Features of Corrosion Processes of Field Equipment of LLC Fe "Sanoat Energetika Guruhi" and Effective Methods of Corrosion Protection

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ABSTRACT

The article is devoted to the actual problem of corrosion of oilfield equipment and effective methods of dealing with it.The authors of the article faced the real problems of one of the largest oil fields in the Republic of Uzbekistan.The application of a set of measures for corrosion protection, comprehensive monitoring of the corrosion situation, the use of modern solutions, including the development of proprietary chemical reagents, made it possible to significantly reduce the statistics of equipment destruction under the influence of corrosion processes, as well as to increase the level of industrial safety of the facility as a whole.

Keywords: Corrosion, equipment, collection point, oxygen, corrosion inhibitor, oil pipeline, average corrosion rate, witness samples.

Introduction

The mechanism of flow and development of corrosion processes of oilfield equipment is well studied and described. However, multiple factors affecting the corrosion failure of oilfield equipment in the field environments of various fields require individual solutions for the localization of corrosion processes and the development of a set of effective measures to protect equipment from corrosion processes.

Body

In November 2021, due to the high statistics of repair and restoration work due to corrosion failures on the central lines of the oil pipelines of the collection points of the North Urtabulak field of the Mubarek Chamber of Commerce and Industry of FE SanoatEnergetikaGuruhi, specialists of Geo Research and Development Company LLC conducted comprehensive corrosion monitoring of field facilities.

According to the results of corrosion monitoring, critical indicators of average corrosion rates were recorded on the central lines of the collection points "SP1-UPN", "SP2-UPN", "SP3-UPN" of the Severny Urtabulak field:

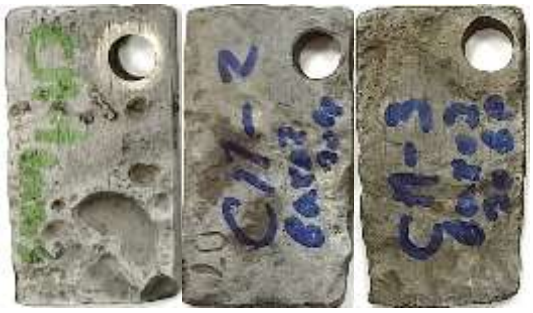
Table 1 Resource requirements by component

Deposit	Checkpoint	Recorded corrosion rate	Conditionally permissible corrosion rate	Exceeding the tolerance for corrosion
North Urtabulak	Line SP1	3.5691 mm per year	0.1 mm per year	35.7x
	Line SP2	2,2092 mm per year		22.0x
	Line SP3	4.5510 mm per year		45.5x

Photographs of Control Steel Corrosion Witness Samples (USCs) after exposure

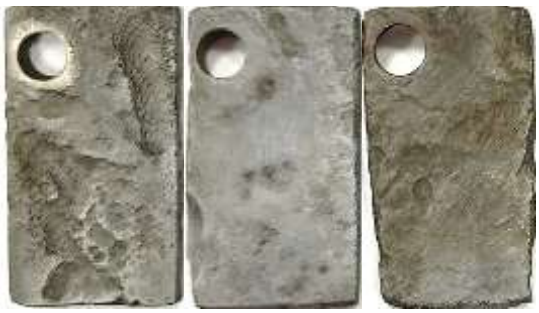
Line SP1 Line SP2 Line SP3

Side **A**



Line SP1 Line SP2 Line SP3

Side **B**



Samples-witnesses of corrosion, during the exposure of 35 days, underwent a mixture of corrosion of a mixed type - a combination of carbon dioxide, oxygen and hydrogen sulfide corrosion. At the same time, focal corrosion ulcers and caverns with dimensions from 1 to 22 mm Ø and a depth of up to 2.3 mm indicated a penetrating corrosion rate of up to **29.9821 mm / year,** which accordingly leads to short-term irreversible local destruction of fishing equipment.[1]

The main reason for such a high corrosion rate is the high content of free$_{O2}$ in the transported medium. At the same time, it is well known that oxygen is an extremely aggressive gas, more aggressive than, for example, carbon dioxide.

