International Journal of Advanced Biotechnology and Research (IJBR)
ISSN 0976-2612, Online ISSN 2278–599X,
Vol-8, Issue-2, 2017, pp466-471
http://www.bipublication.com

Research Article

Retracted: Technical Inspection Engineering, risk-based technical inspection and technical protection in oil industry

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ABSTRACT

The main product risk assessment, risk management program in which the specified equipment. The program, contain parts or equipment that they risk in terms of safety / health / environmental or economic terms to it. Also in this recipe inspection program is provided to reduce risk, together with the resulting risk, after the exercise of this instruction. The result is that minimum risk-based inspection techniques can provide very useful information about the current risk equipment. If the instructions provided in the risk-based inspection program are well run, we could also reduce the risk of equipment. The application of risk assessment, the risk of equipment at an acceptable level or less, it is also indicated. This type of equipment requires less attention and can increase the time interval between inspections them. This is in addition to reduce inspection costs, inspection activities will be focused on high-risk equipment; surely focus on lower volumes of equipment will also increase the accuracy of the inspection. The use of risk-based inspection, inspection of equipment provides a means for continuous improvement program and they will be followed to reduce systemic risk. Risk Based Inspection results can be used as a tool for planning the organization's annual, so that it is using resources and budget needed for the equipment to operate at acceptable levels of risk and efficiency can be demonstrated. Given the benefits of Risk Based Inspection, most recently in Iran, more attention has been attracted executives and technical inspection. Implementation of Risk Based Inspection in Iran's oil industry is faced with problems of its own. In this article we explain the necessity of implementing risk-based inspection, to examine problems in the implementation of this method and provide appropriate solutions will be discussed.

Key words: risk based inspection; risk management; failure mechanisms, performance inspection method

INTRODUCTION

Inspection programs to detect and evaluate defects in the equipment being serviced, designed and executed. The whole range of inspection programs from the perspective of their effectiveness there. One side of the spectrum are reactive programs in which the inspection is focused on sensitive areas. On the other side are programs in which the inspection and repair equipment only when they are subjected to failure. In the mid-range of the spectrum are also programs that all equipment using several methods, according to a schedule limited (usually thickness or radiographic method is UT) is inspected [1]. The most comprehensive inspection program is designed primarily as codified standards of damage that may occur during maintenance, design. Implementation of such inspection programs is very expensive and their effectiveness is low compared to the cost of inspection. Risk Based Inspection has the potential to reduce the costs of inspection. For this purpose, Risk Based Inspection system provides for priority inspections until the inspection is optimally focused on devices that have a higher risk [1,2].The more devices that are considered

higher risk and are checked more often, while areas with less risk inspection are such that fits their risk.

Risk Based Inspection concepts

The Risk Based Inspection As the name implies all inspection programs, are designed and implemented based on risk. The risk that we are dealing with here, the risk of an accident occurring. These risks can be various aspects such as safety, health, the environment and the disruption of operations involve. According to API RP581 incident is any incident that led to the loss of boundary layer pressure. Various scenarios can be considered an accident to happen. Standard API RP581 to simplify the process of calculating the risk, creates a hole in the body of the equipment is considered as a scenario. To take calculated risks related to the creation of four scenarios, each of which is a different whole diameter, is used. Risk is comprised of two components:

- Likelihood of Failure
- Consequence of Failure

To illustrate the risk of a matrix called risk matrix, the horizontal axis represents the consequences of failure and the vertical axis represents the probability of failure is used. An example of risk matrix is shown in Figure 1. Consequences of an accident can be studied from four aspects:

