Risk-based approach for industrial environmental control during the construction of the main gas pipeline

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Abstract. Based on the analysis of acts of industrial environmental control and the content of the Register of Environmental Violations of the General Contractor, the distribution of categories of documentary and natural violations by frequency of occurrence was revealed. Based on the analysis of the legislation of the Russian Federation, the severity of potential environmental consequences, translated into point values, is determined. On the results of the established parameters, the final score is calculated. It is proposed to supplement the Company Register with this parameter.

Today, hydrocarbon pipelines are an integral part of the oil and gas business both at the national level and within the global energy supply system. Such activities are associated with high environmental risks, the reduction of which is directed to the industrial environmental control (IEC), specified in Art. 67 of the Federal Law of the Russian Federation "On Environmental Protection" dated January 10, 2002 No. 7-FZ. Methods and approaches for conducting IEC were considered in the works of a number of domestic scientists, for example, Lomash S. I. [1], Brinchuk M. M., Samorukova O. I. [2], Lantsovoi I.V., Tulyakova G.V. [3]. It is worth noting the importance of conducting IEC not only during operation, but also at the stage of construction of trunk pipelines, since during the period of construction and installation work, an aggressive effect is exerted on the state of soils, lands, water bodies, and the atmosphere. Such anthropogenic interventions in natural ecosystems require their long-term recovery recovery.

Currently, construction companies are faced with a number of difficulties in carrying out IEC, the main problem is the need for significant expenditures of forces and resources for carrying out this procedure. Therefore, it is important to rationally plan the resources of a construction company. The difficulties of conducting IEC were also considered in the works of Prituzhalova O.A., Radchenko K.S. [4], Mishanina O.E., Khisamutdinova E.V., Arefieva A.V., Abrosimova A.E. [5]. As part of the study, in the framework of this article, SGM Group, the leading corporate group in Russia engaged in construction works for the oil and gas industry, was chosen. The problems associated with the conduct of IEC at the main hydrocarbon transport facilities were considered in the work of Sitdikov R.R., Kupina N.A., Polovkova S.A., Troshina M.A. [6], and the objects of the chemical industry were considered by Degtyareva T.P. [7].

As part of IEC, the activities of contracting organizations monitor compliance with the requirements of the environmental legislation of the Russian Federation, design decisions in the field of environmental protection during the performance of work and the conditions of the subcontract. In the course of the
study, the analysis of acts of IEC for the construction of gas pipelines at the level of the Customer, General Contractor and acts of corporate control for 2016-2018 was conducted.

Today, a Register of Environmental Violations, the structure of which is shown in Figure 1, has been developed in the General Contractor’s internal documentation system. Two large groups of violations are distinguished in the Register: documentary (include 6 main categories) and on-site (include 8 main categories).

![Figure 1. The structure of the register of environmental violations.](image)

At the first stage of the study, an analysis of recorded documentary violations during the construction of gas pipelines for 2016-2018 was carried out. In a matter of the researched period, 313 violations were detected. The categories of documentary violations are shown in Figure 2. As can be seen from the diagram, the largest share of violations falls into the following categories: protection of water bodies (failure to provide a decision on making available water bodies for use, water pollutant discharge permit, etc.), and the least - soil protection (failure to provide a schedule for reclamation work, as well as permits for the right to use land property, etc.).

![Figure 2. Categories of documentary violations.](image)
During the research, a correlation between the results of IEC conducted by the Customer, the General Contractor, and corporate control was also found, and it was estimated that the violations detected by them were almost identical (figure 3). Thus, it is worth noting that aggressive effects on water bodies can often be exerted outside for use for the construction of the main pipeline, which means that the project may not include measures to restore the natural ecosystem in these places.

Figure 3. Correlation of IEC results for documentary violations.

At the second stage of the research, the analysis of the categories of full scale violations during the construction of gas pipelines for 2016-2018 was carried out. In a matter of the researched period, 343 violations were detected. The categories of natural violations recorded during the Customer’s IEC, the General Contractor and corporate control are shown in figure 4. As can be seen from the presented diagram, the largest share of violations falls on such categories as: unauthorized occupation of the land plot outside the land allotment strip (unregulated driveways, parking of equipment, placement of construction sites, which entailed damage or destruction of the soil and plant layer, tree and shrubbery vegetation) and violations of the waste management rules (for example, the placement of waste in bulk on unsuitable sites, the pollution of the construction site with construction and household waste), and the least - failure to carry out reclamation work (failure to provide a schedule for restoration work, as well as permits on the right to use land properties, etc.).

Thus, the aggressive effect on the soil ecosystem is both within the boundaries of the land provided, and beyond the boundaries of land allotment.

Figure 4. Categories of full violations.

