***To-do list (список завдань):***

***1. P. Ex. 1. 2. 3. 4. 5. 6. 7. 8. 9.***

***2. P. Additional Reading “ENVIRONMENTAL DAMAGES OF MINING” - Read and translate the text. Write down new unfamiliar words (10 words). Put 10 different questions to the text.***

***I. Use the dictionary and write down transcriptions and translations of the words given below.***

Effect, affect, leak, advantage, population, expose, efficiency, solve, rehabilitation

***II. Give English equivalents to the following Ukrainian words and word combinations. Make up your own sentences*.**

Навколишнє середовище; хімічні речовини; оточувати; ресурси; гарантувати; зупинити (закрити); поліпшувати; розбивати (на частини); науково-дослідна робота

***III. Match the definitions.***

**1.** environment

**2.** erosion

**3.** visual pollution

**4.** extraction

**5.** AMD

**6.** bioleaching

**7.** noise pollution

**8.** mineral

**9.** Environmental Geology

**A.** It refers to the outflow of acidic water from metal mines or coal mines;

**B.** The extraction of metals from their ores through the use of living organisms;

**C.** An aesthetic issue which refers to the impacts of pollution that impair one's ability to enjoy a vista or view;

**D.** The disturbing or excessive noise that may harm the activity or balance of human or animal life;

**E.** A naturally occurring, homogeneous inorganic solid substance having a definite chemical composition and characteristic crystalline structure, color, and hardness;

**F.** A community of living organisms (plants, animals and microbes) in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system;

**G.** The wearing away of rocks and other deposits on the earth's surface by the action of water, ice, wind, etc;

**H.** An applied science concerned with the practical application of the principles of geology in the solving of environmental problems;

**K.** The process of removing a substance from the ground or from another substance.

***IV. Fill in the blanks with the proper words. Change the form if necessary.***

**contaminate/contamination/contaminant**

1. Radioactive \_\_\_\_\_\_ is the deposition of, or presence of radioactive substances on surfaces or within solids, liquids or gases.

2. The town's water-supply has been \_\_\_\_\_\_ by chemicals from the factory.

3. The researchers used a polymer with chemical groups that attract the \_\_\_\_\_\_ strongly.

4. What you eat affects the ability of your lungs to withstand smoke and many \_\_\_\_\_\_.

**protect/protection/protective**

1. The trees were a good \_\_\_\_\_\_ against the wind.

2. He wore \_\_\_\_\_\_ glasses.

3. Nature Conservancy \_\_\_\_\_ freshwater sources around the world.

**disturb/disturbance**

1. \_\_\_\_\_\_ of the river's sediment causes cloudy water.

2. He was arrested for \_\_\_\_\_\_ of the peace.

3. A violent storm \_\_\_\_\_\_the surface of the lake.

***V. Match the synonyms.***

|  |  |
| --- | --- |
| impact | degradation |
| reduce | technology |
| contamination | pollution |
| affect | apply |
| increase | grow |
| technique | decrease |
| use | cause |
| destruction | require |
| demand | effect |

***VI. Put 7 – 10 key questions to the text.***

***VII. Control points.***

1. Name the sciences which are closely related to Environmental Geology. What does each of these sciences study?

2. What ecological systems of biosphere do you know? What are the elements of these ecological systems?

3. Speak about the aspects Environmental Geology concerns.

4. What is the environmental impact of mining?

5. What techniques to reduce or to eliminate environmental degradation do you know? Give more detailed analysis to one of the techniques.

***VIII. Analyze the chart. Speak on the environmental hazards associated with mining.***

|  |  |  |
| --- | --- | --- |
| ***Risk*** | ***Affected compartments*** | ***Relevant toxic compounds*** |
| Overtopping of tailing dam | ground water, surface water, soil | **Water emissions**   * In most cases radionuclides, mainly thorium and uranium; * Heavy metals; * Acids; * Fluorides   **Air emissions:**   * In most cases radionuclides, mainly thorium and uranium; * Heavy metals * HF, HCI, SO2, etc. |
| Collapse of tailing dam by poor construction | ground water, surface water, soil |
| Collapse of tailing dam by seismic event | ground water, surface water, soil |
| Pipe leakage | ground water, surface water, soil |
| Ground of tailing pond not leak-proof | ground water |
| Waste rock stockpiles exposed to rainwater | ground water, surface water, soil |
| Dusts from waste rock and tailings | air, soil |
| No site-rehabilitation after cease of mining operation | land-use, long-term contaminated land |
| Processing without flue gas filters | air, soil |
| Processing without waste water treatment | surface water |

***IX. Give Ukrainian equivalents to the following:***

arsenic, sulfuric acid, mercury, lead, cadmium

***X. Read the texts from Additional reading. Describe briefly each of the forms of mining. Speak on the: Environmental Risks of mining; how they arise and how their effects can be mitigated*.**

ADDITIONAL READING

Unregulated mining has the potential to release harmful substances into the soil, air, and water. Governments should enforce regulations on companies and control their use of cutting-edge technology to reduce the damage from mining-related sources.

