КАФЕДРА ІНОЗЕМНИХ МОВ

**МЕТОДИЧНІ ВКАЗІВКИ**

для проведення практичних занять та

для самостійної роботи студентів

з навчальної дисципліни

«Іноземна мова професійного спрямування»

***English for Bachelors in Ecology***

***(для студентів-екологів)***



Затверджено на засіданні
науково-методичної ради ЖДТУ
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 Методичні вказівки з дисципліни «Іноземна мова професійного спрямування» для студентів денного відділення гірничо-екологічного факультету (галузі знань 10 «Природничі науки» спеціальності 101 «Екологія», галузі знань 18 «Виробництво та технології» спеціальності 183 «Технології захисту навколишнього середовища» та галузі знань 0401 «Природничі науки» напряму підготовки 6.040106 «Екологія, охорона навколишнього середовища та збалансоване природокористування»). – Житомир: ЖДТУ, 2018. – 31 с.

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Могельницька Л.Ф.

 Методичні вказівки призначені для студентів-екологів денного відділення, які вивчають дисципліну «Іноземна мова професійного спрямування». Основна мета – розвиток навичок усного мовлення та читання оригінальної літератури за професійною тематикою.

Розглянуто і рекомендовано на засідання кафедри іноземних мов

Протокол № 7 від 29. 03. 2018 р.

**МЕТОДИЧНІ ВКАЗІВКИ**

Методичні вказівки призначені для студентів денного відділення гірничо-екологічного факультету (галузі знань 10 «Природничі науки» спеціальності 101 «Екологія», галузі знань 18 «Виробництво та технології» спеціальності 183 «Технології захисту навколишнього середовища» та галузі знань 0401 «Природничі науки» напряму підготовки 6.040106 «Екологія, охорона навколишнього середовища та збалансоване природокористування»). Методичні вказівки призначені для аудиторної та самостійної роботи студентів, які вивчають курс «Іноземна мова професійного спрямування» в рамках вибіркової професійно-орієнтованої дисципліни;

Основна мета вказівок – навчити студентів читати, розуміти і перекладати тексти по тематиці «Навколишнє середовище» та «Гірнича екологія», а також вести бесіду на основі засвоєного матеріалу.

Методичні вказівки передбачають засвоєння лексичного матеріалу під час аудиторних занять та самостійної роботи студентів.

Методичні вказівки складаються з 2 розділів. Перший розділ включає 5 уроків для аудиторного засвоєння та для індивідуального опрацювання. Другий розділ розроблено для закріплення матеріалу та розширення професійного лексичного мінімуму.

Тематика розділів методичних вказівок «English for Bachelors in Ecology» відповідає тематиці викладання фахових дисциплін. Студентам до засвоєння пропонується розглянути наступні теми: «Що таке навколишнє середовище», «Що відбувається навколо нас?», «Гірництво і навколишнє середовище», «Екологічна геологія», «Екологічні наслідки видобування вугілля». У межах кожного розділу подано базові поняття, науковий словник, лексичні вправи та перелік питань для обговорення.

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**UNIT I**

***“Mother Planet is showing us the red warning***

***light – “be careful”- she is saying.***

***To take care of the planet is to take care of our own house”.***

***Dalai Lama***

**WHAT IS THE ENVIRONMENT?**

**Look at the Mind-map.**

****

**Task I. Learn the following words:**

|  |  |  |
| --- | --- | --- |
| Garbage  | http://disted.edu.vn.ua/media/images/asia/eng_9/u01_26.files/image003.jpg | сміття, що гниє; кухонні відходи |
| Litter   | http://disted.edu.vn.ua/media/images/asia/eng_9/u01_26.files/image004.jpg | розкидані речі, безлад, сміття (папір, пластик,пляшки, тощо), що розкидані на вулиці |
| Rubbish | http://disted.edu.vn.ua/media/images/asia/eng_9/u01_26.files/image005.jpg | мотлох, макулатура, побутові відходи; бракований матеріал |
| Trash   | http://disted.edu.vn.ua/media/images/asia/eng_9/u01_26.files/image006.jpg | тверді відходи (крім металобрухту) |
| Waste  | http://disted.edu.vn.ua/media/images/asia/eng_9/u01_26.files/image007.jpg | відпрацьовані відходи виробництва |

**Task II. Do you know the difference? Match the word (1-5) with its definition (a-e):**

|  |  |
| --- | --- |
| 1. garbage | a. an untidy accumulation of objects lying about |
| 2. litter | b. food waste, discarded or useless material |
| 3. rubbish | c. something in a crumbled or broken condition  |
| 4. trash | d. an unwanted by-product of a manufacturing process |
| 5. waste | e. useless or rejected matter |

**Task III. Choose one word to complete the sentences:**

**Garbage     Litter     Rubbish    Trash     Waste**

1. I don’t like their house – it’s always full of **\_\_\_\_\_\_** .

2. The main problem of ecology today is thousands of tons of industrial **\_\_\_\_\_\_** .

3. She always leaves a lot of **\_\_\_\_\_\_** in the kitchen.

4. In Singapore a person throwing **\_\_\_\_\_\_\_\_** on the road may be put to prison.

5. Sometimes it seems that **\_\_\_\_\_\_\_\_** accumulates itself.

**Task IV. Learn the following word-combinations:**

**Air pollution** – забруднення повітря; забруднення атмосфери.

**Water pollution** – забруднення води.

**Soil pollution** – забруднення ґрунту.

**Noise pollution** – шумове забруднення довкілля.

 **Task V. Put the activities below into the appropriate pollution groups:**

|  |  |  |  |
| --- | --- | --- | --- |
| Air pollution | Water pollution | Soil pollution | Noise pollution |

