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RATIONALE FOR THE DEVELOPMENT OF NEW SOLUTIONS TO ENSURING SAFETY OF TRANSPORTATION OF DANGEROUS GOODS THROUGH THE MOUNTAINEOUS AREAS OF UZBEKISTAN

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ANNOTATION: This article examines the issue of transportation, as well as various leaks and failure to comply with safety regulations, soil pollution and, as a consequence, the entire natural environment. Environmental consequences of pollutants entering the natural environment. The issue of oil and oil product spills is considered.
Keywords: Oil spill, oil products, environment, ecology, nature region.
АННОТАЦИЯ: В данной статье рассматривается вопрос при транспортировке, а также, при различных утечках и не соблюдении правил техники безопасности происходит загрязнение почв и, как следствие, всей окружающей природной среды. Экологические последствия поступления загрязняющих веществ (ЗВ) в природную среду. Рассмотрен вопрос о разлива нефти и нефтяных продуктов.
Ключевые слова: Разлив нефти, нефтяные продукты, окружавшая среда, экология, природа рагион.

One of the determining factors influencing the choice of solutions is the assessment of the general state of the environment in the mountainous regions of the Republic. The unique spatial and temporal variability of natural conditions, especially the hydrotechnical regime, the widespread development of seasonal and permafrost determine the significantly lower stability of mountain ecosystems relative to the mountainous regions of Uzbekistan.

Instability increases from south to north, which can be seen at least in the example of climate. The issue of preserving the natural environment in the mountainous regions of the Republic is especially relevant, where any anthropogenic impact has a significant impact on the unique biocenosis.

The main risk factors in rail transport include the transportation of large quantities (more than 300 million tons per year) of dangerous goods, such goods make up more than 23% of the total volume of transportation, and their volume has been constantly increasing in recent years. The main share in the volume of dangerous goods is oil and oil products.

During transportation, as well as during various leaks and failure to comply with safety regulations, soils are contaminated and, as a consequence, the entire natural environment. The environmental consequences of pollutants (PS) entering the natural environment are as follows: changes in soil properties and soil cover, pollution of surface and groundwater, degradation and transformation of vegetation, degradation of landscapes. Oil spills can occur almost everywhere during the storage and transportation of oil. Spills are classified by:

– the significance of the polluted object (protected natural areas, water areas),
– location (water surfaces, urban areas, sparsely populated or remote areas),
– the volume of oil spills and the area of oil contamination of surfaces,
– availability of access roads and accessibility for restoration work and other parameters.

In turn, it is necessary to take into account that oil, as a pollutant, is a complex mixture of about 1000 different substances, most of which are various liquid hydrocarbons, usually constituting 80-90% by weight, and (4-5%) organic compounds, mainly sulfur, nitrogen and oxygen, as well as organometallic compounds. The remaining components are dissolved

hydrocarbon gases (4%), water (up to 10%), mineral salts, solutions of organic acid salts and mechanical impurities. The ratio of these components varies in oil of different types from different layers and deposits.

Pollution causes enormous damage to the biological balance of the environment and is the cause of a whole range of problems that negatively affect not only flora and fauna, but also people and the economy for years and decades to come.

Damage to the environment is caused not only by accidental spills, but also by the loss of petroleum products during their transportation. Until recently, it was considered acceptable that up to 5% of the extracted oil is naturally lost during its storage and transportation. The rates of natural loss of petroleum products during transportation in bulk in railway tanks (in kilograms per 1 ton of the transported quantity (in % of the cargo weight)) are presented in Table 2.

Table 1

Standards for natural loss of petroleum products.

Group of petroleum products	Standards for natural loss of petroleum products for all climatic zones and in all periods of the year
1, 2	0.210 (0.021)
3, 4	0.140 (0.014)
5	0.070 (0.007)
6	0.100 (0.010)

The annual volume of oil pollution in Russia is estimated at 10-12 million tons, while oil pollution in Europe does not exceed 1.6 million tons annually. The annual economic damage (direct and indirect) from emergency situations, including those related to oil spills, is 1.5 - 2 percent of the gross domestic product (from 675 to 900 billion rubles) [69].