**ENVIRONMENTAL DAMAGES OF MINING**

***Open pit mining***

Open pit mining is one of the most common forms of mining for strategic minerals. This type of mining is particularly damaging to the environment because strategic minerals are often available only in small concentrations, which increases the amount of ore needed to be mined.

Environmental hazards are present during every step of the open-pit mining process. Hardrock mining exposes rock that has lain unexposed for geological eras. When crushed, these rocks expose radioactive elements, asbestos-like minerals, and metallic dust. During separation, residual rock slurries, which are mixtures of pulverized rock and liquid, are produced as tailings. Toxic and radioactive elements from these liquids can leak into bedrock if not properly contained.

***Underground Mining***

Underground mining has the potential for tunnel collapses and land subsidence. It involves large-scale movements of waste rock and vegetation, similar to open pit mining. Additionally, like most traditional forms of mining, underground mining can release toxic compounds into the air and water. As water takes on harmful concentrations of minerals and heavy metals, it becomes a contaminant. This contaminated water can pollute the region surrounding the mine and beyond. Mercury is commonly used in as an amalgamating agent to facilitate the recovery of some precious ores. Mercury tailings then become a major source of concern, and improper disposal can lead to contamination of the atmosphere and neighboring bodies of water. Most underground mining operations increase sedimentation in nearby rivers through their use of hydraulic pumps and suction dredges; blasting with hydraulic pumps removes ecologically valuable topsoil containing seed banks, making it

difficult for vegetation to recover. Deforestation due to mining leads to the disintegration of biomes and contributes to the effects of erosion.

***In situ leach (ISL) mining***

ISL mining has environmental and safety advantages over conventional mining in that the ore body is dissolved and then pumped out, leaving minimal surface disturbance and no tailings or waste rock (World Nuclear Association, 2012). There is no ore dust or direct ore exposure to the environment and a lower consumption of water is needed in the mining process (International Atomic Energy Agency [IAEA], 2005). However, the strong acids used to dissolve the ore body commonly dissolve metals in the host rock as well. The fluids remaining after the leaching process commonly contain elevated concentrations of metals and radioactive isotopes, posing a significant risk to nearby ground and surface water sources (IAEA, 2005). Additionally, the low pH of ISL mining wastewater can result in acidification of the surrounding environment.

***Heap Leaching***

Environmental issues with heap leaching are centered on the failure to keep process solutions within the heap leaching circuit. Release of toxic heap leaching fluids into the environment can affect the health of both the surrounding ecosystem and human population. Water balance is crucial in heap leaching projects because of the possibility of the overflow of solutions containing toxic concentrations of heavy metals after a heavy rainfall or rapid snowmelt. In some cases cyanide is used to extract metals from oxidized ores and the resulting leach ponds have caused significant wildlife mortality.

***Brine Mining***

Brine mining involves extracting and evaporating the brine solutions to remove harmful elements and compounds, potentially releasing them into the environment. The drilling and transport of brine solutions can disrupt existing ecosystems and well casings, pipelines, and storage tanks are subject to corrosion due to the high salinity content of the solutions that they are exposed to, which can lead to leaks and contamination of adjacent bodies of water. Currently, there is no economically plausible plan to clean up contamination of an aquifer by sodium chloride and harmful concentrations of chloride inhibit plant growth and can cause fish kills.

***Specific Contaminant Materials***

*Radionuclides*

All REE (rare-earth element)-bearing minerals contain low levels of the radioactive isotopes that can become concentrated in mine tailings. Radionuclides are released as dust during mining or from exposed waste rock stockpiles where they are least containable (and mostly airborne). Radiation can also leak into the ground and nearby water sources after they have been separated into tailings, if the tailings are not stored safely. Once radionuclides are in an ecosystem, they accumulate in plants, where the higher concentrations are ingested and ascend the levels of the food chain. Radioactive contamination has become such a problem that monazite mining has been banned by China and the United States has imposed strict regulations effectively accomplishing the same.

***Dust & Metal***

When companies break up materials during mining, the dust can release a variety of heavy metals commonly associated with health problems. As dust, these minerals (such as the asbestos-like mineral riebeckite) can be absorbed into lung tissue, causing problems like pneumoconiosis and silicosis, commonly known as “Black Lung”. Another example of harmful dust generated is flue dust, a byproduct of mining fluorine. According to the Chinese Society of Rare Earths, every ton of REE produced generates 8.5 kilograms of fluorine and 13 kilograms of flue dust, waste materials which contain the heavy metals discussed above