**Activities:**

1. Burying waste or household trash - \_\_\_\_\_\_\_\_\_ pollution.

2. Rock concerts - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pollution

3. Car exhaust fumes -  \_\_\_\_\_\_\_\_\_\_\_ pollution

4. Hyperactive fishing - \_\_\_\_\_\_\_\_\_\_\_ pollution

5. Oil split in oceans -  \_\_\_\_\_\_\_\_\_\_\_\_ pollution

6. No change footwear in schools  -\_\_\_\_\_\_\_\_\_\_ pollution

7. Airport noise - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pollution

8. Smoking - \_\_\_\_\_\_\_\_\_\_\_\_\_\_ pollution

9. Burning leaves in spring and autumn  -\_\_\_\_\_ pollution

10. Littering and spitting in schools, streets, and woods - \_\_\_\_\_\_\_\_\_\_\_ pollution

 **Task VI. Match the given English words with their Ukrainian equivalents:**

|  |  |  |
| --- | --- | --- |
| 1. Burying waste or household trash | Вирубка лісів | http://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 2. Cutting forests | Автомобільні вихлопні гази | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 3. Rock concerts | Викиди нафти в океан | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 4. Car exhaust fumes | Куріння | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 5 .Hyperactive fishing | Закопування промислових або побутових відходів | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 6. Oil split in oceans | Відсутність змінного взуття в школах | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 7. No change footwear in schools | Спалення листя весною ти восени | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 8. Poaching | Надмірний вилов риби | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 9. Airport noise | Рок концерт | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 10. Smoking | Шум аеропорту | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 11. Burning leaves in spring and autumn | Забруднення сміттям шкіл, вулиць та лісів | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.pnghttp://disted.edu.vn.ua/templates/disted/html/admin/images/down.png |
| 12. Littering and spitting in the schools, streets, and woods | Браконьєрство | http://disted.edu.vn.ua/templates/disted/html/admin/images/up.png |

**Task VII. Complete the sentences, using these words:**

**air         animals        forest        land        water**

We must teach the younger generation how to protect the **(1) \_\_\_\_\_\_**. Each of us must do everything possible to keep the land, **(2) \_\_\_\_\_\_**, and **(3) \_\_\_\_\_\_**clean.
**(4) \_\_\_\_\_\_** areas have been planted or replanted. The problem of disappearing
**(5)** **\_\_\_\_\_\_** is one of the most important.

**Task VIII. You have a short text. Read the text. Fill in the gaps. Choose the right words from the box given below:**

|  |
| --- |
| **pollution**  **ecology       environment       is pointed out****lessen              take care           nature** |

People all over the world are worried about what is happening to the **(1) \_\_\_\_\_\_.** Newspapers and magazines write about air, land and water **(2)** **\_\_\_\_\_\_**. They write that the Earth is our home and all people must **(3)** **\_\_\_\_\_\_**of it. We must do everything possible to save the **(4)** **\_\_\_\_\_\_**, to make our rivers and air clean. The importance of this task **(5)** **\_\_\_\_\_\_** by scientists. The branch of science that deals with the relation of living things to their environment is called **(6)** **\_\_\_\_\_\_**. From the point of view of ecology the mankind should first of all **(7)** **\_\_\_\_\_\_** pollution.

**UNIT II**

**WHAT'S HAPPENING**

**Pre-reading tasks**

**I. Why do you think you know the words without looking up?**

carbon dioxide, sulphur, oxide, nitrogen, oxygen, affect, assimilate, atmosphere, base, botanist, centrifuge, collection, cyclone, decorative, delicate, filter, gas, group, ocean, period, principle, resource, selection, separation, ventilation.

**II. Match a word in A with a word in В**

 **A** **B**

consume a) pollutant

combust b) variety

eject c) cleaner

emit d) combustion

pollute e) purification

produce f) consumption

purify g) ejection

vary h) production

clean i) emission

**Air pollution**

Until about 150 years ago, the air was pure and clean – perfect for people to breathe. Then people started building factories. Those factories, then cars - put a lot of harmful gases into the air. Today the air is so polluted that it’s not always safe to breathe. Many cities have air filled with a pollution called “smog”. It is so strong in some places that the air looks brown. Polluted air is bad for people, animals and trees.

**Acid rain**

When we look up, we see the clouds and the blue sky. But there are other things in the sky that we don’t see. Some of these are harmful to the Earth. When power factories burn coal to make electricity and when cars burn gasoline, invisible gases are released into the air. Some of these gases can mix with water and make it acidic, like lemon juice or vinegar. Sometimes gases get into rain clouds, where they get mixed with rain or snow. Then the acid falls back to earth with rain and snow. This is called acid rain. Acid rain is harmful to plants, rivers and creatures that live in them. Acid rain kills forests, pollutes water.

**Disappearing animals**

Every day there are more and more people living on the Earth. All those people need room to live. So they move into places that are already homes for plants and animals. When people move into new land the plants and animals that live there begin to disappear. Some even become extinct – which means that they all die out, and are gone from the Earth forever.

**Too much garbage!**

When you throw sometimes away, it goes in a garbage can. Once a week the garbage truck comes and the can is emptied. Almost all garbage is taken to a garbage dump or landfill, where a big tractor comes along and pushes dirt on top of the garbage. So, most of our garbage is just buried. Now we are making so much garbage that in many places there is not enough room to bury it all.

**Water pollution**

The planet Earth is mostly water. Oceans cover the biggest part of it and there are lakes, rivers, streams, and under-ground water. All life on the Earth depends on water. But we don't always keep water clean. Rivers and lakes are polluted by garbage or by poisonous chemicals. The ocean, which is a home to so much life, has been used as a place to dump garbage and poisonous chemicals for a long time.

**The greenhouse effect**

The Earth is surrounded by a blanket of invisible gases (carbon dioxide) that act just like a greenhouse. The sun shines in, and the blanket of gases traps the heat like a roof. That’s good – we can’t live without warmth. Factories, electric power mills, cars make a lot of new gases. The new gases are trapping more and more sun's heat. This is called the greenhouse effect or global warming. If the Earth's temperature gets hotter by just a few degrees, it could change the weather all over the planet. Places which are warm would become too hot to live in, and places that are cold would become warm. The places that grow food could get too hot to grow crops.

**The ozone hole**

Up in the sky, above the air we breathe, there is a layer of gas, called ozone. It helps us by blocking out rays from the sun that can harm our skin, and by letting the rays that are good for us come through. We are lucky to have the ozone to protect us. Now the ozone layer is being damaged by gases that people have made. The gases are called CFCs, and halons. The CFCs float up to the top of the atmosphere and "eat up" the ozone. Scientists are very concerned about the ozone layer, because a lot of it has gone away in just a few years.

**III. Find sentences in the text with the following words and translate them:**

rainforest, harmful gases, acidic, extinct, garbage truck, garbage dump, water pollution, chemicals, greenhouse effect, carbon dioxide, give off gases, global warming, ozone hole.

