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Abstract. This paper considers an algorithm for constructing an integrated assessment of the environmental risk of enterprises based on risk indicators. An overview of risk assessment methods is given. To find and process the research results, the method of expert assessments and elements of the fuzzy logic method were used. The membership function is constructed for the classification of the current value of the environmental risk factor. Based on the obtained numerical results, the ranking of the studied variables is given. A generalized indicator of the level of environmental risk of an oil and gas enterprise is found.

1. Introduction

The production process in the oil and gas sector often ignores the negative impact on the environment. Usually, the activity is aimed only at maximizing the economic effect and almost no money is spent on environmental activities. This approach causes enormous damage to the environment and becomes the main cause of the existing deep environmental and economic crisis. At the same time, there is a mismatch between the pace of economic development and environmental safety requirements. The critical state of the energy resource base, the shortage of national fuel and energy resources, morally and physically obsolete technologies for extraction, transportation, processing and use of natural resources, lack of work culture and consumption reduce environmental safety and increase environmental risks of oil and gas companies. Currently, the issues of environmental hazard and environmental risk management are becoming among the most economically significant, but to solve them is becoming increasingly difficult due to the sufficient neglect of the situation

The purpose of assessing the environmental risks of oil and gas companies is to identify hazards, generalize the qualitative and quantitative information and methodological support on the level and consequences of harmful and dangerous factors affecting the environment. There are levels and degrees of risk [1]. The procedure of environmental risk assessment involves the following stages:

hazard identification, environmental risk assessment and risk characterization [2]. Environmental risk assessment determines the likelihood that adverse environmental effects may occur as a result of one or more sources (stressors) [3].

Table 1. Methods of environmental risk assessment.

Qualitative methods of risk assessment	Quantitative methods of risk assessment	Disadvantages
Statistical		
Stream maps	Control cards	The need for a large number of observations (the larger the data set, the more reliable the risk assessment). Sources of risk origin are not analyzed, i.e multi-components of risk are ignored. Low estimation accuracy.
Deterministic		
Process Hazard and Analysis Analysis of the type and consequences of failures Analysis of erroneous actions (AEA) Analysis of the influence of the human factor	Cluster analysis Methods of expert assessments. Risk identification and ranking methodology Analysis of the type, consequences and criticality of failure Methods for determining and assessing potential risk.	The variability of variables in time and space is not taken into account, as well as the sensitivity of objects of influence
Probabilistic		
Accident Sequences Precursor (ASP) Expert assessments Method of analogies for determining scenarios of accidents	Event tree analysis (ETA) Failure tree analysis (FTA) Risk assessment of the minimum pathways from the initiating to the main event Decision tree Probabilistic risk assessment Scores Methods of pairwise comparisons Simulation modeling (Monte Carlo method) Fuzzy set method Methods based on the principle of artificial neural networks.	Large expenditure of time and resources for the preparation of information support for risk assessment. The assessment of the condition of uncertainty of non-static nature characterizes the subjectivity of the choice of the membership function and the formation of the base rules of "fuzzy input", as well as the need to use special software and attract specialists with the necessary skills to work in such programs.
Combined		
Logical and graphical methods of risk analysis Analysis of the maximum possibility of an accident Reliability block diagram (RBD)	Methods of optimal risk analysis (ORA) Methods of organized systematic risk analysis Quantitative risk assessment (QRA).	Labor-intensive, requires processing a large amount of statistical, accounting and management information

Developed by the author on the basis of [1,2,5]

In [4] the probabilistic assessment of ecological risk is investigated. Ensuring a reliable assessment of environmental risks, the use of effective methods of their assessment, adapted to specific economic conditions and specific activities, in particular, oil and gas companies at all stages of their operation will improve environmental safety at the national level. In this regard, it is advisable to review existing methods for assessing and forecasting environmental risks and the possibility of their application in oil and gas companies.

Thus, in practice, to assess the environmental risk in oil and gas companies, it is necessary to conduct a phased assessment of hazards and risks using several methods simultaneously. In addition, each method requires prior justification as to its feasibility at each stage.

