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COMPREHENSIVE TECHNICAL DIAGNOSTICS OF STORAGE TANKS AND PREDICTION OF THEIR SAFE OPERATIONAL LIFE AT HAZARDOUS INDUSTRIAL FACILITIES

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Abstract

The safe operation of storage tanks at hazardous industrial facilities depends on the ability to determine their actual technical condition and predict possible changes during long-term operation. This article analyzes the application of comprehensive technical diagnostics for evaluating the condition of storage tanks and determining their remaining service life. The study considers the combined influence of corrosion damage, welded joint condition, metal thickness reduction, and operational factors affecting the reliability of tank structures. The study confirms that regular technical inspection and data-based assessment methods help identify critical changes in the condition of storage tanks at an early stage. This approach reduces the risk of unexpected failures and provides a scientific basis for planning maintenance and repair activities.

Keywords: storage tank, technical diagnostics, residual life assessment, corrosion monitoring, welded joints, non-destructive testing, industrial safety, reliability evaluation.

1. Introduction

Storage tanks used at hazardous industrial facilities require continuous monitoring because their failure may lead to serious economic losses, environmental damage, and risks to human safety. Such tanks are widely used in



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oil and gas processing plants, chemical industries, energy facilities, and other production areas where large volumes of hazardous substances are stored. During operation, storage tanks are exposed to different factors that gradually affect their technical condition. The most common factors include corrosion of metal surfaces, changes in wall thickness, defects in welded joints, mechanical loads, temperature changes, and the influence of stored substances. Over time, these factors may reduce the strength of structural elements and limit the safe operating period of the equipment.

In many industrial facilities, storage tanks continue to operate after several decades of service. Therefore, determining their actual condition and remaining service life becomes an important technical task. The traditional approach based only on scheduled repair and inspection is not always sufficient because the real condition of individual structural elements may differ from expected values. Modern technical diagnostics makes it possible to obtain more accurate information about the condition of equipment. By combining different inspection methods, it is possible to evaluate corrosion development, identify welding defects, determine metal degradation, and estimate how long the structure can continue operating safely.

Previous studies have shown that corrosion assessment and welding quality control are separate but closely connected parts of storage tank reliability evaluation. Corrosion reduces the thickness and strength of metal structures, while welding defects may become areas where damage develops more rapidly. Therefore, a comprehensive approach that considers all these factors is necessary. The purpose of this study is to analyze methods of comprehensive technical diagnostics of storage tanks and evaluate approaches for predicting their safe operational life.



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The main tasks of the research are to analyze the methods used for assessing the technical condition of storage tanks, determine the role of corrosion and welding defects in reducing reliability, and develop an approach for improving the assessment of residual service life.

2. Materials and Methods

The research was based on the analysis of technical inspection methods used for hazardous industrial equipment, scientific publications, industrial standards, and practical approaches applied in storage tank operation. The study considered steel storage tanks operating under conditions typical for oil, gas, and chemical industries. The assessment process included analysis of the main factors affecting structural reliability, such as corrosion damage, welded joint condition, and reduction of metal thickness during operation.

The technical condition of storage tanks was evaluated using a combination of diagnostic methods. Visual inspection was considered as the initial stage of assessment because it allows identifying visible defects, deformation, corrosion traces, and damage to protective coatings. However, visual inspection alone cannot provide complete information about internal structural changes. Ultrasonic thickness measurement was analyzed as one of the main methods for determining metal degradation. This method allows measuring the remaining thickness of tank walls and identifying areas where corrosion has caused significant material loss. The obtained measurements can be used to calculate corrosion rates and estimate future changes in structural condition.

Non-destructive testing methods were also included in the research for evaluating welded joints. Ultrasonic testing, radiographic inspection, and magnetic particle testing were considered effective tools for detecting cracks, incomplete penetration, lack of fusion, and other defects that may reduce structural reliability.



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The residual service life assessment was based on analysis of current technical parameters and prediction of future degradation processes. The calculation approach considered the existing wall thickness, corrosion rate, operational conditions, and safety requirements for continued operation.

The collected data were analyzed to determine the relationship between individual damage factors and the overall reliability of storage tanks. This approach made it possible to evaluate not only separate defects but also their combined influence on safe operation.

