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Research Article

Retracted: Technical Inspection Engineering, The study of Risk Based Inspection in process industries

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ABSTRACT

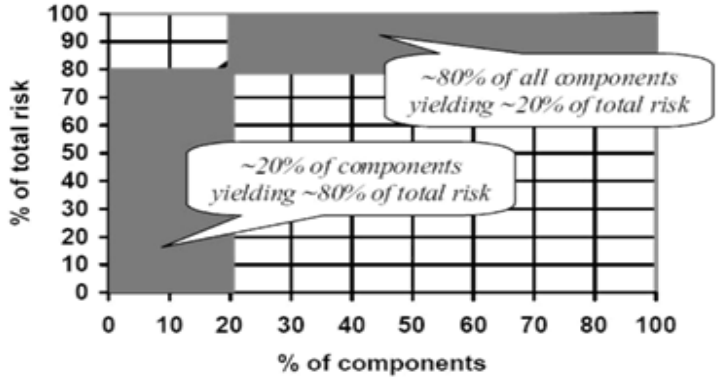
Technology Risk Based Inspection (RBI, Risk Based Inspection) gives companies the ability to a range of key factors, such as taking into account the level of reliability of the equipment as well as safety, environmental, and financial issues in the processes of decision consider your decision. For this purpose, various organizations, American and European projects to develop guidelines for the definition and implementation of RBI guidelines have been prepared, including API Risk-Based Inspection Base Resource Document (BRD), ASME documents related to the RBI, and European project Risk Based) RIMAP. (Inspection and Maintenance procedures for European Industry (2000) in this article, the guidelines contained in the field (RBLM-Risk Based Life Management) RBI / RBLM, especially common guidelines in the United States and Europe together will be compared and the differences and similarities of the above instructions will be defined. at the end of the field and the needs of industry and their relationship with the RBI / RBLM as well as conventional solutions and results, will be mentioned.

Keywords: Risk Based Inspection (RBI), Risk Based Life Management (RBLM), Based Inspection Base Resource Document (BRD), API , ASME,

INTRODUCTION

The increased attention to the issue of risk and risk-based approaches in the field of inspection, maintenance and management in the process industries, oil and gas and power generation industries have evolved around the world, including Iran. Understand and manage risk has become in a matter of economic, social and environmental issues. Actually understand the risk and manage it more important than it has been reduced or eliminated. Unlike previous wrong attitude toward luxury industry executives and the futility of these activities, increasing interest to invest in risk management and its related activities, is remarkable in the hope of achieving greater profitability. Given the risks to the daily activities overhauled a process that is obtained simply.To achieve its current status during the different phases the first and indeed the "natural" way to maintenance, was "corrective maintenance". This method is based on the principle of "ever broke, fix it now" steadfastness. The old way of maintenance, this is currently used for critical components and insensitive. Only when a piece is broken or damaged it considers. This method, especially for sensitive parts, the concept of maintenance planned / scheduled (scheduled / planned maintenance) were replaced where it was assumed that all issues related to the design and maintenance of critical parts (such as pressure parts or aircraft engine components) can be predicted in advance. As a result, they meet the target level of safety. In addition, it was assumed that the predictable nature and amount of equipment (e.g. with regard