This approach significantly complicates the risk assessment process and hides certain shortcomings:
- there is a direct relationship between the growing number of assessment methods and possible errors in the process of assessing environmental risk in the activities of oil and gas companies, as each method a priori contains certain shortcomings and inaccuracies in use [3];
- occurrence of additional errors in substantiation;
- incomplete evaluation procedure and high level of subjectivity.

Thus, a comprehensive solution to the scientific question can be achieved only with the use of its own system of special approaches to environmental risk assessment, which determine the specifics of oil and gas companies and research objectives. None of the known methods is universal and not adapted for a comprehensive and objective risk assessment at all stages of modern oil and gas companies. Therefore, the current areas of improvement of methodological tools are in the plane of applying a holistic approach and the use of appropriate stochastic models that can objectively describe the random and hybrid nature of negative influences. Using probabilistic environmental risk assessment instead of deterministic estimates, when each variable or parameter acquires a fixed value or a series of fixed values under any given conditions, will take into account the variability of variables in time and space, as well as the sensitivity of objects. A distinction should be made between the variability of exposure due to the random nature of variables and the uncertainty caused by errors caused by inaccurate measurements, the proximity of the selected distribution of random variables, errors in the application of laboratory results to real conditions, and so on. In addition, the construction of adequate mathematical models, such as emergency processes - a very difficult task, even at the current level of software development.

2. Literature review

Methodical principles of assessment and management of environmental risks, considered in the works of domestic scientists [6-10] and others. The authors of [11] carry out systematization and ranking of risks according to their significance. A model of risk management in the life cycle of a project is built and a scientific approach to assessing the weight characteristics of an indicator is proposed. The approach based on the choice of a risk assessment criterion in the form of a matrix can be used in the oil and gas industry, incl. to assess environmental risk. In their work [12], the authors analyzed the importance of environmental risk in the ranking of global problems. They systematized the approach of European countries to environmental taxation. In the presence of various types of environmental tax, the urgency of building an effective taxation system was shown.

Artificial intelligence methods, in particular neural networks and fuzzy logic elements, can be used to predict and model enterprise risks. Noteworthy is the original approach to modeling based on the segmentation and clustering of the objects under study [13]. The authors of [14] propose an algorithm for the model of dynamic management of technological innovations in conditions of scarcity and incomplete information. This process allows you to optimize the management of the economic system and reduce the risks of the enterprise. For the sustainable development of an organization, it is necessary to use modern innovative methods based on artificial intelligence [15]. The use of neural networks allows you to improve enterprise management and reduce the risks arising in their activities. The article [16] examines the possible risks at the enterprises of the oil and gas complex, which arise

during the redistribution of natural rent. A strategy for minimizing risks is proposed, taking into account all members of the cooperative alliance.

To reduce the risks of an enterprise and increase the efficiency of its management, the methods and tools of machine learning [17] have been increasingly used lately, which do not imply the need for a preliminary study of the processes under study and the introduction of a priori knowledge about them into the model. The work [18] considers the process of creating an IT project by enterprise risk management. For an adequate assessment of emerging risks, two groups of methodology are used, based on the life cycle of system development and a standard methodology. Analysis of the characteristics of IT projects allows you to determine the features of using methods and models of risk management, taking into account the scope.

In [19], a model was created based on the construction of a discrete dynamic system. This system includes a risk-based technology innovation module. The use of the obtained economic and mathematical model allows to optimize the processes of data management and forecasting. In [20], theoretical and empirical aspects of the tax consciousness . The proposed approach is to determine the main factors of effective management to control tax behavioral risks. Good management will reduce the existing tax risks the functioning and development of the socio-eco-economic system of the country.

The book [21] examines the application of project management theory in the oil and gas complex. It is proposed to use the global integrated systematic approach to the analysis and effective management of oil and gas projects and programs. The oil and gas industry has a significant impact on the sustainable national development of the country. The work [22] considers the definition of risk factors at the stage of designing the construction of oil and gas fields. Based on a survey of experts, the main risks of the project were identified, both internal (financial, operational, etc.) and external (economic, political, environmental, etc.). It was noted that there should be a comprehensive, integrated risk management system.