It should be noted that during the analysis, a correlation between the results of the frequency of identifying types of violations within the Customer’s IEC, the General Contractor and corporate control
(figure 5), which proves the proposed frequency of identifying categories of natural violations within the framework of optimizing the registry of environmental violations was found. For convenience, the values are converted to percentages.

![Figure 5. Correlation of the results of IEC on full scale violations.](image)

Based on the results of the analysis of violations, it is proposed to introduce a risk-based approach when conducting IEC, by ranking the categories of violations in the Register of Environmental Violations of the General Contractor. The basis of the proposed ranking was included the following formula (1):

$$B = 10 \cdot q \cdot F$$  \hspace{1cm} (1)

where $B$ is a final score of the category of violation;  
$q$ is a share of the category of violation in the group of documentary or full scale violations;  
$F$ is a point estimate of the severity of environmental consequences, determined from the maximum amount of potential administrative fines in the case of verification by supervisory authorities, since the legislator in the amount of the penalty laid down the severity of environmental consequences from economic and other activities (table 1).

**Table 1. Scores for environmental impact severity.**

| Score (F) | Characterization of the consequences in accordance with the Code of Administrative Offenses of the Russian Federation |
|-----------|----------------------------------------------------------------------------------------------------------|
| 1         | Violations involving an administrative fine on legal entities in the amount of less than 100,000 rubles. |
| 2         | Violations entailing the imposition of an administrative fine on legal entities in the amount of more than 100,000 rubles. |
| 3         | Violations involving the suspension of activities. |

Table 2 shows the values of the parameters $q$ and $F$, as well as the final score $B$. It is proposed to rank the final score in accordance with table 3.
Table 2. Final scoring of categories of violations.

| №  | Categories of violations                                           | Violation category share q | Scoring of environmental impact severity F | Final scoring of categories of violations B |
|----|-------------------------------------------------------------------|----------------------------|------------------------------------------|------------------------------------------|
|    | Documentary violations                                           |                            |                                          |                                          |
| 1  | Responsibility for environmental protection at the construction site | 0,109                      | 1                                        | 1                                        |
| 2  | Environmental management                                         | 0,061                      | 1                                        | 1                                        |
| 3  | Waste management activities                                      | 0,227                      | 3                                        | 7                                        |
| 4  | Air protection                                                    | 0,246                      | 3                                        | 7                                        |
| 5  | Water bodies protection                                          | 0,351                      | 3                                        | 11                                       |
| 6  | Soil protection                                                   | 0,006                      | 2                                        | 0                                        |
|    | Full scale violations                                            |                            |                                          |                                          |
| 1  | Unauthorized occupation of a land plot outside the land allotment strip | 0,192                      | 2                                        | 4                                        |
| 2  | Violation of the regime of economic and other activities within WPZ | 0,128                      | 2                                        | 3                                        |
| 3  | On the territory of the pipe-collecting base, the location of fuel and lubricants tanks outside the equipped areas | 0,105                      | 1                                        | 1                                        |
| 4  | Violation of the waste management rules                          | 0,216                      | 3                                        | 6                                        |
| 5  | Placement of eroded soil dumps within PSB, soil getting into water bodies Violation of the water bodies protection rules and the protection of adjacent lands from flooding/swamping | 0,079                      | 2                                        | 2                                        |
| 6  |                                                                 | 0,149                      | 2                                        | 3                                        |
| 7  | Failure or unsatisfactory performance of removal and storage of the fertile layer Failure to carry out reclamation work, violation of the schedule of reclamation work | 0,117                      | 3                                        | 3                                        |
| 8  |                                                                 | 0,015                      | 2                                        | 0                                        |

Table 3. Ranking of categories of violations.

| Final score B | Description of violation category level |
|---------------|-----------------------------------------|
| 0 < B ≤ 5     | Low negative impact                      |
| 5 < B ≤ 10    | Average negative impact                  |
| B > 10        | High negative impact                     |

In conclusion, it should be noted that the introduction of a risk-based approach during IEC will optimize the audit procedure, as it will help the auditor to determine the order of precedence, priority and frequency of verification of environmental requirements.

References
[1] Lomash S I 2013 Theoretical and applied ecology 2 102-8
[2] Brinchuk M M and Samorukova O I 2008 Ecology and industry in Russia 2 50-3
[3] Lantsova I V and Tulykova G V 2008 Environmental systems and devices 11 11-4
[4] Prituzalova O A and Radchenko K S 2019 Construction and industrial safety 14(66) 145-54
[5] Mishanina O E, Xisamutdinova E V, Arefeva A V and Abrosimova A E 2012 Oil industry 1 103-5
[6] Sitdikov R R, Kupina N A, Polovkov S A and Troshin M A 2016 Science and technology of pipeline transport of oil and petroleum products 1(21) 97-101
[7] Degtyareva T P 2017 Anthropogenic transformation of the natural environment 3 93-5