more profitable to mine low grade ore, even more waste will be generated in the future.

Ore is mineralized rock containing a valued metal such as gold or copper, or other mineral substance such as coal. Open-pit mining involves the excavation of large quantities of waste rock (material not containing the target mineral) in order to extract the desired mineral ore.

The ore is then crushed into finely ground tailings for processing with various chemicals and separating processes to extract the final product. In Canada on average for every tons of copper extracted 99 tons of waste material (made up of soil, waste rock and the finely ground “tailings”) must also be removed.

The Canadian mineral industry generates one million tons of waste rock and 950,000 tons of tailings per day, totaling 650 million tons of waste per year. After being removed, waste rock, which often contains acid-generating sulphides, heavy metals, and other contaminants, is usually stored above ground in large free-draining piles. This waste rock and the exposed bedrock walls from which it is excavated are the source of most of the metals pollution caused by mining in British Columbia. In other regions of North America tailings also represent a major source of heavy metals contamination of waterways.

Task 4. Discuss in groups the main factors that lead to water pollution from mining.

Task 5. Sum up the main information and write a summary of the text.

Task 6. With the help of additional material, make up a report about the measures that should be taken to protect surface and ground water from contamination resulted in mining operations.

Text 2. Types of Water Pollution from Mining

Task 1. Read and translate the following words and word combinations. Use specialized dictionaries if needed.

Drainage, sulphuric acid, sulphide mineral, Thiobacillusferroxidans, oxidation and acidification process, leaching, trace metal, source rock, watershed vegetation, riverbed.

Task 2. Skim through the text and think of the questions you might ask about.

Task 3. Read the text and discuss in groups each type of mining impacts on water quality.

There are four main types of mining impacts on water quality.

1. Acid Mine Drainage

Acid Rock Drainage (ARD) is a natural process whereby sulphuric acid is produced when sulphides in rocks are exposed to air and water. Acid Mine Drainage (AMD) is essentially the same process, greatly magnified. When large quantities of rock containing sulphide minerals are excavated from an open pit or opened up in an underground mine, it reacts with water and

oxygen to create sulphuric acid. When the water reaches a certain level of acidity, a naturally occurring type of bacteria called Thiobacillusferroxidans may kick in, accelerating the oxidation and acidification processes, leaching even more trace metals from the wastes. The acid will leach from the rock as long as its source rock is exposed to air and water and until the sulphides are leached out – a process that can last hundreds, even thousands of years. Acid is carried off the mine site by rainwater or surface drainage and deposited into nearby streams, rivers, lakes and groundwater. AMD severely degrades water quality, and can kill aquatic life and make water virtually unusable.

2. Heavy Metal Contamination & Leaching

Heavy metal pollution is caused when such metals as arsenic, cobalt, copper, cadmium, lead, silver and zinc contained in excavated rock or exposed in an underground mine come in contact with water. Metals are leached out and carried downstream as water washes over the rock surface. Although metals can become mobile in neutral pH conditions, leaching is particularly accelerated in the low pH conditions such as are created by Acid Mine Drainage.

3. Processing Chemicals Pollution

This kind of pollution occurs when chemical agents (such as cyanide or sulphuric acid used by mining companies to separate the target mineral from the ore) spill, leak, or leach from the mine site into nearby water bodies. These chemicals can be highly toxic to humans and wildlife.

4. Erosion and Sedimentation

Mineral development disturbs soil and rock in the course of constructing and maintaining roads, open pits, and waste impoundments. In the absence of adequate prevention and control strategies, erosion of the exposed earth may carry substantial amounts of sediment into streams, rivers and lakes. Excessive sediment can clog riverbeds and smother watershed vegetation, wildlife habitat and aquatic organisms.

Task 4. Sum up the main information and write a summary of the text.

Task 5. With the help of additional material, make up a report about the main types of mining impacts on water quality in your region.

UNIT IV.TAILINGS

Task 1. Skim through the text to get the general idea of it. Find key words that you can use to speak about the nature of tailings.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

Mine dump, slime, tails, leach residue, gangue, overburden, waste rock, barren rock, placer mining, valuable minerals, hard rock mining, micrometer, mill, slurry, heap leaching, host ore, arsenic, barite, calcite, fluorite, mercury, sulfur, sulfide compound, pyrite, cadmium, hydrocarbons.

Task 3. Read the text and think of the questions you might ask about.

Text 1. The nature of tailings

Tailings, also called mine dumps, slimes, tails, leach residue, or slickens, are the materials left over after the process of separating the valuable fraction from the uneconomic fraction (gangue) of an ore. Tailings are distinct from overburden or waste rock, which are the materials overlying an ore or mineral body that is displaced during mining without being processed.

The extraction of minerals from ore can be done two ways: placer mining, which uses water and gravity to extract the valuable minerals, or hard rock mining, which uses pulverization of rock, then chemicals. In the latter, the extraction of minerals from ore requires that the ore be ground into fine particles, so tailings are typically small and range from the size of a grain of sand to a few micrometers. Mine tailings are usually produced from the mill in slurry form (a mixture of fine mineral particles and water).