• Fire
• Poisoning
• Environment
• Interruption of operations

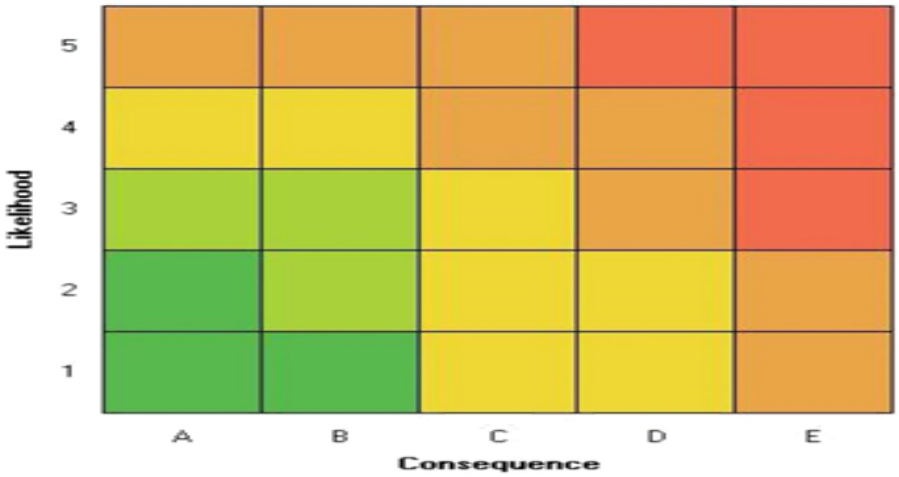

Figure.1. Risk Matrix

In the case of fire and poisoning, the consequences of occurrence of an accident is the decisive indicator of the area is affected by fire or toxic substances, While on the Environment and the suspension of operations, the index will determine the cost of the factory imposed by the incident. Calculate the probability of failure is the most important and complicated stage risk assessment. In order to calculate the probability of failure general frequency data of failure equipment is used. General failure frequency data for each of the types of equipment can be calculated by statistical calculations of the records failure of plant, equipment or records of a company's failure to equip all factories produced an industry.General frequency of equipment failure in the refinery and petrochemical units come in standard API RP581. This frequency is changed by two factors: the failure to obtain the actual frequency. These factors include: [1]

Management Modification Factor (F_M): Which corresponds to the plant management system?

Equipment Modification Factor (F_E): This is affiliated with any of the equipment and working conditions, including the following invoice:

- Technical Module Sub factor
- Universal Sub factor
- Mechanical Sub factor
- Process Sub factor

The most important factor, the factor of technical modules that enable degradation mechanisms related to the status and efficiency of the inspection program through this mechanism can be used to detect defects arisen. This factor is important since this factor determines the relationship between inspection and risk. Whatever the effectiveness of the program is further inspection, the amount of the invoice less and thus the probability of failure will be lower, And the probability of failure on a device is less, the risk is less. Read more on the mechanisms of degradation in the performance of the inspection program will be discussed. All the things are that had to be addressed first stage of Risk Based Inspection (that is, risk assessment). In the next step should be based on calculated risks, inspection programs to be designed. For this purpose, all the equipment is sorted based on their risk for any of the equipment according to the type of active degradation mechanisms, effective inspection method is proposed. The remarkable thing is that Risk Based Inspection is a continuous and dynamic process, so that after the inspection and to obtain new data, Risk Based Inspection database should be updated and re-evaluated the risk of equipment, the new risk-based inspection program to be modified.

METHODOLOGY

Degradation mechanisms

One of the most important factors affecting the probability of failure is technical factor modules. Technical modules that are systematic methods to estimate the impact of degradation mechanisms are used on the likelihood of disability. [1]Technical modules evaluated in two categories of information:

- The speed of deterioration (degradation) of the unit, through its operating conditions.
- Inspection program in the diagnosis and monitoring the effectiveness of active degradation mechanisms to device failure.

Inspection methods for diagnostics and monitoring a failure mechanisms may be quite a ways for another mechanism used is different, so for each individual mechanisms destroyed one of technical-module calculated and at the end of the calculated total will be equal to the sum of all modules.

Types of degradation mechanisms have been studied in detail in the standard API RP571. Using information such as operating conditions (temperature, pressure, fluid within it) as well as the type of material to determine the degradation mechanisms can be activated. [3] Records failure of the device or devices that are in a similar situation can be very useful for determining degradation mechanisms available to researches.Each of the above mechanism could lead to the destruction of one or more types. Overall, eight of the damage that may arise include [1, 3].

- Reduced thickness (including the thickness reduction of public, local and pitting)
- Surface cracks
- Subsurface cracks or deep
- The formation of small pits or Micro fissuring
- Metallurgical changes
- Dimensional changes.
- Blisters (air sign)
- Change the properties of the alloy

After determining the active mechanisms of destruction, should also slow the progression of destruction caused by any mechanism known to be the best. This information resource for corrosion monitoring and inspection records or records the device is working devices in a similar situation. In the event of unavailability of this information can simulate the process in the laboratory, information on the speed of progress achieved destruction. Data released by statistical analysis or laboratory accreditation bodies that have been set can also be used to determine the speed of progress of destruction.

The efficiency of inspection procedures employed to identify the type of destruction is determined qualitatively. For this purpose, the efficiency of inspection procedures classified as follows: [1]

- Highly Effective
- Usually Effective
- Fairly Effective

- Poorly Effective
- Ineffective

Determine the efficacy of each inspection procedure for a specific type of demolition requires professional judgment and opinions of the experts. Standard API RP581 is presented in the tables where specific examples of classification of the effectiveness of inspection to detect any damage are given.In addition to the efficiency of inspection methods, inspection intervals ranged impact also on the probability of failure.Of course, the interval between inspections is less, will be less likelihood of unforeseen failures [8].According to the above (speeds up the progression of destruction, the effectiveness of inspection methods and intervals between inspections)API RP581 standard mechanisms can be activated for each technical module to calculate the degradation factor.Calculated are from the sum of all technical modules achieved total technical module that is used to determine the probability of failure.