In their book [23], the authors conduct an in-depth analysis of environmental policy. They consider the factors that are used in environmental policy and investigate their impact on the quality of life. A comprehensive baseline analysis of environmental research is proposed. This paper [24] examines the impact of changes in state environmental standards on the location of the company's production branches. It is shown that for not heavily polluting enterprises, these norms do not significantly affect the location of the business. The impact of environmental regulation on the structure of a competitive industry is discussed in [25].

To reduce environmental risk, a three-level information system was developed in [26]. This system allows for settlements between the seller and the buyer using electronic commerce methods. The authors of [27] in their work considered the main factors that affect the spread of global e-commerce. Trends and statistical indicators of the spread of e-commerce in the context of globalization are presented. To increase the income of a firm, in [28] a model is considered that allows increasing the number of consumers of a product. This model takes into account the optimal advertising costs, taking into account the increase in the number of buyers. Increasing the profit of an enterprise by optimizing the number of consumers of products and pricing policy is considered in [29,30]. The resulting profit can be used to reduce environmental risk. The authors [31] propose a model of price competition between companies using elements of e-commerce. To reduce the company's risk, incl. ecological, it is proposed to implement a mixed model for the sale of goods.

In their work [32], the authors review the literature on the problem of environmental damage from air pollution, climate change and deforestation. An empirical approach is proposed to study the effect of marginal environmental damage on various population groups. The authors of [33] consider the problem of environmental pollution during the extraction of minerals. An integrated technological approach is proposed, aimed at reducing emissions of pollutants, which will lead to a decrease in environmental risk. In [34], the issue of payment for environmental services for people with low and high incomes is investigated. The environmental Kuznets curve and environmental justice are analyzed. They showed that income tends to have a positive effect on environmental improvements.

The authors of [35] consider methodological issues regarding the impact of industrial air pollution on environmental inequality in 50 US states. To assess environmental policies in relation to equity issues, an integrated approach needs to be taken, taking into account various indicators. In works [36,37] the issues of rent at the enterprises of the oil and gas complex are considered. To reduce the environmental risk, the optimal distribution of rental income when using natural resources is proposed, taking into account the interests of all stakeholders.

Article [38] analyzes the impact of the value of the US dollar on global financial conditions. It is shown that a positive shock to its trade leads to a decrease in the global interest rate. The work [39] considers the issue of price formation for products with changes in prices for raw materials and variable production costs. This approach is based on the study of the constant elasticity of substitution function. The proposed algorithm allows to optimize the risk management indicators of an enterprise in connection with the current changes. The article [40] analyzes the relationship between oil prices and world interest rates and innovations in industrial production. It is shown that global macroeconomic factors depend on the economies of the U.S., China and Euro area. In their article [41], they examined the impact of changes in oil prices on US macroeconomic indicators. They showed that the movement in oil prices can be viewed as exogenous variables in relation to the US macroeconomy. Research has shown that stagflation in the 1970s in the US is not solely due to oil price shocks. The article [42], using VAR analysis, examines the impact of surges in oil prices on the economies of the main industrialized countries. For most countries, an increase in the price of oil has a greater impact on GDP growth than its decline. Management and forecasting of GDP components is presented in [43,44].

The author of [45] in his work studies the degree of influence of the policy of hedging oil and gas producers on their financing costs. It is shown that larger oil and gas companies with greater financial leverage reduce price risk through optimal risk management. In their paper [46], the authors evaluate the hedging of 119 US oil and gas producers and test the hypothesis about the impact of hedging on the increase in the market value of the firm. This hypothesis was rejected on the basis of hedging rates and oil and gas reserves. One of the methods for optimizing the risks of an enterprise is insurance [47,48].

The work [49] analyzes methods and ways to improve the development of environmental entrepreneurship. The authors systematized the concept of environmental entrepreneurship terminology, and also proposed a classification of environmental goods. To reduce environmental pollution and depletion of natural resources, in addition to administrative and economic instruments, it is necessary to involve instruments based on market relations. This approach will reduce the environmental risk of the enterprise. To optimize environmental risk, it is proposed in [50] to use a differential carbon tax rate. The authors take into account regional peculiarities and propose to introduce a correction factor for calculating the carbon tax. To compensate for the damage, it is proposed to redistribute budget revenues.