Tailings represent an external cost of mining, and this is particularly true of early mining operations which did not take adequate steps to make tailings areas environmentally safe after closure. Modern day mines, particularly in jurisdictions with well-developed mining regulations and/or operated by responsible mining companies; incorporate the rehabilitation and proper closure of tailings areas in the mining costs and activities.

The composition of tailings is directly dependent on the composition of the ore and the process of mineral extraction used on the ore.

Certain types of extraction process, like heap leaching for example, may result in quantities of chemicals used to perform the leaching remaining

in the material once leaching has been completed. Older forms of mineral extraction, such as those utilized during the early gold boom years of Australian gold mining, resulted in large heaps of fine tailings being left dotted around the landscape. These tailings dumps would continue to leach residual chemicals into the environment, and if weather conditions allowed it the finer fraction would become windborne, blowing around the townships surrounding the now-dormant mining areas.

Typically, the bulk quantity of a tailings product will be barren rock, crushed and ground to a fine size ranging from coarse sands down to a talcum powder consistency.

Tailings may contain trace quantities of metals found in the host ore, and they may contain substantial amounts of added compounds used in the extraction process. Elements are rarely in elemental form, more often as complex compounds.

Common minerals and elements found in tailings include:

Arsenic - Found in association with gold ores
Barite
Calcite
Fluorite
Radioactive materials - Naturally present in many ores
Mercury
Sulfur - Forms many sulfide compounds / pyrites
Cadmium
Hydrocarbons - Introduced by mining and processing equipment (oils & greases).

Tailings present a long term cost to the mining industry. If the company leaves or goes bankrupt, the local government can find itself with responsibility for the maintenance and monitoring of tailings dumps essentially forever - this, and other costs of cleanup, can impose liabilities that were estimated at up to 12 billion dollars in the US alone in 2005.

Task 4. Sum up the main information given in the text.

Task 5. Write a summary of the text.

Text 2. Environment considerations

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Task 3. Find key words that you can use to retell the text.

The elements and compounds uncovered and liberated through mining and processing, which are not usually part of the ecological systems (in such a form or concentration) have the potential to alter the receiving environment to its detriment. Most mining and minerals processing wastes contain minerals, such as sulphides, which are formed at higher temperatures and pressures at geological depth. When exposed to aerobic surficial conditions, or as a result of processing, minerals may breakdown releasing elements from their mineralogical bindings which may not be easily absorbed by unaccustomed ecosystems without impact (this process is sometimes known as Acid and Metaliferous Drainage). It is precisely, because these elements did not interact with the overlying ecosystems before mining that they may pose issues to ecosystems and communities post-mining.

Disposal of mine tailings is one of the most important environmental issues for any mine during the project's life. While significant pressure is placed on mining projects in developed countries to conform to stringent environmental standards, many projects in developing nations do not take significant steps to prevent or mitigate environmental damage.

The sustainability challenge in the management of tailings and waste rock is to dispose of material, such that it is inert or, if not, stable and contained, to minimize water and energy inputs and the surface footprint of wastes and to move toward finding alternate uses .

Although ideally the tailings would be made up of gangue materials (i.e. silica), to some degree, the sought-after mineral also appears in the tailings. Tailings also commonly contain unmineralized sulphides that can breakdown and release metals and generate acidic conditions. In operations that recover lead, uranium and other toxic heavy metals, this represents a significant environmental hazard. In addition to the minerals themselves, some processing methods involve marine pollutants such as copper sulfate, xanthate or cyanide which will be present to some degree in the tailings. In some operations, components of the gangue may also be toxic, though it is rare for these materials to be present above trace levels. An example is thallium in sulfide ores.

In order to prevent the uncontrolled release of tailings material into the environment, mines usually have a disposal facility which quite often takes the form of a dam or pond. This is a convenient method of storage since tailings are often in the form of slurry when they are discharged from the concentrator. These facilities often require the clearing of more land than the rest of the mine (including open-pit operations) combined, and failure of the wall can result in a massive release of tailings. As such they are of great environmental concern.

Tailings release and subsequent damage to the environment can also occur without catastrophic failure of the storage facility. These kinds of release are much less obvious and may take the form of acid drainage or dry tailings dust being blown away from the storage area. Several major environmental disasters have been caused by tailings dam failures and other release of tailings into the environment. Some examples are the Ok Tedi environmental disaster, the Buffalo Creek Flood, the 2000 Baia Mare cyanide spill and the Ajka alumina plant accident.

Task 4. With the help of additional material, make up a report about one of the environmental disasters (mentioned in the text) caused by tailings dam failures or other release of tailings into the environment.

Task 5. Retell the text.

UNIT V. MINING AND HEALTH

Task 1. Read and translate the following words and word combinations. Use specialized dictionaries if needed. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

Gold, silver, copper, gem, diamond, ruby, minerals, uranium, asbestos, coal, sand, salt, open-pit surface mine, underground mine, small-scale mine, small-scale mining, large-scale mining, mining operation, threats to health.

Task 2. Read and translate the following words and word combinations, make up your own sentences with them on the topic of the text.

