



National Iranian Oil Refining and Distribution Company  
(NIORDC)



Journal of Farayandno

Review Paper

## An overview of the risks of petroleum concrete storage tanks and their management and maintenance methods

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Received: 4 Apr 2022

Accepted: 6 Aug 2022

### 1. ABSTRACT

Concrete oil tanks are one of the most important storage structures. These reservoirs require management and maintenance during their operation period to deal with various risks. Lack of maintenance management of concrete tanks can lead to life, environmental, economic and social risks. According to the geographical location of Iran, oil extraction, consumption and export, and concrete tanks have become very important, and the need for maintenance management is felt. This research focuses on introducing risks, risk-based management and maintenance methods for petroleum concrete storage tanks. First, the definitions, types of maintenance, risk cycle and research related to reservoir risks are reviewed. The basis for future research and suggestions for research, based on previous studies, can be considered by providing risk-based maintenance management.

**Keywords:** Risk, management and maintenance, concrete tanks, structural information, maintenance operations, risk based on maintenance.

### 2. INTRODUCTION

In recent years in Iran, the use of metal materials in the construction of some special structures has changed to concrete materials. Among these structures are the cooling towers of thermal power plants, whose construction has changed from metal materials with Russian technology to using concrete materials with native technology. The first cooling tower built with this technology is the cooling tower of Shahid Montazeri power plant in Isfahan. Also, concrete materials have been used in the construction of fuel tanks of Iranshahr and Hamedan power plants. One of the important infrastructure and strategic projects in Iran is the construction and operation of fuel storage tanks. The need for the development and progress of these projects in the country as well as other factors such as passive defense increases the potential of using concrete materials technology in the construction of the structures of the mentioned projects. The experiences of countries such as Norway, China and Vietnam in the construction of concrete fuel tanks are of interest [1].

### 3. MATERIALS AND METHODS

Risk management is one of the management policy tools in every organization, which is created by using the review and evaluation of the risks in the system and with the aim of preventing the occurrence of unfavorable conditions or reducing the effects of risk factors or in other words reducing the risk is used. This tool has been widely used in investments, project management, etc. The process of using this technique in security systems includes determining risk, determining factors causing risk, examining and evaluating risk, and taking action to control existing risks [2]. The risk management cycle is presented in Figure (1). Also, Figure (2) shows the maintenance management cycle of concrete petroleum tanks. In addition, Figure (3) presents the classification of maintenance methods for concrete petroleum tanks. A comparison between important maintenance methods is also presented in Table (1).

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Please Cite This Article Using:

Sadiri, H., Behruyan, M., Ghasemi, A., "An overview of the risks of petroleum concrete storage tanks and their management and maintenance methods", *Journal of Farayandno – Vol. 17 – No. 78, pp. 71-94, In Persian, (2022).*

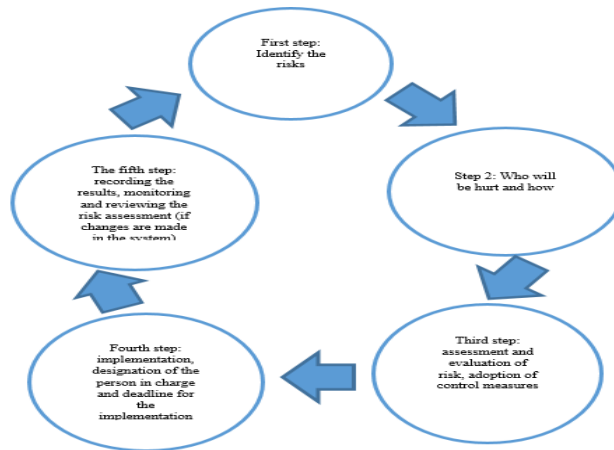


Figure 1. Risk management cycle [3]

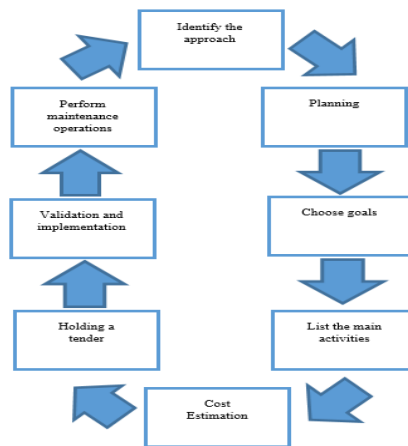


Figure 2. Maintenance management cycle of petroleum concrete tanks [3]