**IV. Put the words in the right order and write down their sentences:**

• depends /water / on / on / Earth / life / all.

• a / blanket / gases /of / by / surrounded / is / the / Earth.

• layer / the / ozone / scientists / are / about / concerned.

• lakes / to / protect / we / streams / rivers / can / oceans / help.

• the Earth / anyone / can / green / help / to / keep.

• greenhouse / trees / fight / help / effect / and /us / give / oxygen.

• April / 22 / day / Earth / inhabitants / of / celebrate / Earth.

• air / polluted / for / people / trees / and / plants / but / for / animals / is / not / only bad.

• harmful / and / acid / to / plants / is / rain / rivers / live / in / creatures / them/ that.

**V. What sentences do these letters make?**

Plantscombinecarbondioxidewithsunenergywaterandminerals.

Protectionoftheenvironmentiseverybody'sconcern

Theseasareindanger.

TheAralseaisonthebrinkofextinction.

Peoplesupportgreenparties.

**VI. Fill in the table and translate the words.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Noun** | **Verb** | **Noun** | **Adjective** |
| Change |  | Variety |  |
|  | Achieve | Environment |  |
|  | Advance |  | Ecological |
| Development |  |  | Industrial |
|  | Protect |
|  | Pollute | Danger |  |
|  | Global |
| Action |  | Nature |  |
|  | Increase |  | Numerous |
| Elimination |  |  | Safe |
| Interaction |  |  | Oceanic |

**UNIT III**

**MINING AND THE ENVIRONMENT**

It should be stressed that effects of mining on the environment are twofold: firstly, there are direct effects arising from mining as a physical activity, which include disturbances of the land surface and accumulation of waste. Secondly, there are indirect destructive effects resulting from treatment of mineral products, such as coal burning, ore processing, smelting and other metallurgical processes. These frequently result in contamination of soil and ground water, pollution of the atmosphere and an adverse effect on vegetation and wildlife. Mining, especially open-pit mining, deforms the surface of the land and creates a large amount of waste materials which contain hazardous substances that pollute water and soil. Water from mining and concentration operations may contaminate the subsoil and rivers into which it flows. Most serious of all are gases produced by smelting, which may not only contaminate the air in the region of the smelter, but affect lakes and vegetation hundreds of miles away through the creation of acid rain.

There is one more point which affects the environment. It concerns the transport of coal representing one component of the complete coal cycle — from exploration and extraction of the fuel, through refining, processing, storage and finally its conversion to an end-use product for consumers. Coal transportation is executed by train, truck (lorry), water (on rivers, canals, lakes, etc.) and slurry pipeline or conveyer belt. Environmental impacts of coal transport occur during loading or unloading. For example, rail transport and trucks cause damage to buildings, highways and other places.

Accidents are associated with all forms of transport. Besides, the transport of coal in all its forms involves dust, even though special measures are increasingly taken. Emission of coal particulate and other air pollutants occur during loading, unloading and during coal movement.

At the same time, research and development have provided greatly improved engineering and biological methods of land reclamation. It is necessary to say that land reclamation has emerged as a method of controlling the negative after-effects of extracting coal and other minerals. Land reclamation covers the problem of landscape redevelopment and the restoration of its productivity, ecological integrity, and economic and aesthetic value. The economic uses of reclaimed land depend on natural and socioeconomic factors of the locality. They may be orchards, meadows, parks, swimming pools, etc.

In recent years, many industrial countries have developed and adopted laws, national programs and specific policies for environmental protection. The basis of most laws applicable to the mining industry and its effect on land is to control land management for resources protection, regulate land reclamation and landscape retraction. The principal impact of pollution regulations on the mining industry arises from regulations on emissions of CO2 and other air pollutants from copper lead and zinc smelters.

1. **Match the synonyms:**

|  |  |
| --- | --- |
| result | negative |
| contamination | effect |
| adverse | affect |
| disturb | pollution |
| execute | reclamation |
| impact | cause |
| restoration | perform |

1. **Find the synonyms to the following words in the text:**

mine, take place, appear, contaminants, form, affect

1. **Translate into English. Make up sentences with these words :**

впливати, призводити до, використовувати, відходи, регулювати, гірнича промисловість, захищати, засоби.

**IV. а) Find the topic sentence of each of the paragraphs. Entitle the paragraphs.**

 **b) Briefly retell the text using the following phrases:**

*The «object of the text is ...; The text deals with ...; It is pointed out that...; It should be stressed that...*

**V. Put 10 questions to the text. Ask your classmates to answer these questions.**

**VI. Generalize the information of the text.**

**VII. Read the advertisement about the Conference.**

**Words for understanding:**

*Implication — залучення, причетність; appropriate — підходящий, відповідний; legislation — законодавстство; workshop — секція, семінар; issue — питання, проблема; agenda — порядок денний*

Leaders from the international mining, regulatory and environmental communities will meet in October to discuss the most crucial environmental issues facing the mining industry.

Sponsored by Mining Journal LTD and Mining World News, the First International Conference on Mining Environmental Manage­ment will focus on mining-oriented environmental legislation, the financial implications, the available technological solutions and management control systems.

The three-day meeting will be held at R's Conference Hall starting with a reception on Sunday evening. The event will comprise three parts: a central conference, plus parallel workshop sessions and an exhibition.

The main Conference will be broken into six halfday sessions which will contain only four or five papers in each session. These 20-minute papers will focus on subjects which are appropriate for executive debate. Each session will end with a 40-minute discussion on the topic.

The six session topics will be: The differing perspectives of the mining industry / environmentalists in developed / developing countries; Cont-international regulations and standards; Management practices and legal obligations; The role of government; Financial implications of a greener world.

The two-hour Workshops will occur on the morning of each day, being scheduled for completion by the start of the main conference proceedings. Papers will be 20 minutes each (to include time for questions after each presentation), with the workshops being divided into three sections; Air / Water Issues, Land Issues, and General Issues. The six papers in each workshop will be devoted to case studies and technical presentations. Consideration is also given to Poster Displays of relevant technical work.

The Exhibition will offer equipment manufacturers and consultants the opportunity to present their products to the international industry.

Details of papers, speakers and exhibitors will be advised as soon as possible.