To earn a livelihood, to protect smb's health, to protect the environment, to dig a huge pit,, to hurt people and the environment, to take precautions to do smth., to reduce harm.

Task 3. Skim through the text below and point out the general idea of it.

Task 4. Read the text and think of the questions you might ask about.

Task 5. Find key words that you can use to retell the text.

People mine the earth for metals such as gold, silver, and copper; for gems such as diamonds and rubies; and for minerals such as uranium, asbestos, coal, sand, and salt. All mining is dangerous, and it is difficult for miners to earn a livelihood while also protecting their health and the environment. But there are ways to make mining safer. Often the only way to get the mining industry to use less harmful methods is through community pressure.

Mining is done in very large open-pit surface mines or deep underground mines operated by large corporations, as well as in small-scale mines run by local people. Large-scale mining causes greater damage because it requires clearing large amounts of land, digging huge pits and tunnels, and moving massive amounts of earth. But small-scale mining can also hurt people and the environment.

Mining conditions are very different depending on the location, type, and size of the mining operation. By understanding mining's threats to health and long-term well-being and by taking precautions to reduce harm in all mines, miners and other people in mining communities can better protect their health and improve their lives.

Task 6. Translate the text in writing.

Text 1. Safety at Mine Sites

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Task 3. Find key words that you can use to retell the text.

Mining companies are responsible for making mines operate safely. Governments, miners, and their unions are responsible for making sure the companies do that. Unfortunately, many governments do not enforce health, safety, and environmental regulations.

Workers and communities need the right to protect themselves from harm, information, and equipment and training to reduce exposure to harmful materials. Miners and communities often form safety committees to make sure conditions are as safe as possible. Safety committees can also prepare

for emergencies with plans to transport hurt workers and evacuate anyone in danger.

Mine operators should provide protective equipment for all workers and maintain it in good condition. Mine operators should also make sure every mine operation has first aid supplies, and that all workers have access to them. Most importantly, all workers should be trained about mining dangers, such as chemicals, using explosives, and landslides.

To make sure mining does as little harm as possible to the environment, communities and their allies should monitor water and air near mine sites for signs of pollution. People who may be exposed to toxic chemicals, excessive dust, or other dangers should be tested by health workers on an ongoing basis, and be given treatment at the first signs of health problems.

Task 4. Discuss in groups what measures should be taken to make mines operate safely.

Task 5. With the help of additional material, make up a report about safety measures undertaking by Russian mining companies to make sure mining conditions to be as safe as possible.

Text 2. Health Problems from Mining

Task 1. Before reading the text discuss what way mining damages people's health.

Task 2. Skim through the text below and point out the general idea of it.

Task 3. Read the text and think of the questions you might ask about.

Mining causes serious accidents such as fires, explosions, or collapsed mine tunnels that affect miners and people living in communities near mines. Even in places where mining happened long ago, people can still be exposed to health threats from mining waste and chemicals that remain in the soil and water. Mining damages health in many ways:

• Dust, chemical spills, harmful fumes, heavy metals and radiation can poison workers and cause life-long health problems as well as allergic reactions and other immediate problems.

• Heavy lifting and working with the body in awkward positions can lead to injuries to the arms, legs, and back.

• Use of jackhammers or other vibrating machinery can cause damage to nerves and blood circulation, and lead to loss of feeling, very dangerous infections such as gangrene, and even death.

• Loud, constant noise from machines can cause hearing problems, including deafness.

• Long hours working underground with little light can harm vision.

• Working in very hot conditions without drinking enough water can cause heat stress. Signs of heat stress include: dizziness, weakness, rapid heartbeat, extreme thirst, and fainting.

• Hiring and labor practices of mining companies create divisions among families, neighbors, and communities. These disagreements can lead to tears in the social fabric, an increase in personal stress, and mental health problems throughout the community.

• Water pollution and overuse of water resources leads to many health problems.

• Land and soil are destroyed, leading to food scarcity and hunger.

• Air pollution from power plants and smelting factories built near mines causes serious illness.

Task 4. Discuss in pairs what way mining damages people's health and list some health problems from mining.

Task 5. Sum up the main information and write a summary of the text.

Text 3. Illnesses from Dust

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

To cough, lung damage, black lung disease, silica dust, silicosis, asbestos, asbestosis, shortness of breath, coughing, wheezing, sputum, sore throat, fever, chest pain, tiredness.

Task 3. Read the text and think of the questions you might ask about.

Lung damage caused by rock and mineral dust is a major health problem. Whether you are mining underground or above ground, you may develop lung damage if:

• dust covers your clothes, body, and equipment as you work.

• you cough a lot and have trouble breathing.

Once dust has damaged the lungs, there is no way to reverse the damage. Dust is a threat both to mineworkers and to communities near mines.

The most dangerous kinds of dust are coal dust, which causes black lung disease, and silica dust, which causes silicosis. Dust that contains asbestos (which causes asbestosis, see page 371) or heavy metals (page 337) is also dangerous.

