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General characteristics and structure of environmental risks in the subsoil use sphere

This article reviews the essence, types and structure of environmental risks in the subsoil use sphere. It has been defined that a variety risks associated with the environment is covered by the single term which is "environmental risks". The environmental risk is understood as a beforehand evaluated probability and an extent of hazard that in any man-made intervention into the environment disturbances may arise that can be unfavorable for further functioning and existence of environmental systems both in the man-made effect zone and beyond its limits. It has been demonstrated that works executed in the subsoil use sphere considerably affect the environment. On the basis of researches performed that author provides a comprehensive definition of the "environmental risk" term, formulates its main characteristics and structural elements.
Keywords: environmental risks, environment, land, land use, insurance risks.

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Жер қойнауын пайдалану саласындағы жалпы мінездеме және экологиялық тәуекелдердің жалпы сипаттамасы

Берілген мақалада жер қойнауын пайдалану саласындағы экологиялық тәуекелдердің мәні, түрлері және құрылымы қарастырылған. Қоршаған ортамен байланысты көп түрлі тәуекелдер біркелкі экологиялық тәуекелдер терминімен анықталады. Экологиялық тәуекелдер тікелей антропогендік әсер ету және одан тыс аймақта экологиялық жүйелердің әрі қарай дамуына қолайсыз болуы мүмкін қоршаған ортаға антропогендік әсер ету кезінде бұзушылықтардың пайда болу қаупінің деңгейі мен ықтималдығын алдын ала бағалауды экологиялық тәуекелдер ретінде түсіну қажет. Жер қойнауын пайдалану саласында жүргізілетін жұмыстардың қоршаған ортаға әсері көп. Жүргізілген зерттеу негізінде авторлармен экологиялық тәуекелдер терминінің толық анықтамасы, оның негізгі сипаттамасы және құрылымдық элементтері беріледі.
Түйін сөздер: экологиялық тәуекелдер, қоршаған орта, жер қойнауы, тәуекелдер, жер қойнауын пайдалану, сақтандыру.

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Общая характеристика и структура экологических рисков в сфере недропользования

В данной статье рассмотрены сущность, виды и структура экологических рисков в сфере недропользования. Определено, что все многообразие рисков, связанных с окружающей средой, описывается в рамках единого термина – «экологические риски». Под экологическим риском принято понимать заблаговременно оцениваемые вероятность и степень опасности возникновения при том или ином антропогенном вмешательстве в природную среду таких нарушений, которые могут быть неблагоприятны для дальнейшего функционирования и существования экологических систем как непосредственно в зоне антропогенного воздействия, так и за ее пределами. Показано, что работы, проводимые в сфере недропользования, оказывают существенное воздействие на окружающую среду. На основе проведённого исследования авторами даётся полное определение термина экологического риска, формулируются его основные характеристики и структурные элементы.

Ключевые слова: экологические риски, окружающая среда, недра, риски, недропользование, страхование.

In the domestic subsoil use when planned economy was in place, especially during geological studies of the subsoil, there was no need to determine environmental risks as "The important feature of state investing to geological exploration was that a high geological exploration and environmental risk of each project was distributed to a host of projects implemented at the same time "[1].

From 1992 on, that situation has been changed drastically and prompted that a problem of environmental risks became urgent and required determining its characteristics and structures. Due to this a number of scientific works had been written dedicated to solving such issues. The books mentioned show uprightly that environmental risks can be and must be managed. Realizing that a risk is a measure of danger represents an essential step towards solving a problem to manage a situation when potential factors exist that can affect the human and the environment.

"Risk" (French – "risguc") is defined as any probable hazard. In the subsoil usually there are identified natural, man-induced, environmental, currency, regional, price and other risks that in the subsoil use sphere may come out during geological studies and use of the subsoil in both state funding and attracting funds of investors [2]. In the subsoil use sphere they can be summarized in the table below (Table 1).

From Table 1 it follows that during subsoil use various risks may arise where specific are risks related to natural geological processes and the environmental study and use of mineral resources, which should be clearly distinguished.

Generally, an environmental risk is understood as a probability that negative changes may occur in the surrounding environment or remote unfavorable

Risks in subsoil use			
Pure		**Speculative**	
External	Internal	External	Internal
Natural	Environmental	Inflation/deflation	Bankruptcy
Political	Industrial	Currency	Portfolio
Transport	Geological	Pricing	Interest
Information	Mining		
Trade	Technological		
Credit	Organizational		

Table 1 – Classification of risks in subsoil use
(Chainikov V.V., Lapin D.G.)

consequences of such changes may originate as a result of the affected environment. Environmental risk may be caused by emergencies whether of a natural and man-made nature [3].

Any environmental risk has to be considered only in conjunction with в specific economic and social conditions. In subsoil use risks arise that may be connected with both inability to receive expected outcomes during exploration of mineral resources and possible breaks or loss of expensive machinery, which in both cases results in inexpedient costs of financial and labor resources. Thus, environmental risks in subsoil use can be related to both dampened expectations and substantial loss. In the first case, due to technical or technological reasons no complete and accurate information on mineral resources can provided necessary to achieve the goals set, and in the second case a planned material object will not be received because a mineral deposit has not been discovered, a desired mineral raw stock (proven reserves of a required condition) in a sufficient quantity was not received, and also other material losses have been incurred, which are destruction of used equipment, buildings, structures and so on.