Improvement of the environmental situation at the enterprise and in the region occurs when the enterprise observes environmental standards and there are innovations directly related to production [51]. The modernization of production processes is one of the main factors in reducing environmental risk. To analyze the financial and economic sustainability of enterprises, both classical statistical modeling methods and modern mathematical tools, such as Fractal analysis [52], as well as artificial intelligence methods [53] are used. This approach allows you to optimize the economic and economic activities of the enterprise and manage the risks of the enterprise. In his work [54], the author examines the mutual influence of energy and environmental policies It is shown that the consequences of the energy policy are regressive in relation to the environment. Six environmental impacts are presented and shown that they are more likely to harm the poor than the rich. Article [55] reviews the literature on environmental justice and the relationship between pollution and race and poverty. The mechanisms of the relationship between pollutants and residents are also investigated.

The criterion for assessing socio-economic development is the integral indicator. A model using a mathematically sound complex indicator is given in [56]. Optimization of this criterion will reduce the

risk component of the organization's activities. To improve the environmental component at petrochemical enterprises, it is necessary to control the processes occurring at the enterprise [57].

With the development of information technology, computer security is one of the main in the company. In [58], a method for detecting malicious software based on network diagram analysis was developed. Article [59] discusses the issue of compatibility of indicators of economic growth and ecosystem conservation. The main approaches for assessing ecosystem values are proposed. It is shown that the decline in ecosystem functions can be compensated for by human capital and that environmental values increase with income.

The study of the effectiveness of environmental taxation at oil and gas companies indicates the feasibility of raising environmental tax rates in the long run to achieve a reduction in pollutant emission, and it will encourage companies to implement innovative technologies to reduce anthropogenic burden on the environment [60]. It has been proved [61] that the country's business climate characterizes the state of socio-eco-economic development and the results of its effectiveness, the impact on the environment.

The authors [62] substantiate that the development of a diagnostic model for the resource efficiency of the oil and gas sector is an urgent scientific problem that requires further consideration.

However, scientific views on the theoretical and methodological basis for environmental risk assessment are contradictory. There is no single approach to quantitative environmental risk assessment, assessment criteria and no clear definition of the term environmental risk. Therefore, the solution of scientific and practical issues to improve the assessment of environmental risk and information and methodological support for the assessment of environmental hazards, led to the relevance of this study.

Many organizations such as the European Association of Petrochemicals, the Norwegian Ministry of Petroleum and Energy, Shell Expro [5] and others. recognized that a holistic approach is necessary to assess environmental risk. This approach involves environmental risk assessment for all technological operations and processes from field exploration, drilling, oil production, transportation to the liquidation of the field and provides cost savings for environmental risk management.

3. Methods

One way to assess the level of risk is the method of expert assessments. The heads of the respective enterprises act as experts (N = 30). The survey was conducted among managers of enterprises using a specially developed software package Survey 1.0. This software package makes it possible to conduct surveys and register all the answers chosen by the respondents to the questionnaire.

The next method of assessing the level of risk is the fuzzy set method. The proposed model specifies a set of qualitative indicators with a total number of n. As a result of the expert's uncertainty, there are vague explanations in the structure of the model. Commonly used functions in this case are trapezoidal membership functions (Fig. 1). Note some clarifications: the upper limit of the trapezoid corresponds to the full confidence of the expert in the correctness of its classification, and the lower - the confidence that no other values of the interval [0; 1] do not fall into the selected fuzzy subset.
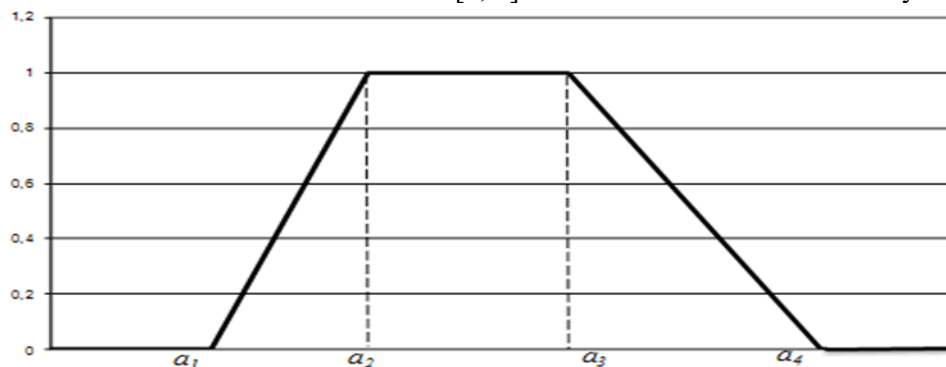

