Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

ASSESSMENT OF CORROSION DEGRADATION PROCESSES IN STORAGE TANKS USED AT HAZARDOUS INDUSTRIAL FACILITIES AND METHODS FOR ENSURING THEIR SAFE OPERATION

Sharopov Rovshan Tolib oglu
Independent Researcher, Karshi, Uzbekistan

Abstract

The article analyzes the corrosion degradation processes occurring in storage tanks operated at hazardous industrial facilities and examines modern approaches to ensuring their safe and reliable operation. Storage tanks are considered critical elements of industrial infrastructure, especially in oil and gas, chemical, petrochemical, and energy sectors, where their technical condition directly affects industrial safety and environmental protection. The study focuses on the main factors influencing corrosion processes, including aggressive operating environments, chemical composition of stored products, temperature variations, humidity, and mechanical stresses. The obtained findings can be applied for developing effective strategies for maintenance, inspection, and safe operation of hazardous industrial facilities.

Keywords: Storage tank, corrosion degradation, industrial safety, hazardous production facility, residual life, technical diagnostics, metal corrosion, non-destructive testing, corrosion protection, reliability assessment.

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

Introduction

Storage tanks are among the most important structural elements of hazardous industrial facilities and are widely used for storing petroleum products, chemical substances, liquefied gases, and other industrial materials. The reliability and technical condition of these structures directly influence the safety level of industrial processes, environmental protection, and economic efficiency of enterprises.

During long-term operation, storage tanks are exposed to various external and internal factors that contribute to corrosion degradation of metallic structures. Corrosion is one of the main causes of deterioration in the mechanical properties of steel elements, reduction of wall thickness, formation of defects, and decrease in the overall operational reliability of tanks. According to industrial safety studies, corrosion-related failures remain among the most common causes of accidents in storage facilities[1].

The corrosion process in storage tanks is influenced by several factors, including chemical aggressiveness of stored substances, presence of moisture and oxygen, temperature fluctuations, electrochemical reactions, and mechanical loads. Internal corrosion usually occurs due to direct contact between the tank surface and stored products, while external corrosion develops under the influence of atmospheric conditions, soil moisture, and environmental pollution.

In Uzbekistan, many hazardous industrial facilities operate storage tanks that were constructed several decades ago. Their long-term exploitation requires continuous monitoring, technical inspection, and assessment of current conditions. Ensuring safe operation of such facilities requires the implementation of modern diagnostic methods, corrosion control technologies, and scientifically based approaches for determining residual service life[2].

The purpose of this research is to analyze corrosion degradation mechanisms in storage tanks, evaluate factors affecting their durability, and identify effective

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas
Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)
ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

methods for improving operational safety through corrosion assessment and preventive measures.

The objectives of the research include:

- analyzing the main causes and mechanisms of corrosion damage in storage tanks;
- evaluating methods for determining corrosion rates and metal degradation;
- studying modern approaches to technical diagnostics of storage tanks;
- developing recommendations for improving safe operation and extending service life[3].

Materials and Methods

The research was conducted using a comprehensive methodological approach based on analysis of scientific literature, industrial safety standards, technical inspection methods, and practical experience in operating hazardous industrial facilities.

The study involved the analysis of storage tanks used in oil and gas, chemical, and industrial sectors. Particular attention was paid to steel tanks exposed to aggressive environments and operating under conditions of prolonged service periods.

The following research methods were applied:

Technical analysis method. Existing data related to storage tank operation, corrosion damage characteristics, and maintenance practices were analyzed. Technical documentation, inspection reports, and operational parameters were studied to identify the main factors influencing corrosion development.

Metallurgical and corrosion assessment methods. The corrosion state of metallic structures was evaluated based on changes in wall thickness, corrosion depth, and defect formation. The relationship between operational conditions and corrosion intensity was analyzed.

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

Non-destructive testing methods. Modern diagnostic techniques were considered, including ultrasonic thickness measurement, visual inspection, magnetic particle testing, and other instrumental methods. These methods allow determining the actual condition of tank components without damaging structural integrity.

Statistical analysis method. Collected technical data were analyzed to identify corrosion trends, estimate corrosion rates, and predict possible changes in structural condition over time.

Risk-based assessment approach. The research also considered risk assessment principles for hazardous industrial facilities. This approach allows prioritizing maintenance activities based on the probability and consequences of potential failures. The combination of these methods provided a comprehensive evaluation of corrosion processes and allowed the development of recommendations for improving storage tank reliability.

Results

The analysis showed that corrosion degradation remains one of the most significant factors affecting the operational reliability of storage tanks. The intensity of corrosion processes depends on operating conditions, chemical characteristics of stored materials, environmental factors, and the quality of protective measures.