For further details please contact:

Mining Journal Ltd,

60 Worship Street, London, U.K.

Telephone:\_\_\_\_\_\_\_\_

Fax:\_\_\_\_\_\_\_\_\_

**VIII. Speak about the problems to be discussed at the Conference. Who are the participants? What is the Exhibition organized for?**

**UNIT IV**

**ENVIRONMENTAL GEOLOGY**

**Science Vocabulary**

|  |  |
| --- | --- |
| interaction | взаємодія |
| degradation | деградація, погіршення, руйнування |
| advantageous | сприятливий, корисний, вигідний |
| fossil fuel | викопне паливо |
| edaphology | ґрунтознавство |
| mitigation | запобігання наслідкам; пом’якшення наслідків |
| exposure | виставляння; піддавання (небезпеці тощо) |
| hazard | ризик; небезпека |
| domestic waste | побутові відходи, комунально-побутові стічні води |
| disposal | розташування, розміщення, усунення, видалення |
| eliminate | усувати, знищувати |
| pollution | забруднення |
| litigation | судова справа, процес |
| damage | збиток, шкода, завдавати збитків, шкоди |
| erosion | ерозія, роз’їдання, поступове руйнування |
| sinkhole | карстова воронка |
| biodiversity | біорізноманіття |
| protective measure | заходи безпеки |
| debris | уламки порід, наносні породи, що вкривають родовище |
| drainage | дренаж, осушення, стік |
| aqueous | водний, водяний, водянистий |
| devastate | спустошувати, розоряти |
| vegetation | рослинність, вегетація |
| bioleaching | біовилуговування |
| technique | метод, методика, технологія |
| diversion system | система відведення |
| treatment facilities | очисні споруди |
| tailings dam | хвостосховище |
| siltation | замулення |
| disturbance | порушення, пошкодження |
| grazing | пасовисько, випас |
| leakage | витік, теча, просочування |
| impact | вплив, дія |

**Read and translate the text**

Each of these fields involves the study of the interaction of humans with the geologic environment, including the biosphere, the lithosphere, the hydrosphere, and to some extent the atmosphere. In other words Environmental geology is the application of geological information to solve conflicts, minimizing possible environmental degradation or maximizing possible advantageous condition resulting from the use of natural and modified environment.

Environmental geology includes:

* managing geological and hydrogeological resources such as fossil fuels, minerals, water (surface and ground water), and land use.
* studying the earth’s surface through the disciplines of geomorphology, and edaphology;
* defining and mitigating exposure of natural hazards on humans;
* managing industrial and domestic waste disposal and minimizing or eliminating effects of pollution;
* performing associated activities, often involving litigation.

Multiple studies show that demand for strategic natural resources continues to increase. As global population grows and countries become more developed, there is no doubt that demand for strategic resources will continue to grow as well.

Modern mining is an industry that involves the exploration for and removal of minerals from the earth with minimum damage to the environment.

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. Mining can have bad effects on surrounding surface and ground water if protective measures are not taken. Large amounts of water produced from mine drainage, mine cooling, aqueous extraction and other mining processes increase the potential for ground and surface water contamination. The result can be unnaturally high concentrations of some chemicals (arsenic, sulfuric acid, mercury) and heavy metals (lead, cadmium). Runoff of soil or rock debris, even non-toxic, devastates the surrounding vegetation. 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 best done through the use of such 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, ground water pumping systems, subsurface drainage systems, and subsurface barriers. In the case of AMD, contaminated water is generally pumped to treatment facilities that neutralize the contaminants.

Erosion of exposed hillsides, mine dumps, tailings dams and resultant siltation of drainages, creeks and rivers can also significantly impact the surrounding areas. 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.

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 closely to its original state.

To minimize environmental and public health effects the new mining technologies should be used. The plan for improving efficiency and decreasing the environmental impact of mining can be broken up into the following categories:

* Shutting down illegal and unregulated mines;
* Choosing environmentally friendly general mining processes;
* Implementing recently discovered green mining technologies;
* Cleaning up the sites of shut-down mines;
* Research and Development of Green Mining Technology.

**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

**UNIT V**

**СOAL MINING IMPACTS**

**Science Vocabulary**

|  |  |
| --- | --- |
| force off | витісняти |
| expand | поширювати; розповсюджувати |
| subsidence | осідання |
| extract | виймати, добувати, витягувати |
| strip mine | [кар’єр, де](http://www.multitran.ru/c/m.exe?t=5127221_2_1&s1=strip%20mine) ведуться розкривні роботи; покинута копальня; вугільний розріз |
| topsoil | верхній шар ґрунту |
| scrape away | шкребти, зчищати |
| coal seam | вугільний пласт |
| blast | вибух, вибухати |
| smother | стримувати, пригнічувати |
| flooding | затоплення |
| upturn | перевертати |
| pump out | викачувати |
| suppress | стримувати, придушувати |
| slurry | не осаджений шлам |
| barren | непродуктивний, безплідний |
|  re-seeding | повторний пересів |

Mining is the first step in the dirty life cycle of coal. When coal mines move in, whole communities are forced off their land by expanding mines, coal fires, subsidence, and overused and contaminated water supplies. Mines are quick to dig up and destroy forests and soils. But once the coal is gone, the problems they leave behind, like acid mine drainage, can persist for decades. Around the world, Greenpeace campaigns to help communities stop coal mines, and speed up the shift to 100 percent clean, safe renewable energy.

Underground mines, which provide the majority of the world’s coal, allow coal companies to extract deep coal deposits. About 40 percent of the world’s coal mines are the more damaging strip mines (also called open cast, open pit, mountaintop or surface mining).

**Strip mining impacts**

Strip mining damages and pollutes ecosystems. It is highly destructive. Yet the industry often prefers to strip mine because it takes less labor and yields more coal than underground mining. In some countries, such as Australia, strip mines make up 80 percent of mines.

Strip mining clears trees, plants and topsoil. Mining companies scrape away earth and rocks to get to coal buried near the surface. Mountains may be blasted apart to reach thin coal seams within, leaving permanent scars on the landscape. In this way, strip mining destroys landscapes, forests and wildlife habitats. It leads to soil erosion and destruction of agricultural land.

When rain washes topsoil disturbed by mining into streams, these sediments pollute waterways. This can hurt fish and smother plant life downstream. It can also disfigure river channels and streams, which leads to flooding.