3. Results

The analysis showed that reliable assessment of storage tanks requires consideration of several factors simultaneously. The technical condition of a tank cannot be determined only by evaluating corrosion or only by inspecting welded joints because different damage mechanisms may influence each other. The research demonstrated that corrosion remains one of the main causes of structural degradation. Continuous exposure to aggressive environments leads to gradual reduction of metal thickness. Areas with increased corrosion activity require special attention because local damage may significantly reduce the strength of the structure even when the average condition of the tank appears satisfactory.

The assessment of welded joints showed that defects located in connection areas may accelerate the development of damage. Cracks, incomplete penetration, and lack of fusion create stress concentration zones where further destruction can occur under operational loads. The results confirmed that ultrasonic thickness measurement provides valuable information about the current condition of tank walls. Regular measurements allow determining corrosion rates and identifying areas where repair or additional monitoring is required.



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The study also showed that the combination of several diagnostic methods gives more accurate results than the use of a single inspection method. For example, corrosion measurements provide information about metal loss, while welding inspection reveals possible defects that may affect structural strength. The application of residual life prediction methods allowed estimating the expected period of safe operation based on actual technical parameters. Such assessment helps enterprises move from planned repair systems toward condition-based maintenance.

The research indicates that storage tanks with regular diagnostic monitoring have lower operational risks compared with equipment operated without systematic technical assessment.

4. Discussion

The obtained results confirm that technical diagnostics should be considered as a continuous process throughout the entire service life of storage tanks. A single inspection provides information about the current condition, but regular monitoring allows identifying changes and predicting possible future problems. One of the main advantages of a comprehensive diagnostic approach is the possibility of evaluating the combined influence of different factors. For example, corrosion may reduce the thickness of metal, while welding defects may weaken certain areas of the structure. When these factors occur together, the risk of failure increases.

The results also indicate that maintenance decisions should be based on actual technical data rather than only on the age of equipment. Two tanks with the same service period may have different technical conditions depending on operating environment, maintenance quality, and previous repair history. For hazardous industrial facilities, the implementation of diagnostic systems is especially



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important because unexpected failures may have serious consequences. Regular inspection, accurate defect identification, and prediction of residual life allow improving safety and reducing unnecessary repair costs.

The development of digital technologies provides additional opportunities for improving technical monitoring. Electronic databases of inspection results, automated analysis systems, and condition monitoring technologies can help specialists make more accurate decisions regarding further operation of storage tanks. For industrial enterprises operating in Uzbekistan, where many storage tanks have long service periods, improving diagnostic methods and introducing integrated assessment approaches can significantly contribute to increasing operational safety.

5. Conclusion

The study shows that comprehensive technical diagnostics is necessary for ensuring the safe operation of storage tanks at hazardous industrial facilities. Evaluation of only one factor, such as corrosion or welding condition, does not provide a complete picture of structural reliability. The combined use of visual inspection, ultrasonic thickness measurement, non-destructive testing of welded joints, and residual life assessment methods allows obtaining more accurate information about the actual condition of equipment.

The research confirms that regular monitoring and scientifically based prediction of operational life help prevent failures, improve maintenance planning, and extend the safe use period of storage tanks. Therefore, the development and application of integrated technical diagnostic methods should be considered an effective approach for improving industrial safety and ensuring reliable operation of hazardous production facilities.



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References:

1. API Standard 653. Tank Inspection, Repair, Alteration, and Reconstruction. American Petroleum Institute, Washington, 2014.
2. API Standard 650. Welded Tanks for Oil Storage. American Petroleum Institute, Washington, 2020.
3. Fontana M.G. Corrosion Engineering. 3rd Edition. New York: McGraw-Hill, 1986. 556 p.
4. Revie R.W., Uhlig H.H. Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering. 4th Edition. Wiley-Interscience, 2008. 512 p.
5. Roberge P.R. Corrosion Engineering: Principles and Practice. New York: McGraw-Hill, 2008. 754 p.
6. ISO 17640:2018. Non-destructive testing of welds — Ultrasonic testing. International Organization for Standardization.
7. ISO 17638:2016. Non-destructive testing of welds — Magnetic particle testing. International Organization for Standardization.
8. ГОСТ 31385-2016. Резервуары вертикальные цилиндрические стальные для нефти и нефтепродуктов. Москва: Стандартинформ, 2016.