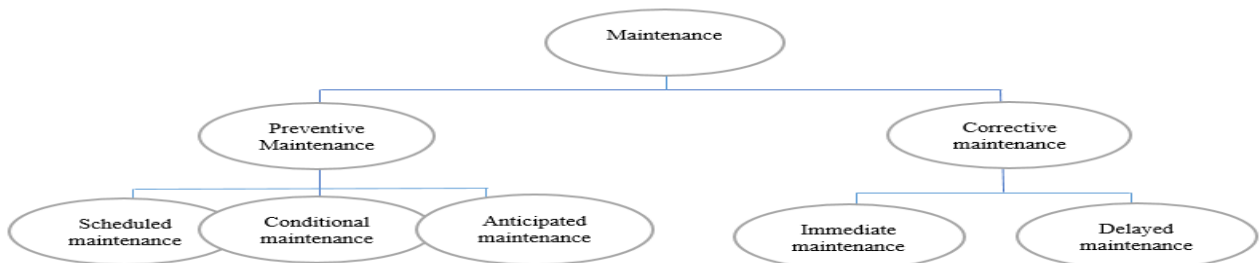


Figure 3. Classification of maintenance methods for concrete petroleum tanks [3]

Table 1. A comparison between important maintenance methods [3]

Disadvantages	Advantages	Establishment fee	Summary	Strategy
The possibility of uncontrollable repair costs	Ideal for low priority equipment	Low	Maintenance during failure	reactive
Waste of costs and resources if not optimized	The best strategy for deployment in organizations with medium expertise	medium	Maintenance based on a predetermined schedule	preventively
It requires a lot of money to set up	Timing and conscious control, more awareness of the causes of failure	Much	Agenda control based on equipment conditions or the occurrence of a predetermined trigger	prophetic
It requires a lot of time, skill and financial resources to be effective	Realizing the maximum efficiency of the maintenance program if the strategy is implemented correctly	Very much	Possible failures to determine the best strategy to hold	Reliability based



#### 4. RESULTS AND DISCUSSION

In the review of previous works, it was observed that the lack of information and research about the risks related to petroleum concrete tanks are among the challenges and limitations that have made it difficult to investigate in the research. On the other hand, the lack of research based on which risk management and maintenance can be carried out with regard to all effective structural factors and elements related to the tank to create a space to reduce the risk in petroleum concrete tanks and the related risk has led to further limitations in research. Also, another challenge is the lack of standards and detailed guidelines for visiting and maintaining concrete oil tanks. Deficiencies in inspection and maintenance methods and leading to breakdowns and related risks are observed in previous researches. The above cases have not been solved in previous researches and there is a need to use a method based on risk and maintenance management in order to solve them in future researches.

#### 5. CONCLUSION

In this research, the types of maintenance management methods as well as the risk of petroleum concrete storage tanks were investigated. The results showed that concrete has a higher compressive strength than steel, high resistance to fire and no need for expensive materials, and heavy maintenance against corrosion compared to steel is one of the advantages of concrete oil tanks. The most important risk factor in tanks is the corrosion of the bottom of the oil storage tank due to the reaction of petroleum materials inside the concrete tank, which in all cases corrosion methods such as: using the prediction of corrosion of the tank bottom using the gray model. Using acoustic emission test, using non-destructive testing and acoustic emission, using 3D laser scanner, using lean maintenance management model using tank structure information modeling is very important. Considering that today structural information modeling is used as one of the new tools in the design and construction of structures, the digital display of the physical and functional characters of the structure can facilitate the sharing of structural project knowledge among stakeholders. Therefore, considering that such an approach has rarely been considered in previous researches, a risk-based maintenance management model of petroleum concrete storage tanks can be investigated and introduced for future research related to risk management and maintenance of petroleum concrete storage tanks. Costs related to initial construction and based on loss of strength and structural specifications can indicate the need for maintenance. The design and construction is more suitable when using the building information modeling method and taking help from it, the structure can somehow maintain its resistance characteristics for a longer period of time. By having the information of the structure through this method, the structure will have better construction quality and require longer maintenance.

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