Strip mining also causes noise pollution and dust as heavy machinery disrupts topsoil and mining activity creates coal dust.

***Strip mining contaminates water***

When miners upturn earth, minerals and heavy metals within it can dissolve into mine wastewater and seep into the water table. This increases risk of chemical contamination of groundwater and acid mine drainage.

Strip mining also lowers groundwater levels around the mine. This is because, in order to remove coal, vast quantities of groundwater must be pumped out of the mine. As a result, surrounding ecosystems and farmland may become drier, and erosion may start to change the landscape.  Strip mining also uses significant amount of water to suppress dust.

When mines lower groundwater levels, this also affects local people, who must continually drill deeper wells to get water.

Washing coal (to remove unwanted materials) creates toxic waste slurry that can threaten surface waters or leak into groundwater. Coal power plants also [strain precious global water supplies](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coals-thirst-for-water/).

***Strip mines leave lands barren***

Coal mining is land disturbance on a vast scale.

* In the US, from 1930 to 2000, coal mining altered about 2.4 million hectares (5.9 million acres) of natural landscape, most originally forest.

This mining activity leaves behind barren lands that stay contaminated long after the mine shuts. Although many countries require coal mines to have reclamation plans, it is a long, difficult task to undo all their damage to water supplies, habitats and air quality.  Re-seeding plants is difficult because mining thoroughly damages soil. If coal companies go bankrupt, costly rehabilitation may be left undone.

* In China, coal mining degraded the quality of 3.2 million hectares of land, according to a 2004 estimate, but total mine wasteland was restored at a rate of only 10 to 12 percent.
* In Montana, US, replanting projects were only 20 to 30 percent successful. In Colorado, even lower survival (about 10 percent in some locations) was seen for oak and aspen seedlings.

**Vocabulary**

|  |  |
| --- | --- |
| room-and-pillar  | камерно стовпова система  |
| funnel  | вирва, воронка |
| disrupting | руйнувати, спустошувати |
| feedstock | сировина |
| fracking | гідророзрив пласта |
| smoulder | повільно горіти, тліти |
| smoke laden | задимлений |
| fissures | тріщина |
| unearthed  | розкопаний |
| estuaries | гирло |
| energize | спонукати до дій |
| boost | підтримувати |
| concern | зацікавленість, стурбованість;(v) бути стурбованим |
| obscure | прихований; закритий |
| deplorable | жахливий; жалюгідний |
| complacently | безпечно; самовдоволено |

**Underground coal mining impacts**

Although seen as less destructive than strip mining, underground mining still causes widespread damage to the environment.

***Subsidence***

Collapse of earth into underground mines, or subsidence, is a serious problem.

In room-and-pillar and long-wall mines, columns of coal and other structures are used to support the ground above. Later in the mining process, they are often taken out. The mines are left to collapse. The land above starts to sink, seriously damaging buildings and entire landscapes. Subsidence can also cause farmland to fill with water and become wetland or lakes.

***Underground mine water drained away***

Underground mining lowers the water table, changing the flow of groundwater and streams.

In Germany, the mining industry pumps over 500 million cubic meters of water out of the ground every year. Only a small percentage of this water is used by industry or local towns — the rest is wasted. What’s worse, removing so much water creates a kind of funnel that drains groundwater from an area that is much larger than the immediate coal-mining environment.

***Underground mines bring toxins to surface***

Underground mining also brings huge amounts of waste earth and rock to the surface. This waste often becomes toxic when it contacts air and water.

Coal mining releases [methane](http://www.greenpeace.org/international/en/campaigns/climate-change/End-oil-and-gas/) into the atmosphere. Formed during the geological process that creates coal, methane is 84 times as powerful as carbon dioxide at [disrupting the climate](http://www.greenpeace.org/international/en/campaigns/climate-change/about/The-cause/) over a 20-year timespan.

Globally, about six percent of methane emissions due to human activity come from coal mining.

Most coal mine methane comes from underground mines. This methane is often captured and used as town fuel, industrial fuel, chemical feedstock and vehicle fuel. Methane is also used in power generation projects.

The process to extract this methane, coal seam gas fracking, creates large amounts of waste water, risking surface and groundwater sources. It also increases the risk of uncontrolled methane leaks, contaminating water sources and destroying climate.  Yet coal bed methane projects have been increasing rapidly globally.

***Coal fires smoulder and pollute***

Coal fires can burn for decades or even centuries, releasing fly ash and smoke laden with [greenhouse gases](http://www.greenpeace.org/international/en/campaigns/climate-change/about/The-cause/) and toxic chemicals. These fires are a significant environmental problem in China, Russia, the US, Indonesia, Australia and South Africa.

Coal fires occur when coal seams burn or smoulder, or when coal storage or waste piles burn. Lightning, forest fires and peat fires can start coal fires. But they are often caused by mining accidents and bad mining practices. In Indonesia, the same fires used to clear large tracts of rainforest ignited over 300 coal fires since the 1980s.

Underground coal fires can release smoke laden gases including carbon monoxide (CO), carbon dioxide (CO2), methane (CH4), and sulphur dioxide (SO2). Coal fires also cause fly ash to release from mine vents and fissures. Coal fires can cause temperatures to rise at the surface, and contaminate groundwater, soil and air.

China has the world's most coal fires. Between 20 and 200 million tons of coal burn uncontrollable each year. This accounts for 0.5 to 5 percent of China's national coal consumption and related carbon dioxide emissions. (Although coal fires are significant, emissions from China's power plants are far higher.) India, on the other hand, has the world’s greatest concentration of coal fires.

***Acid mine drainage***

When coal and other rocks unearthed during mining mix with water, this creates acid mine drainage. The water takes on toxic levels of minerals and heavy metal and leaks out of abandoned mines. From there it contaminates groundwater, streams, soil, plants, animals and humans.

Taking on an orange color, it can blanket rivers, estuaries or sea beds, killing plants and making surface water unusable for drinking. Acid mine drainage can continue for decades or centuries after a mine closes unless costly reclamation projects are done.

* Greenpeace documented massive open-cast coal [mines' harmful effects in Kalimantan, Borneo](http://www.greenpeace.org/seasia/id/PageFiles/645408/FULL%20REPORT%20Coal%20Mining%20Polluting%20South%20Kalimantan%20Water_Lowres.pdf). The mines cause widespread water pollution when they discharge toxic waste into rivers and leave acid mine drainage to collect in artificial lakes.