Inspection program design

The inspection program is designed to determine the inspection to detect defects in the equipment is in service before it fails. For program design inspection should know that [5]:

• Seeks to identify what types of damage (defect) to be?
• In what areas we are looking defects?
• Inspection for detecting defects of the techniques we use?
• At what intervals to inspect equipment to detect defects?

Revealing the active mechanisms of degradation can demolish (defects) caused by each also be specified. Depending on the machine may malfunction is occurring locally or public. Effective inspection techniques for detecting damage are determined according to the types of damage. There are no inspection techniques that have the ability to detect all kinds of defects. Considering the type of deficiencies that may arise, a combination of several techniques used to inspect. The intervals between inspections is determined according to four factors: [1]

• Mechanisms to enable the destruction and damage caused by them.
• Ground speed degradation
• Tolerance (tolerance) device against damage
• Probability of identifying damage (defects) and predict its future techniques inspection.

Due to these factors the remaining life of the device can be determined according to the following equation. The interval between inspections with respect to the remaining life of the device and is considered equivalent to a fraction of that.

$$\text{Remaining Life (years)} = \frac{\textit{Damage Tolerance (units)}}{\textit{Damage Rate (units/yr)}}$$

RESULTS

The results and benefits of Risk Based Inspection

Implementation of Risk Based Inspection industry experience in other countries has shown that for every dollar capital investment to establish risk-based inspection, return on investment can be 8 to $ 20. [4, 6].The return on investment thus reducing the number of employees, savings in cost and time and improve the inspection. Implementation of Risk Based Inspection makes the most of resources and funding for equipment maintenance and repair on 10 to 20% 80 to 90% of disability equipment that focuses on takes place. [7] In addition to the economic importance of the implementation of Risk Based Inspection, the following benefits can also outlined [1,2].

• Improve safety and reduce risk
• Improved planning for inspection and repair and maintenance
• Focus on ways and means of inspection
• Using new technologies and methods On-Line
• Impairments work less and avoid sudden failures
• Increase the interval between overhaul
• Reduce the time it takes to overhaul

Risk Based Inspection methodology to determine the optimal combination provides methods and

frequency of inspections. Any existing inspection methods can be analyzed and their relative effectiveness in reducing the probability of failure to be estimated. As previously mentioned, despite this information, and given the cost of each inspection method can be optimized to design an inspection program.

Technical inspection in Iran's oil industry and the application of risk-based inspection

Technical inspection, due to equipment failure history as well as their experiences and colleagues in other departments' equipment that has identified more fail more precisely they are and inspection. Although it makes the program more efficient inspection, but compared to the Risk Based Inspection of the great weaknesses that some of them are mentioned below:

- As mentioned in these emphases considered only the possibility of failure and the consequences of failure risk than other components of attention.
- The Risk Based Inspection according to the specification of the active mechanisms of destruction and damage caused by them, Inspection program according to its efficiency in detecting this type of destruction, designed, while in the above inspection system often increasing the accuracy of inspections and review of techniques used there.
- At Risk Based Inspection Equipment that is too inspections are identified and appropriate inspection program with their risk is for them, But the system is carefully inspected only organizations with high failure frequency increases and changes in the inspection program does not occur other devices.
- The system does not change while the intervals between inspections for Risk Based Inspection due to risk of unit intervals, the effectiveness of the inspection techniques used and determined.

Deployment of risk-based inspection system in Iran's oil industry

Because of a phenomenon in its infancy and Risk Based Inspection refinery and petrochemical units do not have much experience in this field, the establishment of these units with their own problems facing the system. First and foremost problem in establishing risk-based inspection system, the lack of a comprehensive database in refining and petrochemical units is required to access the information. A lot of information for risk analysis, including design, operation, process, inspection records, maintenance records and maintenance is required. Due to the lack of a comprehensive database, the required information should be collected from various sources that in some cases the information was incomplete and it is not possible to access part of the information. This information is usually collected from more than 70% of the time allocated to the project. The next problem is the complete lack of inspectors and Risk Based Inspection System is especially managers. This means that in some cases, industrial managers do not understand the necessity of implementing the system or in other cases too many expectations, Risk Based Inspection have ultra wide band.

Guidelines for the establishment of risk-based inspection system in Iran's oil industry

Develop a comprehensive database of existing equipment in these units can take effective measures to solve this problem. The database should contain all information relating to any of the equipment. The above information contains design conditions, operating conditions, process information, technical inspection records, and maintenance. Focus All information in this database, in addition to risk-based inspection system can also be used in other systems and projects, and helpful. Risk Based Inspection workshops for staff and operational managers a significant impact on their familiarity with the system and understand the necessity of using it. The workshops could be referred to the results of this system in other countries more and more managers are encouraged to implement these systems.

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