Signs of lung damage

Dust from mining can make it difficult to breathe. Large amounts of dust can make the lungs fill with fluid and swell up. Signs of lung damage from dust include:

• shortness of breath, coughing, wheezing

• coughing up green or yellow sputum (mucus that comes up from the lungs)

• sore throat

• bluish skin at ears or lips

• fever

• chest pain

• loss of appetite

• tiredness

Black lung disease, silicosis, and asbestosis, are serious conditions with no cure. It is best to prevent exposure to harmful dust. Because these diseases worsen very quickly, by the time you have signs all you can do is keep the disease from getting worse. If you have any of the signs above, or have been exposed to these kinds of dust, see a health worker right away. Because smoking greatly increases the risk of lung damage from dust, it is particularly important that miners do not smoke tobacco.

Task 4. Sum up the main information and retell the text.

Text 4. Black lung disease and silicosis

Task 1 Skim through the text below and point out the general idea of it.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

Black lung, bronchodilators, dairy food, nutrition, tuberculosis, chronic bronchitis, heart disease, lung cancer, pneumonia, asthma, rheumatoid arthritis, lupus, rheumatic fever, sclerosis,

Task 3. Read the text and think of the questions you might ask about.

Black lung is caused when coal dust blocks the lungs, causing severe and permanent breathing problems. Underground coal miners, and children and women who work separating rocks from coal, are most affected by black lung. Silicosis is caused by exposure to silica dust. Silica is a common mineral released from sand and rocks during mining, exposing many miners to harm.

Treatment

Black lung and silicosis cannot be cured. But you can reduce the suffering they cause.

• Drink plenty of water to help loosen mucus from the lungs.

• Keep breathing passages open. Fill a bowl with steaming hot water and strong-smelling herbs such as eucalyptus, oregano, mint, or thyme. Put your head over the bowl, cover yourself with a towel or cloth, and breathe the vapors. Do this for
15 minutes at a time, several times a day.

• Medicines called bronchodilators can help open the breathing passages. The kinds that are inhaled work fastest.

• Hospitals may give oxygen to help a person breathe more easily.

• Some people believe dairy foods like milk, cheese, and butter make mucus thicker and more difficult to cough up. If eating these foods makes you feel worse, avoid them as long as you can get good nutrition from other foods.

Related health problems

People with black lung disease or silicosis have a higher risk of developing
other health problems such as:

• tuberculosis (TB)
• chronic bronchitis
• heart disease
• lung cancer
• pneumonia

• asthma
• rheumatoid arthritis
• lupus
• rheumatic fever
• sclerosis

Task 4. Sum up the main information and retell the text.

Text 5. Preventing harm from dust

Task 1 Skim through the text below and point out the general idea of it.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed. If you are not sure how to pronounce the words correctly, look them up in the dictionary.

Air pump and fan, water sprinkler, shaft, tunnel, hole, shower head, sour water, fresh water, cutting and grinding equipment, breathing dust, to trap dust, blanket, blasting, rubber respirator, goggles, gear, damp mop, curtain.

Task 3. Read the text and think of the questions you might ask about.

By limiting the amount of dust you breathe in, lung damage can be prevented. Mine operators should provide equipment to reduce dust in mines

• Pump fresh air into underground mines. Mines should have many openings to the surface. Air pumps and fans can bring fresh air in and push dust and dirty air out.

• Provide water sprinklers to damp down dust. Store water in a tank above, and pump it or let it run down into shafts and tunnels through pipes with small holes or shower heads. “Sour water” not fit for drinking works fine. However, miners need plenty of fresh water to drink.

• Provide cutting and grinding equipment that sprays water to trap dust. Mine operators should provide materials to protect miners from breathing dust.

• Provide supplies such as crushed limestone and blankets to cover blasting areas.

• Provide proper masks and make sure they are cleaned and maintained.

Workers need a place to change out of dusty clothes and bathe before leaving the mine site, and a clean area to store clothes. Mine operators also

have a responsibility to find ways to keep dust from mining operations out of the surrounding communities.

Miners can reduce the amount of dust they breathe in

• Wet surfaces before cutting or drilling to prevent dust from rising.

• Spread crushed limestone to prevent silica or coal dust from rising into the air.

• Cover blasting and grinding areas with a wet blanket or tarp to trap dust. After blasting or grinding, spray the area with water.

• Let dust settle after blasting and before entering an area.

• Wear protective clothes and equipment. The best mask for miners is a rubber respirator that fits tightly and has filters for the materials you work with. Miners should receive training in how to choose, use, and maintain masks. If no dust mask is available, wear a cloth around your mouth and nose, and wash it daily. Glasses or goggles will protect your eyes.

• Wash hands and face before eating, drinking, or smoking, and during and after work.

• Wash gear often. Do not shake out dusty bags — this throws more dust into the air. Wash the bag instead. If you must shake the bag, make sure the wind carries dust away from you. Cloth bags trap a lot of dust — use plastic bags if you can.

Prevent mine dust from entering your home

• Wash after work and before entering the house.

• Leave dusty work clothes at the mine, or change out of them before entering your home.

• Clean floors with a damp mop to remove dust. Sweeping will put dust in the air.