Environmental risk as one of types of risk may be classified in view of a base classification of risks as to a scale of occurrence, a level of admissibility, forecasting, a possibility to prevent or insure. Based on causes of occurrence one can present a classification of environmental risks as follows:

1. Natural environmental risks – risks caused by changes in the natural environment.
2. Technical environmental risks – risks conditioned by the technosphere emergence and development:
   - Risk of sustainable man-induced effects – a risk associated with changes in the environment as a result of usual business activities;
   - Risk of catastrophic effects – a risk associated with changes in the environment as a result of man-induced catastrophes, emergencies and incidents.
3. Social environmental risks – risks caused by a defensive response of the state and the public to the environment.
4. Ecological regulatory risk – a risk due to enacting environmental laws and regulations or their constant tightening;

Man-made sources of environmental risks	Probable environmental risks	Consequences for ecosystems as a result of implemented risks
Mining objects (~ 10 % of a total number of sources)		
Quarry, peatery, mine, gallery, waste bank, dump	Fire, collapse	Landslide, ravine erosion, loss of land and vegetation resources; dusting, thermal and noise pollution of the atmosphere; mechanical and chemical pollution of natural water, soil and vegetation cover
Objects of subsoil and oil and gas fields (~ 22 % of a total number of sources)		
Field, plant, wells (exploratory, production, injection), hydrocarbon raw initial preparation units, oil and gas storages	Fire; accidents associated with emissions of oil products, natural gas and formation water to the environment	Loss of land and vegetation resources; dusting, chemical, thermal and noise pollution of the atmosphere; mechanical and chemical pollution of natural water, soil and vegetation cover
Waste storages (~ 8 % of a total number of sources)		
SDW landfills, industrial waste landfills, drill cutting storages, pits, animal burial sites	Fire; entry of toxic, chemically and biologically hazardous substances to the ecosystems	Loss of land resources; chemical and biological pollution of ecosystem components; thermal pollution
Other objects (~ 6 % of a total number of sources)		
Complexes of hydro-technical works	Emergency collapse of embankment protection structures, breaks of dams and artificial ponds, fires	Flooding of territories, destruction of communications and structures, sowing loss; thermal pollution of ecosystem components

Table 2 – Structure of man-made sources of environmental risks in the subsoil use sphere

5. Ecological political risk – a risk conditioned by environmental protest actions.

6. Economical environmental risks – risks conditioned by financial and economic activities[4].

Three main constituents of environmental risks are identified:

– assessment of human health and a possible number of victims;

– assessment of condition of biota (in first line, photosynthetic organisms) by biological integrated indexes;

– assessment of impact of pollutants, man-induced accidents and acts of God on the human and the natural environment.

Management of environmental risks means to prevent environmental catastrophes, on the one hand, and to minimize their negative consequences, on the other hand. Environmental risks are chiefly prevented by:

- Clear forecasting environmental consequences of projects to be implemented;
- Development of introduction of ecologically clean and resource-saving technologies;
- Economic incentives for business units that care of the environment;
- Administrative and legal restriction of unfair entrepreneurs;
- A wide application of environmental education and awareness [5].

Harm to the natural environment from various man-made and elemental effects caused in the subsoil use sphere is obviously unavoidable; however it should be mitigated and economically justified. Any business or other solutions are to be made so that not to exceed limits of harmful impacts on the environment. It is very difficult to establish such limits as thresholds of effects of many man-made and natural factors are unknown. Therefore, calculations of environmental risks must be probable and multi-versioned with the identification of risks to the human health and the environment (Table 1).

As a rule, environmental risks become apparent in possible breaches of environmental laws. In the subsoil use sphere a risk to violate the environmental protection laws relates to the technology to mine fields and to transport raw materials.

The maximum probablilty of environmental risks under field mining projects takes place during construction, at the steady production stage and at the abandonment stage. A level of impacts of environmental risks on the project result is maximal during the steady production period as adverse events may lead to significant penalties, additional capital costs or termination of works under the project [6].

Summarizing results of the reviewed problem of environmental risks in subsoil use the following conclusions can be made.

1. Based upon the summarization of characteristics mentioned above, one can word the concept of the environmental risk. Environmental risk is a potentially existing possibility to cause damage to the environment through emergency emissions of pollutants or unplanned pathological depletion of natural resources.

2. Assessment of environmental risks is an integral attribute of market economy; therefore it should be studied, defined and considered in subsoil use.

3. Year after year environmental risks become more and more urgent not only for the public as a whole, but also for separate organizations being subsoil use entities. Companies involved in the subsoil use sphere have a direct relation to environmental risks, where such entities act as potential sources of environmental hazards and threats.

4. Lately, a greater emphasis is placed on assessment of tolerable environmental risks, in particular when decisions are made to invest to one or another mining business. Management of environmental risks means to prevent environmental catastrophes, on the one hand, and to minimize their adverse consequences, on the other hand.

5. In order to study and manage environmental risks in the subsoil use sphere, risk management must be a practice to study the environment and to use mineral resources, as well as to create a regulatory and methodical framework on the basis of laws of the Republic of Kazakhstan.

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