Figure 1. Trapezoidal membership function [63]

For the purpose of a compact description, the trapezoidal membership functions μ(x) are described by trapezoidal numbers of the form: μ(a_1, a_2, a_3, a_4), where a_1 and a_4 are the abscissas of the lower bound; a_2 and a_3 are the abscissas of the upper boundary of the trapezoid.

Thus the classifier of parameter on a qualitative level is constructed. Consider the main stages of application of the obtained classifier in the phased construction of fuzzy - multiple factor model.

Table 2 shows the results of recognizing the level of indicators based on a set of classifiers, where f_{ij} is the level of belonging of the carrier xi to the fuzzy subset B_j, based on expert data.

Table 2. Levels of membership of fuzzy subsets.

Characteristic	The result of classification by subsets				
	B_1	B_2	B_3	…	B_m
X_1	f_{11}	f_{12}	f_{13}	…	f_{1m}
…	…	…	…	…	…
X_i	f_{i1}	f_{i2}	f_{i3}	…	f_{im}
…	…	…	…	…	…
X_n	f_{n1}	f_{n2}	f_{n3}	…	f_{nm}

The first stage. "Linguistic variables and fuzzy subsets".

1. Linguistic factor V "Expected value of the indicator" has the following 5 values: V_1 - fuzzy subset "expected value is very low"; V_2 - fuzzy subset "expected value low"; V_3 - fuzzy subset "expected value average"; V_4 - fuzzy subset "expected value high"; V_5 - fuzzy subset "expected value is very high".

2. For an arbitrary exponent xi we set the linguistic variable B_j - "Indicator level" on the following terms-set of values: B_1 - subset "very low level"; B_2 - subset "low level"; B_3 - subset "average level"; B_4 - subset "high level"; B_5 - subset of "very high level".

The second stage. "Quantitative assessment of factors that characterize environmental risk."

At this stage, it is necessary to obtain normalized values of the studied environmental risk factors, taking into account their belonging to the classification of the linguistic variable B_j. In ascending order, to assess the degree of environmental risk, we will use a point system from 1 to 5, respectively, i.e. the weight of the subset B_1 is 1, the weight of B_5 is 5. To further evaluate these experts, we introduce the following indicator λ_{ij} :

$$\lambda_{ij} = \frac{f_{ij} \cdot k_j}{\sum_{i=1}^{n}\sum_{j=1}^{m} f_{ij} \cdot k_j} \tag{1}$$

where f_{ij} – is the level of belonging of the carrier x_i to the fuzzy subset B_j, based on expert data;
k_j – is the current weight of the linguistic variable B_j.

The third stage. Ranking of environmental risk indicators.

At this stage, we rank the indicators. The importance of indicator X_i is found by the formula:

$$K_i = \sum_{j=1}^{m} \lambda_{ij} \tag{2}$$

The highest value of the indicator indicates that it significantly affects the environmental situation at the enterprise than other indicators. The values obtained by formula (2) can be used to find the weights of environmental risk indicators.

The fourth stage. Calculation of the degree of environmental risk at the enterprise.

At this stage, it is necessary to compare each indicator X_i level of its significance for the analysis of the weighting factor r_i. To assess this level, it is necessary to rank all indicators in descending order of importance so that the rule is followed: $r_1 \geq r_2 \geq \cdots \geq r_n$.