• If it is dusty outside, keep doors and windows closed. If your house does not have doors and windows that close, hang curtains or large banana leaves in doors and windows.

Task 4. Discuss in pairs what measures are taken by Russians mining companies to p*revent harm from dust. Use *additional material if needed.

Task 5. Sum up the main information and retell the text.

Text 6. Tuberculosis (TB)

Task 1 Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Because miners often live in crowded conditions, work long hours without enough food, and have little access to health care or medicines, they have a high risk of getting TB. Signs of TB include a bad cough that will not go away, fever, coughing up blood, feeling weak, weight loss, and night sweats. Without proper treatment, a person can spread TB to others and can die. TB can be fatal to anyone, but is especially dangerous for people weak from hunger or other illnesses like HIV and AIDS. Lung damage from dust increases the risk of TB even more.

Good ventilation will reduce the chance of TB spreading through a mine, miners' dormitories, or homes. The best way to prevent TB among miners, or any workers, is to create the conditions for good health through:

- clean water
- healthy food
- good health care
- better pay
- shorter work hours
- safer work conditions
- safe, clean living conditions

To prevent the spread of TB, it is important to make sure everyone with TB gets proper treatment and medicine. Many governments provide free TB treatment; to get medications, see a health worker.

Task 3. Discuss in groups what you have learnt about why miners have a high risk of getting TB.

Text 7. Contaminated Water

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Task 3. Read the text and write down all unknown terms from the text and translate them with the help of a dictionary.

Mining uses large amounts of water and leaves large amounts of waste, contaminating water sources and the people who depend on them. While all mining operations tend to pollute water, big companies usually cause the biggest problems. Surface water and groundwater in mining areas may

remain contaminated for many years. Water loss can leave the land barren and unusable for farming or raising animals. The long-term damage of water contamination will last much longer than the short-term economic gain from mining.

Preventing and reducing water pollution

Leaking waste ponds are one of the main causes of water pollution from mining.

To prevent pollution, waste ponds should be:

• built away from water sources or watershed drainage areas.
• lined to prevent leaks into groundwater.
• built according to the best international standards.
• monitored to prevent leaks and spills.
• emptied of wastes and safely closed when mining operations end.

Cleaning water once it has been polluted by mining is difficult, costly, and not always successful.

Task 4. Discuss in groups what measures should be taken to prevent and reduce water pollution from leaking waste ponds.

Text 8. Acid mine drainage

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Task 3. ***Read the text and explain when acid mine drainage happens and describe the actions that should be taken against it.***

Acid mine drainage happens when water and air mixes with the sulfur deep in the ground (sulfide) to create acids that dissolve heavy metals and other toxic mine wastes. This toxic mixture eats away at rocks and goes into the soil, groundwater, rivers, and lakes. At first, there may be few signs of danger, but slowly the poisons in the water sicken people, plants, fish, and animals. Acid mine drainage destroys life downstream from a mine for hundreds or even thousands of years.

Any mine can create acid mine drainage. Because it is nearly impossible to stop, companies should prove before opening a mine that there is no sulfide in the ground so there will be no acid mine drainage. Clean-up or containment of acid mine drainage is so costly and difficult that even in

countries with strong environmental laws, thousands of kilometers of river are contaminated. A campaign against acid mine drainage may prevent a company from opening a mine in the first place.

Take action against acid mine drainage

• Identify abandoned mines and have them tested by trusted scientists. Do not let the mining company do the tests and simply tell you the results. They lie.

• Learn how mines can be monitored, and involve the community in making sure they are safe.

• Insist that the only safe way to deal with acid mine drainage is to prevent it in the first place.

Task 4. Discuss in groups what acid mine drainage is and why any mine can create it.

Task 5. Retell the text.

UNIT VI. CHEMICALS USED IN MINES

Task 1. Read and translate the text.

Task 2. Read and translate the following words and word combinations. Use specialized dictionaries if needed.

Sulfuric acid, cyanide, ammonium nitrate and fuel oil, diesel fuel, nitric acid, acetylene, solvents, lead, soldering, powder, exposure, copper mining, storage.

Text 1. Chemicals used in mines

Chemicals used in mining and processing minerals contaminate the land, water, and air, causing health problems for workers and people living near mines. Toxic chemicals used in mining include:

• cyanide, sulfuric acid, and solvents for separating minerals from ore
• nitric acid
• ammonium nitrate and fuel oil ("ANFO") used in blasting tunnels
• heavy metals such as mercury, uranium, and lead
• gasoline, diesel fuel, and exhaust fumes from vehicles and equipment
• acetylene for welding and soldering

Cyanide

Cyanide is used to separate gold from ore. In its pure form, cyanide has no color and smells like bitter almonds. It may lose this smell when it combines with other chemicals. It can be used in powder, liquid, or gas forms.

Cyanide is deadly when swallowed. An amount the size of a grain of rice is enough to kill a person. Exposure to low doses over a long time may cause a swelling in the throat (goiter), which can also be caused by malnutrition.