Pollutants, the most common of which are oil, as well as oil products (fuel oil, fuel, lubricants) not only have a negative impact on the environment, but also worsen the operational properties of the railway track base. To assess soil pollution, a classification of pollution level indicators based on the concentration of oil products in the soil is adopted. According to GN 2.1.7.2041-06 "Maximum permissible concentrations (MPC) of chemical substances in the soil", the level of content, for example, of gasoline in the soil should not exceed 0.3 mg / kg.

The average concentration of oil product pollution is 1.5 g/kg, which exceeds the maximum permissible value by 1.5 times [118, 120]. In some areas, the amount of pollutants on the railway bed reaches 20 g/kg of soil [13]. Such soil is characterized as having a very high level of pollution and requires urgent work to reduce the concentration of harmful pollutants to an acceptable level.

Table 2

Indicators of the level of land pollution by oil and oil products

Compound	Pollution level, mg/kg				
	acceptable	short	average	high	very high

Oil and oil products	MPC	1000...2000	2000...3000	3000...5000	>5000

Analysis of statistical data presented in the work shows that the number of incidents with dangerous goods during transportation in tank cars on the Far Eastern Railway is steadily increasing, which means that the negative impact on the environment is increasing. Numerical values for the number of incidents with a breakdown by causes are presented in Table 3.

Table 3

Incidents with dangerous goods at JSC UTY

	Количество инцидентов за год							
Причина инцидента	2005	2006	2007	2008	2009	2010	2011	всего
Течь из-за дефекта котла	17	26	15	20	29	24	34	165
Течь через сливной прибор	14	17	9	12	28	25	24	129
Течь через аппаратуру котла	3	1	2	0	4	10	1	21
Течь через неплотно закрытый люк	1	4	3	11	3	1	1	24

Continuation of table 3

Flow fromspecial container tank	2	1	0	0	0	0	0	3
Leak from a universal or special container	3	1	1	1	1	2	1	10
Leakage (spillage) from other types of carriages	1	5	1	1	1	0	1	10
Cargo fire	1	0	1	0	2	1	5	10
total	42	31	32	45	24	63	67	372

The railway is an engineering system that ensures the transportation process, at the same time, it is a strip alienated from the natural environment, artificially adapted to the movement of trains, with specified technical and environmental indicators. Therefore, one of the tasks that requires a solution is maintaining operational parameters at the regulatory level and minimizing the negative impact of this object of influence.

The soil in the areas adjacent to the railway track is an active accumulator of oil-containing liquids, therefore the entry of pollutants even in small concentrations, but over a long period of time, leads to their significant accumulation. As a result of the accumulation of pollutants, the physical properties of the ballast layer change, which leads to an increased risk of emergencies.

At the stage of construction and operation of the railway track, a set of measures is envisaged to protect the surrounding air, water and land environment, as well as to protect

the animal and plant world. Despite the measures taken, during operation, there are constant changes in the properties and pollution of the ballast layer and nearby soils and grounds with oil products and their chemical reagents. The greatest damage is caused by emergencies with spills of NNP, when a large amount of aggressive liquid enters the environment at one time.

In this regard, it is important to find ways to effectively respond to emergencies. It is possible to ensure a stable state of equilibrium in the natural environment adjacent to the railway track using a set of legal, organizational and technical methods. Thus, it is necessary to take all possible measures to ensure that the negative impact is minimal.

The problematic nature of adequately assessing the impact of railway transport on the biocenosis is also due to the fact that the parameters used to assess the impact on humans are usually transferred to the environment. The existing maximum permissible concentration standards for NNP do not take into account the special perception of pollution by flora and animals. The diversity of species and living conditions of flora and fauna does not allow for the derivation of uniform criteria. The difficulty of deriving any uniform criteria for assessing the impact on protected areas

is also contained in the wide range of their categories, profiles and status.

An optimal system for assessing the impact of emergencies with NNP on protected areas should include a comprehensive assessment of the impact on each of its components: air, surface and ground water, flora and fauna, soils, etc. An analysis of possible emergency situations and their consequences for protected areas is mandatory, with the development of special regulations for emergency response measures in such areas.