***Coal mining harms workers' and residents' health***

Mining coal, the dirtiest fossil fuel on the planet, exposes both miners and local populations to health hazards.

When people who work in mines, or live close by them, inhale coal dust and carbon, this hardens their lungs, leading to black lung disease (also called coal workers' pneumoconiosis or CWP). An estimated 1,200 people in the US still die from black lung disease annually. The situation is even worse in developing countries. Mine collapses and accidents kill over a thousand workers around the world every year. Chinese coal mine accidents killed more than 900 people in 2014 alone.

People living near coal mines have higher-than-normal rates of cardiopulmonary disease, chronic obstructive pulmonary disease, hypertension, lung disease, and kidney disease.

Local communities also suffer when coal fires occur. These fires emit toxic levels of arsenic, fluorine, mercury and selenium, contaminants that can enter the air and food chain of local communities.

**Public Awareness and What can we do?**

Greenpeace documents harm caused by the coal mining industry around the world. They help energize and boost people-powered movements as part of our tireless global campaign to stop the dirtiest coal, oil and gas projects.

Greenpeace often campaign to [stop the flow of investment to coal](http://www.greenpeace.org/international/en/campaigns/climate-change/Solutions/Climate-friendly-finance/) and other fossil fuel projects. At the same time, they work to speed up the shift to 100 percent clean, safe and secure [renewable energy](http://www.greenpeace.org/international/en/campaigns/climate-change/Solutions/Renewable-energy/). Besides, each of us can also explore ways to [power up our life with renewable energy](http://www.greenpeace.org/international/en/campaigns/climate-change/Solutions/What-you-can-do/).Consumers in developed countries are funding multi-billion dollar strategic resource extraction and processing industries, without understanding where they come from or how they are produced.

Most people do not know about where things they use every day come from. While this is partially due to lack of concern, in many cases the information is obscured by companies concerned about competitors and concerned with hiding unethical practices. This means that consumers who would like to be environmentally and socially conscious do not ever have the opportunity, and companies that engage in deplorable practices are allowed to continue without financial pressure. In the democratic countries from which most offending companies originate, the lack of voter awareness enables them to complacently continue their unethical practices, because they do not face voter pressure to have regulatory policies.

The vast majority of consumers is uninformed about rare earths, conflict minerals, and phosphorus scarcity, and thus is led to make uninformed purchasing decisions regarding electronics.

***! Find the synonyms in the text to the following:*** open pit, coal bed, disrupt, smoulder, crack

**Discussion points:**

1. [Strip mining impacts](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a0).
2. [Strip mining damages and pollutes ecosystems](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a1).
3. [Strip mining contaminates water](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a2).
4. [Strip mines leave lands barren](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a3).
5. [Underground coal mining impacts](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a4).
6. [Subsidence](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a5).
7. [Underground mine water drained away](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a6).
8. [Underground mines bring toxins to surface](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a7).
9. [Coal mine methane](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a8).
10. [Coal fires smoulder and pollute](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a9).
11. [Acid mine drainage](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a10).
12. [Coal mining harms workers' and residents' health](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a11).
13. [Threat to mine workers](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a12).
14. [Threats to local populations](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a13).
15. [What is Greenpeace doing?](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a14)
16. [What can you do to lessen mining impacts on environment?](http://www.greenpeace.org/international/en/campaigns/climate-change/coal/Coal-mining-impacts/#a15)

**Individual tasks:**

1. **Mining industry in my country / region.**
2. **Impacts manifested after mining activity (in my country / region).**
3. **Ukrainian legislation governing mining activities.**
4. **Constructive projects to be implemented by environmentalists.**

ADDITIONAL READING

ORGANIZATION OF ECOLOGICAL EDUCATION

Awareness raising and the development of a cultural and integral ecological outlook is a decisive factor in overcoming the present global ecological crisis. Therefore, comprehensive and continuous development of environmental education and education of all segments of the population should be one of the priorities of sustainable society. At the present stage, environmental education should focus on acquiring knowledge and skills for promoting formation of environmentally literate society with a new position and values. Quality ecological education is socially desirable, economically viable and environmentally safe.

The system of ecological training in Ukraine has been developed and improved considering the experience of development experts and the national peculiarities of the country. The scientific and pedagogical staff of Ukraine is highly qualified in the field of sustainable ecological development, medical ecology, military ecology, methodology and matters of ecological education, ecological ethics and psychology, education and control, etc. Thus, several higher educational establishments of Ukraine provide training students for obtaining degrees of Bachelor and Master in Ecology.

According to their qualification characteristics Bachelors in Ecology should be able to:

- determine the present ecological situation at geological, mining, power, civil engineering, transport, chemistry, forestry and agricultural enterprise, industrial unit in town administrative district, area or state by means of analyzing all natural components of the environment (geological basis, mineral resources, geophysical fields and their impact upon ecosystems and people's health; relief and its disturbance by endo- and - exogeodynamic processes; soil and land resources, ground water, air and climatic resources; forests, agro- and plant covering and fauna), as well as anthropogeneous load upon them;

-establish casual relationship between ecological conditions and main diseases;

- calculate permissible discharge into atmosphere and spills of pollutants into water;

- evaluate the impact of industrial objects upon the environment (EIDE);

- find out sources of contaminating soils, waters, air, etc., and suggest the ways of elimination;

- determine how much an enterprise should pay for contamination of the environment and use of natural resources;

- organize systems of ecological monitoring and safety at enterprises and territories;

- perform ecological customs control, ecological certification of industrial and food products, supervise ecological policy;

- take part in ecological statements and expertise of construction projects in different fields of economy applying new technologies and materials;

- carry out ecological control of transport;

- evaluate ecological impact of enterprises as well as ecological situation in populated areas, settlements and administrative territories.