Oxygen saturation of the oil pipeline transported along the central lines was ensured by the architecture of the collection points of the Severny Urtabulak field - an open system.

Together with the specialists of FE "SanoatEnergetikaGuruhi" and LLC "GeoResearchandDevelopmentCompany", a set of measures was developed to reduce the level of oxygen in the transported environment and ensure corrosion protection of field equipment, including:

1. Abandonment of the system of collection points and the transition to a pumpless oil collection system.
2. Providing inhibitory protection of the central lines of oil pipelines and oil collection and treatment systems.

In the laboratory of GeoResearchandDevelopmentCompany LLC, on real fishing environments, an effective composition of the corrosion inhibitor was selected using local raw materials. And according to GeoResearchandDevelopmentCompany LLC, a corrosion inhibitor of the IR-GRDC-0421 Ts 28588472-001:2021 brand was developed, certified, and produced in volumes of 4 tons of a pilot batch.

In October 2021, according to the developed set of measures, work was carried out to reduce the level of free$_{O2}$ in the environment of the North Urtabulak field transported through the SP1-UPN, SP2-UPN, SP3-UPN lines, by switching to a pumpless oil collection and transportation system.

In parallel with this, the supply of a corrosion inhibitor of the brand IR-GRDC-0421 Ts 28588472-001:2021 produced by GeoResearchandDevelopmentCompany LLC (Republic of Uzbekistan) to the central lines of the oil pipelines SP1-UPN, SP2-UPN, SP3-UPN with an average specific consumption of 25 grams per^{m3} of the extracted liquid was started.

The effectiveness of the measures taken was also evaluated on the basis of corrosion monitoring, and the effectiveness of the inhibitory treatment was controlled by comparing the average corrosion rates at the points before and after the corrosion inhibitor is supplied:[2]

Table 2 Resource requirements by component

Deposit	**Checkpoint**	**Recorded corrosion rate**	**Conditionally permissible corrosion rate**	**Effectiveness of the undertaken protective**
North Urtabulak	Line SP1	0.0096 mm per year	0.1 mm per year	reduction of corrosion rate by 372 times
	Line SP2	0.0073 mm per year		reduction of corrosion rate by 302 times
	Line SP3	0.0105 mm per year		433x reduction in corrosion rate

Photographs of Control Steel Corrosion Witness Samples (USCs) after the exposition after the complex of events

Line SP1 Line SP2 Line SP3

Side **A**

Line SP1 Line SP2 Line SP3

Side **B**

After exposure to corrosion witness samples, no pronounced corrosion damage was recorded. The samples were subjected to continuous uniform corrosion not exceeding the tolerance.

The transition to a pumpless oil collection system and a corresponding reduction in the content of free$_{O2}$ in the environment provided a protective effect to reduce corrosivity by 93.4%. However, the average corrosion rate was 0.2868 mm per year, which in turn exceeds the tolerance for corrosion by 2.8 times.

The subsequent use of the corrosion inhibitor of the grade IR-GRDC-0421 Ts 28588472-001: 2021 ensured an average protective effect of 96.8% already in relation to the corrosive activity of the medium in conditions without a pump system for collecting and transporting oil, and the average corrosion rate for the period of inhibitory treatment was 0.0091 mm per year, which in turn is 11 times lower than the tolerance for corrosion.

Conclusion

Analyzing the results obtained, we can confidently conclude that the use of only a corrosion inhibitor in the difficult field conditions of the North Urtabulak field will not give a practical effect, as well as a change in the system of oil collection and transportation separately. The effectiveness of protection of oilfield equipment from corrosion in the framework of the work carried out is ensured by a set of developed measures.

Literature:

1. GOST 9.502-87 Unified system of protection against corrosion and aging. (ESBCS) Inhibitors of corrosion of metals in water-oil media. Methods for determining the protective ability
2. GOST 9.905-85 Unified system of protection against corrosion and aging. (ESZKS) Metals and Glory. Methods for determining corrosion and corrosion resistance. General Requirements