Cyanide is often spilled into waterways during gold mining, and when ponds filled with mine wastes burst and spill. Mining companies say that cyanide in water quickly becomes harmless. But this is true only when there is lots of sunlight and oxygen. Even then it leaves behind other harmful chemicals. If cyanide is spilled underground, or if the weather is cloudy or rainy, it can remain harmful for a long time, killing fish and plants along rivers and making water unsafe for drinking and bathing. Cyanide is so dangerous that it has been banned in some countries.

Sulfuric acid

Sulfuric acid is a toxic chemical used in copper mining. It is also a byproduct of many kinds of mining, mixing with water and heavy metals to form acid mine drainage. Sulfuric acid smells like rotten eggs. Contact with sulfuric acid can cause burns, blindness, and death.

Treatment

Chemicals used at mine sites can spill on the skin and clothes, splash in the eyes, or be breathed in as fumes. If someone is hurt, get medical help as soon as possible.

Prevention

The best way to prevent harm from toxic chemicals, including heavy metals, is to not use them. But there are also ways to prevent and reduce harm if toxics are still being used.

• Use protective equipment whenever possible.

• Wash your hands many times a day. Do not touch your face, smoke, or touch other people while working with or near toxics unless you wash your hands first.

• Demand that mine operators reduce dust and water pollution.

• Never eat where chemicals are being used, mixed, or stored.

• Store chemicals safely.

Storing chemicals

Many chemicals can cause fires, explosions, or release of toxic gases. Safe storage of chemicals can help prevent accidents and reduce harm at mine sites. Store chemicals:

• away from explosives, electrical sources, all sources of water, and motor vehicles.

• away from where people eat.

• in containers that are clearly labeled. If you move chemicals from one container to another, label the new container. Never put chemicals in containers used for food or drinks — someone may accidentally eat or drink the chemical. After a chemical container is empty, it should never be used for food or drinks, even if you wash it out.

• in strong, locked cabinets designed and labeled for chemical storage.

Task 3. Say if the following statements are TRUE or FALSE.

1. In its pure form, cyanide has white color and smells like rotten eggs.
2. Cyanide is often spilled into waterways during gold mining, and when ponds filled with mine wastes burst and spill.
3. Sulfuric acid is a toxic chemical used in ore mining.
4. Chemicals used at mine sites can spill on the skin and clothes, splash in the eyes, or be breathed in as fumes.
5. The best way to prevent harm from toxic chemicals, including heavy metals, is use them.

Task 4. Discuss in groups what else can be done to prevent harm from toxic chemicals.

Task 5. Retell the text.

UNIT VII. HEAVY METALS

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text below and decide which word from the box best fits each space.

Area, mercury poisoning, arsenic, ore, possible, open air, accidents, poison

Text 1. Heavy metals

Heavy metals such as _____, mercury, cadmium, uranium, and lead are harmful to people even in very small amounts. Because many metals are found together at mine sites, it is often hard to know which metal may be causing health problems.

If you know what metals are likely to be found in your _____ and the health effects of these metals, this will help you know if you have heavy metal poisoning. Some miners demand testing from the mine operator to know what heavy metals they are exposed to, and training about ways to reduce harm. Mercury is mined on its own and is also used to separate gold from ore. Lead is often found with copper, silver and zinc. Copper is found with silver and zinc. Arsenic is often found with gold, copper, and zinc. Cadmium is found with silver, copper, and zinc.

Mercury poisoning

When artisanal miners process silver or gold _____, they often mix the ore with mercury to make a soft substance called amalgam. When burned off to collect the gold, the mercury turns to a gas that can be breathed in by anyone nearby. Mercury can also become a gas if it is spilled or left in an open container. Breathing in mercury fumes is very dangerous. Mercury is also dangerous if it is absorbed through the skin or eaten when it passes from someone's hands to food.

Some signs of _____ are easy to confuse with malaria. If you live in a gold mining community and malaria medicine does not seem to work, talk to a health worker about the possibility of mercury poisoning.

Mercury poisons the environment by settling into the water and soil, where it can remain for many years. Lakes and rivers in California, USA, are still poisoned by mercury from gold mining over 100 years ago.

Prevent mercury poisoning

Artisanal gold (or silver) miners can prevent mercury poisoning by using a mercury retort. A mercury retort captures mercury gas before it gets into the air. This prevents miners and others from breathing the poison, and allows miners to save money by reusing mercury rather than losing it to the air.

Always separate gold from mercury in the _____ or in a well-ventilated area. This will reduce the amount of mercury fumes that collect on,

and in, the bodies of people nearby. Wear thick gloves when handling mercury.

Some gold miners simply put a banana leaf over the gold heating pan to capture mercury. When heated, the mercury turns to gas, and turns back to liquid on the leaf. Covering the heating pan with a leaf is much better than leaving it uncovered. But this still allows the mercury to _____ the worker and the environment, and the mercury is not recovered. A better solution is to use a closed retort.

There are many kinds of mercury retorts. All of them require strong, directed heat. A blowtorch or a fire with an air blower will help to recover all the gold as quickly as _____.

Uranium radiation

Uranium is a metal that releases harmful radiation. Radiation causes cancer, skin diseases, and other serious health problems. People are exposed to uranium through mining it, processing it, or living near uranium mines or waste dumps.