The Department of Ecology at the Faculty of Mining and Ecology (Zhytomyr State Technological University) provides training Masters in two specialties: Environmental protection technology and Environmental studies. According to the Diploma Supplements the competencies acquired by Masters of Environmental protection technology are the following:

- ability to develop ecological management strategy at different levels for environment sustainability;

- ability to substantiate management measures within natural and territorial complexes aimed at ecological stabilization;

- ability to develop methods and techniques of scientific research for obtaining optimal results;

- ability to develop and substantiate conservation measures projects in the field of international cooperation, and ability to evaluate general economic and social efficiency of the project;

- ability to use theory and methods of pedagogics in educational process;

- ability to conduct educational and informative activities among various groups and sections of population for rational nature management and protection of nature;

- ability to assess ecological risks at different levels (regional, administrative, etc.) for the development of the conception of sustainable development;

- ability to evaluate production material and energy resources needed for stable production operation;

- ability to use professionally-profiled knowledge and practical skills for practical tasks solution in the field of environmental protection.

The competencies required for Masters of Environmental studies are the following:

- ability to substantiate one’s opinion and conclusion using the basic theories and concepts in environmental sciences;

- ability to organize and perform laboratory and field research of environmental objects / components in an adequate and safe manner;

- ability to describe the results of laboratory and field research and make corresponding reports;

- ability to interpret and evaluate the results of environmental research in a logical manner;

- ability to choose methods, tools and suggest solutions to practical problems in the field of environmental science, nature management and environmental protection;

- ability to make assessment of the environmental impact of economic activity;

- ability to collect, integrate, process, analyze and assess environmental information from various sources;

- ability to identify practical issues in the field of environmental science and nature management, and formulate appropriate scientifically substantiated conclusions;

- ability to inform specialists and non-specialists of ideas and issues of environmental science and nature management;

- ability to forecast the state of particular environmental constituents;

- ability to make ecological analysis of measures (or innovation).

Bachelors and Masters-ecologists can occupy following positions in different fields of economy, in control bodies and departments of the Ministry of Ecology and Natural Resources of Ukraine, in state administrations, scientific and academic institutions:

- engineer-ecologist, leading specialist or deputy chief or chief engineer of an enterprise, amalgamation or concern;

- inspector in nature protection and other positions in state departments of Minecoresources in regions and cities;

- staff-member of departments of ecology in regional, district and town administrations;

- engineer and researcher of scientific, research and production laboratories and institutes;

- instructor of ecology and environmental protection in gymnasiums, colleges, technical secondary schools and academic institutions of higher learning;

- advisor or consultant in ecology in different institutions and firms which produce, sell and buy new techniques, technologies and materials.

For training engineers-ecologists the departments of Ecology are staffed with highly-qualified specialists: lecturers, researchers, doctorate students, engineers-ecologists, biologists, hydrologists, climatologists, geologists, geographers, geophysicists, chemists and forestry specialists who have scientific degrees of Professors - Doctors of Science, Dotsents - Candidates of Science.

The market economy has certain requirements as to the level of training of ecological personnel, and this has resulted in an increased interest in post-graduate ecological education. Thus, the department of Ecology at higher educational establishments usually provides a post-graduate course and a doctorate course with Specialized Council in the specialty.

The main fields of scientific research at the departments are as follows:

- computer system of ecological monitoring and safety of the state, region, administrative districts and territories, cities and separate objects;

- ecological geology, ecological geophysics and ecological geomorphology;

- geological and geochemical methods of evaluating natural resources;

- computerized expert systems of research, prospecting and development of natural deposits;

- ecological-and-economic estimation of non-traditional power resources of wind, water, biogas, solar geothermal and other types of non-traditional energetics;

- estimation of nature-resource potential of the territory;

- estimation of permissible discharge and disposal, as well as discharge source inventory, issuing permits for special water treatment and other engineering and ecological estimations.

Also, scientists conduct research in all spheres of nature and biodiversity conservation, as well as in natural areas management and preservation:

- applied conservation biology;

- ecological restoration;

- natural areas management;

- ecological assessment and monitoring;

- habitat protection, etc.

**Read the text. Speak on the problems of education (in particular ecological education) in Ukraine.**

**ENVIRONMENTAL DAMAGES OF MINING**

**Read the texts. 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.**

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.

***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 possible 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.

**HYDROGEOLOGY CONSEQUENCES OF COAL MINES OPERATION**

**(LVIV-VOLYN BASIN)**

Deep coal mining is considered to be one of the most powerful man-caused negative factors affecting the environment. Formation of shifting troughs, change of initial hydrogeological conditions after a coal-field draining and formation of a stressed condition in rock massifs, as well as drainage of polluted mine water into rivers, terrace dumping, creation of clarification pools and sludge collectors - here is just a very basic list of possible direct consequences of coal mining. Of course, not each process or combination of processes is extremely negative. The degree of impact on the environment to a great extent depends on peculiarities of hydro-geomechanical conditions at each deposit or group of deposits.

A characteristic feature of coal-fields of Lviv-Volyn basin is the deposition of industrial coal beds practically directly under the seam of Mesozoic-Neozoic covering rock represented mainly by marl, chalk with subdued seams of talus. Quaternary deposit of different genesis (loamy soil, clay and sand) covers chalk marl by a compact layer up to 10-20 m thick. Another characteristic feature of geological structure of the basin is a significant decrease of the thickness of chalk deposits in Volyn area due to their washing-out and natural discharge into the near-surface zone of more solid marls. In the south part of the basin, the thickness of chalk deposits exceeds that of the deposits in the north part by 100-200 m. It is the washout and not the weathering that explains the presence of a massive area (up to 100-120 m thick) with fractured marls, comparing to 15-45 m in the south.

From the point of view of hydrogeology, the basin may be broken down into the following water-bearing horizons (complexes):

* Quaternary horizon in sand, loamy sand and, partly, loamy soils;
* Senonian in the fractured marl zone;
* Carbonaceous, in sandstone, limestone, coal and Jurassic sandstone.

The upper confining bed for Carbon horizon (the lower bed for Senonian horizon respectively) is represented by low-fractured chalklike limestone and chalk. In the north part of the basin the thickness of this bed is quite low, which, in general, predetermines direct hydraulic connection of Carbonaceous and Senonian horizons in many areas. In the south, such connection is absent or insignificant due to the natural conditions.

Around the entire basin, chalk deposits are eroded to 20-45 m deep and marls are a no-fissure clay-like mass. With the existing filtration gradients, such thickness of eroded marls is sufficient for formation of the upper confining bed in Senonian water-bearing horizon and for preservation of its water-bearing nature around the entire basin.