When analyzing the possibility of an emergency situation, when developing an Oil Spill Response Plan, it is imperative to take into account the presence of protected areas in the probable spill zone. Summarizing various types of impact on protected areas, for each of them it is possible to calculate or justify the zone of its negative impact. A similar approach was used when assessing the impact of anthropogenic objects on protected areas in the work, where the so-called buffer zones for anthropogenic objects were determined by three main parameters (chemical pollution, noise pollution, change in the hydrological regime). Determination of the impact zone should be based on a combined assessment of all possible potential types of impact and their time scale, assessment of damage to flora and fauna, assessment of emergency situations. Given the differences in the response to impacts of different components of protected areas, it is necessary not to reduce the zone of different types of impact to an average value, but to highlight the most significant ones, taking into account the specifics of the protected area (category, profile, status, international significance), the degree of vulnerability of protected objects, as well as the existing anthropogenic impact on protected areas using weighting factors.

The size of the influence zone can be interpreted as the range of the spread of the influence of an emergency spill of NNP. For example, for oil and gas fields such zones are taken as 5 km, for pipelines - 1 km, and accordingly for a railway, as a transporting NNP, a spread zone of 1 km can be taken. But taking into account the possibility of impacts on protected areas, as a set of various components of the natural environment (flora, fauna, air, water, etc.), we assume that the zone of direct and indirect impact on protected areas can be increased to 2-5 km for activities on land, 3-10 km in the case of impacts on surface water bodies. Thus, taking into account the above, we will accept in our work a zone of influence of the railway on the adjacent territory of 3 km wide.

The negative consequences for the protected area may be particularly significant in connection with an emergency situation, in particular with an oil or oil product spill. In an

accident-free mode of operation, the most negative impact on the protected area may be at the stage of operation (disturbance, change in the properties of the air and water environment, etc.) due to the accumulation of pollutants in the ballast layer of the railway track. The time scale of the impact may be chronic, and the intensity of the impact on the protected area may increase to a significant level.

The assessment of the negative impact of emergencies with NNP on protected areas should include an analysis of all possible potential types of impact, their spatial and temporal scale, and the identification of the most significant ones taking into account the specifics of the protected area. In the system of ensuring environmental safety of transportation of petroleum products by rail, as a component of overall safety, meaningful interpretation of data is important. The most informative is the cartographic interpretation of information. Based on a comparison of the railway map and the map of protected areas, as well as taking into account the location of water bodies, a map of vulnerable conservation areas is presented. For such zones, it is necessary to develop special technical and organizational conditions (including insurance of dangerous goods during transportation through a vulnerable area) in order to concentrate financial resources in case of the need to eliminate the consequences of emergency situations (Fig. 1).

Figure 1 - Railways passing through the mountainous regions of Uzbekistan.

Uneven anthropogenic and environmental loads and disruption of the ecological balance of the territory adjacent to the railway track are among the main reasons for the emergence of the threat of an emergency.

An important aspect in the emergency warning system is the process of modeling the warning system, which includes the stage of comparing the terrain model, which includes cartographic information (vulnerability, relief, technical base) with the model of oil behavior during spills based on emergency cards.

The result is the receipt of indicators (vulnerabilities) characterizing pollution: the configuration of the oil slick, the area with the concentration of the pollutant, as well as the presence of objects that perceive a negative impact [6]. The main danger is oil spilled directly on the ground, where it evaporates, is subject to oxidation and the influence of microbes.

With porous soil and low groundwater levels, oil can contaminate groundwater. Analysis of the information obtained allows for adequate organizational and technical decisions to be made to eliminate the consequences of the spill, and to calculate the forces and resources required to carry out the work.

The vulnerability map allows to determine the locations of concentration of technical means for liquidation of consequences of possible emergency situations taking into account ecological safety of unique natural territories under state protection. The map of conjugation with specially protected natural areas and water bodies is one of the initial information

resources considered by the author for construction of matrices of individual vulnerabilities and ranking of vulnerability of the territory of influence of the railway, determination of the complex territorial coefficient (CTC).

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