If the system of indicators is ranked in descending order of their significance, then the significance of the i-th indicator r_i can be determined by the Fishburne rule [64]:

$$r_i = \frac{2(n-i+1)}{(n+1) \cdot n} \qquad (3)$$

Grade (3) corresponds to the maximum entropy of the existing information uncertainty about the object of study. In this case, it allows the responsible person to make effective decisions in the least favorable information environment.

There may be a situation when all indicators have equal significance (there is no system of advantages), then: $r_i = 1/n$.

The degree of environmental risk V at the enterprise is calculated by the following formula:

$$V = \sum_{j=1}^{m} \left[\left(0{,}1 + 0{,}2 \cdot (j-1)\right) \cdot n \cdot \sum_{i=1}^{n} r_i \lambda_{ij} \right] = \sum_{j=1}^{m} \left[g_j \cdot n \cdot \sum_{i=1}^{n} r_i \lambda_{ij} \right] \qquad (4)$$

where m – is the total number of the level of the linguistic variable B_j.

Fifth stage. Identification of the level of environmental risk of the enterprise.

At this stage, we analyze the degree of environmental risk in the enterprise and the feasibility of using specific tools of crisis management based on the membership function. Table 3 shows the classification of the parameter of the level of environmental risk at the enterprise.

Table 3. Classification of the current value of indicator V of the assessment of the level of environmental risk.

№	The range of values of V	Parameter level classification
1	$0.0 < V \leq 0.2$	V_1 - "The degree of environmental risk is insignificant"
2	$0.2 < V \leq 0.4$	V_2 - "The degree of environmental risk is low"
3	$0.4 < V \leq 0.6$	V_3 - " The degree of environmental risk is medium "
4	$0.6 < V \leq 0.8$	V_4 -"The degree of environmental risk is high"
5	$0.8 < V \leq 1.0$	V_5 - "The degree of environmental risk is marginal"

A consistent continuation of the construction of the model of probabilistic fuzzy-multiple assessment of environmental risk of the enterprise is the construction of the appropriate function of belonging to assess the level of environmental risk. Table 4 shows the function of the assessment of the level of environmental risk in the enterprise.

Table 4. Belonging function and classification of the current value of the indicator of environmental risk assessment at the enterprise [63].

Value range V	Parameter level classification V	Belonging function
$0.00 \leq V \leq 0.15$	V_1	1
$0.15 < V < 0.25$	V_1	$\mu_1 = 10\,(0.25 - V)$
	V_2	$1 - \mu_1 = \mu_2$
$0.25 \leq V \leq 0.35$	V_2	1
$0.35 < V < 0.45$	V_2	$\mu_2 = 10\,(0.45 - V)$
	V_3	$1 - \mu_2 = \mu_3$
$0.45 \leq V \leq 0.55$	V_3	1
$0.55 < V < 0.65$	V_3	$\mu_3 = 10\,(0.65 - V)$
	V_4	$1 - \mu_3 = \mu_4$
$0.65 \leq V \leq 0.75$	V_4	1
$0.75 < V < 0.85$	V_4	$\mu_4 = 10\,(0.85 - V)$
	V_5	$1 - \mu_4 = \mu_5$
$0.85 \leq V \leq 1.0$	V_5	1

The membership function indicates the level of belonging of the studied indicator to a fuzzy subset of the level of environmental risk.

4. Discussions and results

As an example, consider an algorithm for obtaining estimates of environmental risk in the oil and gas industry. Table 5 shows the final distribution of the assessments of 30 experts for 10 environmental risk factors.

Table 5. Levels of membership of fuzzy subsets.

Indicator	Name of the indicator of ecological risk	The result of classification by subsets				
		B_1	B_2	B_3	B_4	B_5
X_1	Environmental protection measures during well construction	2	2	2	10	14
X_2	Impact on the geological environment	2	4	2	5	17
X_3	Drilling accidents	1	4	2	10	13
X_4	Wastewater treatment	1	3	4	13	9
X_5	Waste management	2	5	4	6	13
X_6	Soil protection and restoration	1	3	8	15	3
X_7	Atmospheric air protection	4	4	6	5	11
X_8	Measures to localize and eliminate the consequences of the accident	1	5	9	11	4
X_9	Greenhouse gas emissions	2	7	5	10	6
X_{10}	Hydraulic fracturing while drilling	1	9	5	10	5

Table 6 shows the numerical results of the importance of environmental risk indicators, as well as their ranks. According to experts, the most important indicator that affects the environmental component of the enterprise risk is the indicator «Soil protection and restoration».