Water-bearing horizons are fed mainly by infiltration, although an assumption could be made of presence of disjunctive relief irregularities (dumps-upcasts) in deeper horizons and bottoms of coal measures as well as in Devonian deposits. If the irregularities cross the Mesozoic deposits too, then the increase of toxic micro components content in Quaternary surface deposits is explained by the release of highly mineralized deep water.

Brief hydrochemical description of water-bearing horizons shown in Table 1 evidences that:

* in the north part of the basin, both the Quaternary and Senonian water-bearing

horizons are represented by sweet hydrocarbonate calcium water;

* in the south, the thickness of hydrocarbonate-calcium water is decreased and in lower areas of Senonian horizon hydrocarbonate-sodium water with higher mineralization can be observed;
* in the south, the deposits were developed within a zone of stagnant hydrochemical mode (chloride-sodium water with high mineral content), while in the north they were developed within a zone of quasi-stable hydrocarbonate-chloride-sodium water with a relatively low original mineralization.

Naturally, the dumping of mine water into the drainage network in both areas differed significantly. On the assumption of the existence of the indicated hydrochemical zones for a relatively long time, the conclusion can be drawn that microcomponent content in mine terrace will also be different.

Based on the above review of distinctions of original hydrogeomechanical conditions in the north and the south parts of the basin even at the beginning of working the deposit, the assumption can be made:

* inflow of underground water to the Volyn group mines due to the partial drainage from Senonian horizon, should exceed that of the Lviv group and have a tendency for continuous increase along with the increase of developed zones area;
* inflow to the mines of Lviv group due to the gradual wear-out of static resources in Carbonaceous horizon and absence of any significant overflow from Senonian horizon in the process of working the deposits, should decrease continuously.

Analysis of the data on actual inflow to the mines for the period of time from late 50-s until present time confirms the above assumptions about the inflow in Volyn and Lviv group. At the same time, in the south the inflow stabilized at 45-60 m3/h by 1970, and in the north it stabilized at the level of 160-165 m3/h by 1980.

Certain paradox of the above assumptions and their factual data under the conditions of a deposit working without backfilling of the emptied space (with full roof caving) requires additional and more thorough consideration. Primarily, it is about formation of zones of random failure of the rock and water-conducting fissure zones (WFZ) in the under-worked massifs. In Lviv-Volyn basin, the random failure zone does not exceed 0-10 times the thickness of the under-worked seam.

**Table I. Hydrochemical zones of coal-fields in Lviv-Volyn basin**

|  |  |
| --- | --- |
| Dominating composition of underground water | Zone base depth, m |
| North | South |
| Hydrocarbonate-calcium | 90 - 110 | 10 - 15 |
| Hydrocarbonate-sodium | 275 - 360 | 45 - 75 |
| Hydrocarbonate-chloride-sodium | 375 - 440 | 90 - 160 |
| Chloride- hydrocarbonate- sodium | 440 - 480 |  |
| Chloride-sodium | over 480 | over 160 |

Rock massif characteristics undergo less serious changes in the water-conducting fissures zone comparing to the first zone:

* the fissures separating the blocks grow thicker;
* original block separation of the massif (depending on the distance from failure zone) increases by 4-2 times due to the initiation of additional widening of existing micro cracks;
* study data show that thickness of the water-conducting fissures zone varies within 10-120 times the thickness of the developed seam.

In the north part of the basin, WFZ could reach the fractured water-bearing part of Senonian horizon.

Formal hydrogeology interprets WFZ as a simple variant of the increase of filtration conductivity of rock massif on the account of opening of secondary porosity fissures in double porosity systems. Any changes caused by structural blocks which are the carriers of primary porosity, have no substantial influence on filtration coefficients. Possible decrease of filtration coefficients results from direct mudding of fissures observed when filtration gradients decrease significantly.

Considering that after 1970-1980, the area of under-worked massifs in the basin also had a steady tendency to increase, the fact of stabilization of inflow to the coal mines witnesses (for the whole region) the decrease of volume of the drained water from the under-worked territories, including the overflow from overlying Senonian horizon.

The data on the average annual inflow in the most water-abundant mine №8 (Novovolynska) were studied. The analysis shows that after extension of the underworked zone to 70% of the total area (before it was closed down) the inflow stabilized and then decreased dramatically. It is worth noticing, that production continued in the valley part of Studnianka River, where the conditions for overflow from Senonian horizon into the mine are the most favorable. It is clear that the only reason of the inflow decrease into the mine is the dramatic decrease of filtration coefficients in the lower confining bed of Senonian horizon.

Such process cannot be explained by mudding of fissures with unchanged filtration gradients. A better explanation seems to be the change in deformation properties of structural blocks of the rock-dividing stratum.

Calculations based on the concept of residual stress and long-term strength evidenced:

* the decrease of the structural blocks size at the beginning of the work-out (while the residual stress remains unchanged) is accompanied by geomechanical process of expansion of friction, along with a purely mechanical process;
* subsequently, as far as the relaxation of residual stress in structural blocks takes place (while the normal gravitation and filtration load remains unchanged), the fissures acquire a tendency for closure due to lateral expansion of structural blocks;
* along with mechanical fragmentation of the original blocks, standard durability of the rock decreases;
* from the point of view of filtration coefficients change, the end result of this phenomenon is their diminishing to minimum possible values on the account of fissures closure where at the same time mudding may actively develop and additionally contribute to the decrease of filtration parameters.

As stated above, Quaternary deposits everywhere in the basin rest on the eroded marl stratum i.e., the upper confining bed of the main Senonian horizon. Thus, under natural conditions, presence of excessive head pressure in Senonian water-bearing horizon over the upper confining bed gives evidences of:

* quite low filtration properties of the eroded marl strata with coefficient of filtration close to 1x10-3m/day (as calculations show);
* limited overflow potential (direct and reverse) in the event of creation of relatively high filtration gradients (erosion cut-in zones, drainage of Senonian water-bearing horizon in mined deposits and water draw-off);
* potential possibility to restore the original situation of the nature of hydraulic interrelation after the liquidation of mines.

**‼ Write an abstract on the report ( Ex: ABSTRACT**. This report details issues of registration of changes in filtration parameters of water-bearing horizons in the areas where mining is performed, relevant to forecasting of ecology and hydrogeology consequences of coalmines operation.).

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