Uranium is used to make 2 things: nuclear weapons and nuclear energy. Both are costly, dangerous, and not needed. No country can trust its leaders or military with nuclear weapons built to kill huge numbers of people. What we need is peace.

Nuclear energy is also dangerous, and _____ in nuclear power plants can kill thousands of people. The waste from nuclear energy remains very harmful for thousands of years and cannot be disposed of safely. Electricity can be made in safer ways.

Task 3. Translate the following words. Make up your own sentences with them on the topic of the text.

Nuclear weapons, heavy metals, waste, harmful, artisanal miners, environment, health problems, substance.

Task 4. Complete the sentences.

1. Because many metals are found together at mine sites…
2. Some miners demand testing from the mine operator to know…
3. Mercury can become a gas if…
4. Some gold miners simply put a banana leaf…
5. The waste from nuclear energy remains…

UNIT VIII.SPECIFIC HAZARDS

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Task 3. Read the text and write down all unknown terms from the text and translate them with the help of a dictionary.

Text 1. Specific hazards

A range of unusual **hazards** are evident from time to time in underground mines, and awareness of some of the more serious risks that arise must be maintained and strategies put in place to eliminate or minimize those risks.

Gas Emissions

Although the **release** of hydrocarbon gases (such as methane) is not commonly experienced in metalliferrous mines, it can and does arise, and vigilance is essential to ensure early detection and control.

A range of gases may be emitted from the ground as a result of chemical reactions in the strata. This includes **leaching** by acid ground water of susceptible host rocks (such as carbonates) and their contained minerals, producing CO2, SO2, H2S and other gases. These reactions are exothermic (heat producing) and may become **self-sustaining**, as the gases react with groundwater to produce more acid. Quite high ground temperatures may result from the exothermic reactions in large masses of material of this type.

When gas release from the strata is sustained at a substantial level, rather than minor and transient, effective control measures are required.

Measures may include:

♦ **sealing** of the strata
♦ closure and sealing of the problem area of the mine
♦ draining off the gases to exhaust
♦ pressurizing the area to contain gases in the strata
♦ **dilution** of gases to harmless levels by increased ventilation volumes
♦ absorption by water percolation and spraying
♦ monitoring systems with appropriate alarm

It should be noted that under some circumstances, changes in barometric pressure will affect the release of gas from the strata.

In any mine where gas release from strata is likely to occur, **vigilance** must be exercised in monitoring, and all underground employees must be

made fully aware of what to look for, the need to report, and what **remedial** strategies are available. Remedial strategies may include personal respiratory protection or self-contained self-rescuers where warranted, and training in the use of underground fire refuges, in the event of gas release. Gases may be toxic, asphyxiant or explosive, and some have both toxic and explosive properties, and the risks must be fully understood to be effectively managed.

Oxygen Depletion

Oxygen depletion in mines normally results from dilution (displacement) due to the presence of **asphyxiant** gases such as carbon dioxide (CO2), or from actual depletion of oxygen in the atmosphere due to interaction with reactive sulphides, or from the internal combustion process of diesel engines.

Carbon dioxide is sometimes described as an inert gas, but it does have an adverse physiological reaction at even moderate concentrations which help persons trained to do so to detect its presence without instruments.

No warning is generally had of oxygen **depletion**, which may result not only from oxidation of reactive sulphides, but oxidation of timber or solution and entrainment in stagnant or flowing water.

The effect is most dangerous in a static, although not necessarily closed atmosphere. In sustained airflows of reasonable volume, oxygen depletion is much less likely to present a serious risk.

However, oxygen depletion has proved to be lethal in dead ends which are not sealed off, but where no convective overturn and circulation of air can take place.

Blasting Fumes

The release of fumes after blasting poses an obvious risk and by following correct operating procedures and relevant regulations, the risk is effectively managed.

It is, however, essential that all underground personnel are fully instructed in the nature of blasting fumes, methods of **detection** and correct procedures to avoid risks.

In particular the insidious danger of delayed adverse reaction from inhalation of oxides of nitrogen must be fully understood.

Clearance of fumes from rises, shafts and winzes requires particular attention.

Task 4. Read the text and explain the words in bold. Give their synonyms.

UNIT IX. VENTILATION

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and think of the questions you might ask about.

Task 3. Write down all unknown terms from the text and translate them with the help of a dictionary.

Text 1. Ventilation

Ventilation in an underground mine is of critical importance to the occupational health and safety of underground employees.

The atmosphere underground is limited and confined, and is thus readily reduced to a sub-standard (or even dangerous) condition if contaminants produced in the course of operations are not controlled, or safely extracted or diluted to harmless levels.

The contaminants may include dust, aerosols, diesel fumes and particulates and fumes from blasting, as well as gases released from the rock strata. Reduction of oxygen may result from oxidation of reactive sulphides under some circumstances.

Oxygen reduction may also take place due to recirculation of ventilating air where diesel engines are operating, and in unventilated areas where "standing" water is present.

It is essential to maintain levels of temperature, humidity and air velocity in the workplace such that employees do not suffer detriment to health from exposure to extremes of heat, humidity or cold.