Table 6. The value of environmental risk indicators and their ranks.

Indicator	Name of the indicator of ecological risk	Indicator value K_i	Rank
X_1	Environmental protection measures during well construction	0.0923	8
X_2	Impact on the geological environment	0.1023	5
X_3	Drilling accidents	0,0959	6
X_4	Wastewater treatment	0.1095	2
X_5	Waste management	0.1086	3
X_6	Soil protection and restoration	0.1104	1
X_7	Atmospheric air protection	0.1050	4
X_8	Measures to localize and eliminate the consequences of the accident	0.0896	10
X_9	Greenhouse gas emissions	0.0950	7
X_{10}	Hydraulic fracturing while drilling	0.0914	9

Analysis of research enterprises shows that most of the current expenditures were made on measures to protect and restore soils (36.3% of total current expenditures), wastewater treatment (28.7%), waste management (18.4%) and 3.2% of current expenses were allocated for air protection.

Environmental risks can be divided into three groups. The first group of environmental risks is associated with the legislative activities of the state. They are manifested in the possibility of violating the legislation on environmental protection. In the oil and gas industry, first of all, environmental risk

is associated with drilling technology, field development and transportation of hydrocarbons. Also, a situation may arise when, due to changes in legislation, the implementation of an oil and gas project leads to a violation of the newly established norms. The second group of environmental risks is objective in nature and is associated with special climatic and geological conditions, which cause additional costs for more expensive structures and means of preventing natural changes. These risks can be mitigated to a sufficient extent using the latest technologies for monitoring and preventing natural disasters. The third group of environmental risks is associated with the violation of the integrity of the natural environmental background: environmental pollution with chemical reagents, disposal and handling of waste and emissions into the atmosphere.

The analysis of the main impact indicators will be carried out according to several criteria based on the data of the companies' environmental reports: a) impact on the atmospheric air: gross emissions of pollutants; specific emissions of pollutants; greenhouse gas emissions; utilization level; b) impact on water resources: total water consumption; specific water consumption; water disposal into surface water bodies; c) impact on soils: indicator of contaminated land reclamation (the ratio of the area of contaminated land at the end of the year to the beginning of the year should be equal to 0); d) waste management: waste management indicator (the ratio of the amount of recycled, neutralized and transferred to third-party waste to the amount of waste at the beginning of the year, waste generated during the year and waste received from third-party organizations should be equal to 1).

Based on the data in Tables 5 and 6, as well as using formula (4), we will find the value of the complex indicator for assessing the degree of environmental risk of the enterprise. Table 7 shows the value of the integral indicator of the environmental risk of the enterprise, as well as its level of risk and the degree of confidence in this statement.

Table 7. Comparison of the level of environmental risk obtained and the level of confidence obtained.

Indicator value V	Environmental risk level	The degree of confidence gained, %
0.7729	The degree of environmental risk is high	77.1
	The degree of environmental risk is marginal	22.9

5. Conclusions

This study proposes an algorithm for obtaining an integral assessment of the environmental risk of an oil and gas enterprise. For the analysis of indicators of environmental risk assessment, an expert assessment method was used. The function of correspondence and classification of the current value of the level of ecological risk is built. A gradation of the level of ecological risk using the method of fuzzy sets is proposed.

Analysis of the data shows that, based on expert assessments, the greatest environmental hazard at the surveyed enterprise is represented by the "Soil protection and restoration" indicator. You should also pay attention to the optimization of such indicators as: "Wastewater treatment" and "Waste management". The complex indicator of the environmental risk of the enterprise is 0.7729, which corresponds to the value of the " The degree of environmental risk is high " with a degree of confidence of 77.1% and the value of the " The degree of environmental risk is marginal " with a degree of confidence of 22.9%.

Based on the data obtained, it is necessary to carry out measures to optimize the indicators of the environmental component of the oil and gas enterprise to reduce the environmental risk.

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