The study identified several main types of corrosion damage affecting storage tanks:

Uniform corrosion was found to be one of the most common degradation forms, characterized by relatively even reduction of metal thickness across the surface. Although this type develops gradually, prolonged exposure can significantly reduce structural strength.

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

Localized corrosion, including pitting corrosion, was identified as a more dangerous process due to its ability to create deep defects in limited areas. Such defects may lead to leakage, loss of structural integrity, and emergency situations. **Atmospheric corrosion** was observed mainly on external surfaces of tanks exposed to moisture, temperature changes, and environmental pollutants. The application of protective coatings and regular surface inspections significantly reduces this type of damage[4].

The research demonstrated that corrosion monitoring based on regular thickness measurements provides reliable information about the actual technical condition of storage tanks. Ultrasonic testing methods were found to be particularly effective for detecting metal loss and evaluating remaining wall thickness. The results also showed that early detection of corrosion defects allows enterprises to implement preventive measures before critical damage occurs. The use of anti-corrosion coatings, cathodic protection systems, proper drainage systems, and scheduled inspections contributes to increasing the service life of storage tanks[5].

The analysis revealed that tanks without systematic monitoring experience accelerated degradation, while facilities implementing regular diagnostic programs demonstrate higher operational reliability and reduced risk of accidents.

Discussion

The obtained results confirm that corrosion control is a key component of ensuring safety at hazardous industrial facilities. The long-term operation of storage tanks requires not only periodic inspection but also the implementation of integrated monitoring systems capable of predicting future technical conditions. Traditional approaches based only on scheduled repairs are often insufficient because they do not always reflect the actual condition of structural elements. Modern industrial practice requires transition toward condition-based

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas
OPEN ACCESS JOURNALS

Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

maintenance, where repair decisions are made according to real technical indicators [6].

The effectiveness of corrosion protection depends on the combination of several factors, including appropriate material selection, quality of protective coatings, operating conditions, and regular diagnostic procedures. Therefore, corrosion management should be considered as a continuous process involving monitoring, analysis, prevention, and improvement of operational strategies. The implementation of digital monitoring technologies and automated diagnostic systems provides additional opportunities for improving safety. Such systems allow collecting operational data in real time, identifying abnormal changes, and preventing possible failures[7].

For Uzbekistan's industrial facilities, where many storage tanks have significant operational periods, improving corrosion assessment methods is particularly important. Scientific approaches to evaluating residual life and technical condition can contribute to reducing industrial risks and ensuring sustainable operation of hazardous facilities.

Conclusion

The study demonstrates that corrosion degradation is one of the major factors influencing the reliability and safety of storage tanks operated at hazardous industrial facilities. The analysis of corrosion mechanisms showed that aggressive operating environments, chemical exposure, temperature changes, and insufficient protective measures significantly accelerate metal deterioration.

Effective corrosion management requires a comprehensive approach that includes regular technical diagnostics, non-destructive testing, corrosion monitoring, and preventive protection methods. The application of modern assessment technologies makes it possible to determine the actual condition of storage tanks, estimate residual service life, and prevent potential failures.

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 02, Issue 06, June 2026

https://eurekaoa.com/index.php/9

The research findings confirm that improving corrosion resistance and implementing scientifically based maintenance strategies are essential for ensuring safe operation of industrial storage tanks. These approaches contribute not only to increasing equipment reliability but also to reducing environmental risks and improving overall industrial safety.

References:

1. Fontana M.G. Corrosion Engineering. 3rd Edition. New York: McGraw-Hill, 1986. – 556 p.
2. Revie R.W., Uhlig H.H. Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering. 4th Edition. New Jersey: Wiley-Interscience, 2008. – 512 p.
3. Jones D.A. Principles and Prevention of Corrosion. 2nd Edition. New Jersey: Prentice Hall, 1996. – 572 p.
4. Roberge P.R. Corrosion Engineering: Principles and Practice. New York: McGraw-Hill, 2008. – 754 p.
5. API Standard 653. Tank Inspection, Repair, Alteration, and Reconstruction. American Petroleum Institute, Washington, 2014.
6. ASM Handbook. Corrosion: Fundamentals, Testing, and Protection. Volume 13A. ASM International, 2003.
7. ГОСТ 31385-2016. Резервуары вертикальные цилиндрические стальные для нефти и нефтепродуктов. Москва: Стандартинформ, 2016.
8. ISO 12944. Paints and varnishes — Corrosion protection of steel structures by protective paint systems. International Organization for Standardization.