Of equal importance to the maintenance of a healthy working environment underground is the need to protect employees against the risk and the consequences of underground fires and unplanned explosions, including sulphide dust ignitions.

Correct design, implementation and maintenance of mine ventilation is therefore of fundamental importance. In present day mining, ventilation systems designed and operated to maintain efficient operations will normally enable a high standard of occupational health and safety to be achieved.

Primary Ventilation

The basis of effective ventilation of underground mines is the adequacy of the primary ventilation system that is the total volume flow through the mine which is conducted through the major underground workings, normally involving splits into parallel circuits.

Factors which determine total primary volume capacity (and pressure) requirements for a mine include the extent and depth of the mine, the complexity, and the stoping and extraction systems, together with the size of development openings and the equipment used.

One of the major constraints on primary ventilation volume which is sometimes not adequately provided for at the design stage, is intake air capacity.

Whereas high air velocities may be tolerable in return airways and exhaust rises and shafts, (where no personnel are exposed), there is a practical limit to tolerable air velocity in main intakes (shafts and declines) and main development openings where persons travel and work. Dust generation is one problem deriving from intake velocities in excess of 6m/sec.

Moreover, high velocities require high pressure gradients and very high power costs to maintain them.

Secondary Ventilation

Secondary ventilation refers to the provision of ventilation to development ends, stopes and services facilities which constitute secondary circuits tapped off the primary circuit or main through flow of air. These may be “dead end” in configuration, or be “parallel or “series in parallel” circuits. The use of secondary ventilation fans and ducting is normally required, most commonly in a "forced air" configuration, but pressure/exhaust overlap or total exhaust may also be used.

Total exhaust is used to extract contaminated air and conduct it directly to a return airway, and for long secondary circuits. Solid formed ducting is usually necessary for this purpose.

Effective secondary ventilation can be established only if the primary ventilation system itself is adequately designed and operated. The two systems are in fact an integrated whole. An unbalanced primary and secondary combination can cause re-circulation, which is inefficient and potentially hazardous.

Air volumes which are adequate for operator health and comfort in the workplace may have to be further increased to reduce fume clearance time, or to remove heat from the workplace. Where development headings exceed 500 m in length, an exhaust overlap configuration may be required.

Attention to the correct design of fan/duct combinations is essential where large volumes are required over extended distances to cater for large scale diesel equipment.

The optimal layout of secondary ventilation systems to eliminate or minimize recirculation is of fundamental importance.

The application of properly engineered design to both primary and secondary systems will enable safe and healthy conditions to be maintained, and contamination reduced to levels which are as low as reasonably achievable. Commensurate operational efficiencies will be maintained.

Task 4. Translate the following words and word combinations. Make up your own sentences with them on the topic of the text.

Sub-standard condition, diesel fumes, air velocity, adequacy, primary volume capacity, parallel circuits, dust generation, "dead end".

UNIT X. WHEN A MINE CLOSES

Task 1. Skim through the text below and point out the general idea of it.

Task 2. Read the text and decide which word from the box best fits each space.

Mining, study, closed, fulfill, countries, difficult, lands, money, damaged

Text 1. When a mine closes

Before a mining operation begins, the company must study what the environmental and social effects of the mine will be. This _____, called an Environmental Impact Assessment or EIA should plan for ways to reduce harm and to clean up the site when the mine is closed. It should also make sure that people and communities harmed by mining activities are paid for any damage they suffer.

When a mine is _____, the mining operator, with oversight from the government mining authority, is responsible for restoring the site to make it safe for future use. _____ companies and mine operators should:

• remove toxic materials, machinery, and mining structures.

• fill holes, close off tunnels, fence dangerous areas, and clearly mark these areas with signs.

• stabilize cliff faces, pit walls, and waste dumps to reduce erosion and prevent collapse.

• restore soil and cover the area with healthy soil and plants.

• restore _____ waterways.

• treat polluted water for as long as necessary.

In some _____, mining companies are required to put up money (called a bond) before they begin work. The bond is a way to make sure that the company cleans the site after the mine closes. The bond money is used if the company goes bankrupt or does not have enough _____ to restore the area. If the amount of the bond is less than the costs of restoring land and paying for damages from mining, the company may not fulfill its responsibilities. To make sure that companies _____ their responsibilities, communities or governments need to negotiate for a bond that is high enough. It is usually better to demand one large bond for an entire project, rather than smaller bonds for each separate part of the project.

Restoring damaged land

If land is damaged by erosion and loss of topsoil, it can be restored over time. But land that is badly damaged by mine waste and chemicals may be very difficult and costly to restore, if it can be restored at all. It is so _____, in fact, that few mines have been completely restored.

Restoring and replanting damaged land should be the responsibility of mine owners and operators. But mining communities, with or without support from government, usually must pressure the mining companies to make sure they fulfill this responsibility.

To restore and replant mined _____, toxic waste must be prevented from washing or blowing away, and acid mine drainage must be prevented. It takes a lot of work over many years to bring land back to a healthy state. If land cannot be mined safely and responsibly, it should not be mined at all.

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