to the inspection history of the piece) and the second piece is fixed with no failure mechanisms require no further inspection. However, this method was faced with a problem, because the predicted occurrences lead to disability pieces, the piece was considered only operating conditions. To accurately predict equipment failure and accurate calculation of risk equipment, it is essential that the operating conditions of industrial units and even neighbors and possible changes in the conditions to be considered at the same time. The solution proposed new concepts such as condition-based maintenance (condition-based maintenance), reliability centered maintenance (RCM) (reliability-centered maintenance) Risk Based Inspection RBI, life management based on risk (risk-based life management) (RBLM), and others. [1]This risk-based technique, the necessity of moving away from traditional methods based on time and customizable strategies and risk associated equipment is in accordance with the conditions. As a result, safety, industrial units and improved confidence levels and economic issues with regard to inspections to focus on critical components, are also optimizing the resources used. Two risks must be evaluated individually, probability and consequence of failure for nature. To calculate probabilities, exact knowledge of the details of the degradation mechanisms that can affect any part of the equipment is required. Outcome evaluation requires a thorough understanding of the modes of failure (failure modes) and the consequences of them. As mentioned above, the purpose of risk-based inspection is focusing on critical components. The purpose of the piece "crisis" is a piece that is at greatest risk. In practical terms, this definition means that if a piece severe consequences of an accident, but the probability of such an event is very small, is not necessarily critical piece. The majority of units in the industry for more than 80% of the total risk related to only 20% of the same components (Fig.1) practical means of focusing resources on only 10 to 20% alcohol, the greater the risk will be eliminated unit. Thus, not only the number of points will be operational breakdowns and shutdowns, the resources used will also greatly save.



[2]

Fig.1. Risk of equipment, the risk of a plant [2]

Codes and standards RBI

The core of the activities undertaken to develop standardized guidelines for the implementation of Risk Based Inspection in Europe and the United States, follow the instructions is provided by the America Petroleum Institute (API). Project Risk Based Inspection API and with the support of the oil industry began in 1993 and resulted in the following two documents:

API 580 Based Inspections

API 581 Risk-Based Inspection Base Resource Document

Activities to complete the preparation of this document or new instructions RBI in Europe and America began as a result of codes and standards referenced in Table 1. A few years ago a project in collaboration with several European companies in various industries as RBI RIMAP Instructions for the preparation of petrochemicals, petroleum, power generation, steel and chemical started went on to explain that they'll pay. This paper first

introduces and compares the Risk Based Inspection instructions provided in the United States (ASME, API), we will. Then, the codes will be introduced in Europe. Finally, a comparison of the strengths and weaknesses of each of these codes and each will be provided.

METHODOLOGY

Compare Risk Based Inspection API و ASME

The document API 580/581 Risk Based Inspection guidelines provide a framework where risk-based, will be discussed prioritized and management of inspection programs. The documents aim of Risk Based Inspection, achieve three objectives are:

The definition and measurement of risk;

a) Giving to the management review of the risks to safety, environmental and financial risks in an integrated and cost-effective manner;
b) Giving to the management review of the risks to safety, environmental and financial risks in an integrated and cost-effective manner; providing systematic way to reduce the likelihood of disability with Optimize the use and efficiency of inspection resources. API581 can be used at different levels.API 581 was originally focused on systems and equipment under pressure. But it can be expanded to other equipment, including equipment and control systems, electricity distribution and vital installations, including lead.This document exclusively on the implementation of the RBI is focused on the chemical process industries and hydrocarbons.

America Society of Mechanical Engineers (ASME) also attempted to provide guidelines for the implementation of the RBI that fossil fuel power plants with light-water nuclear reactors also covers (table.1)In terms of philosophy RBI, there is no difference between the methods of API and ASME; however the final documents are completely different. This difference is due to the different goals of these two projects. ASME projects on a risk-based approach are to provide guidelines for expanded inspection. API project on providing practical tools and guidelines which are understandable in the inspection focused on the project. ASME is based on the same methods in the API documentation, but whenever possible has been greatly simplified. The aim of API BRD 581 is understandability and usefulness of every single employee in the industry. Tools, applications and simple model is required for full access to the benefits of RBI.Even using simplified models of large volumes of data need to be collected and analyzed from a refinery or chemical plant. Since the project ASME is a research project, is aimed at achieving high levels of technical developments. As a result, the technology of ASME documents only for the teams and high-level professionals is understandable. Documents of ASME standards are high for future progress RBI under way. [3-5]

Compare API and ASME Quality Risk Based Inspection

The API BRD, qualitative method is a screening tool for use in the operating unit. This feature allows the user to quickly focus on areas with the greatest risk. The results are shown in the matrix 5 × 5 probability and consequence. This method can be extended to component level equipment but the project known as Phase 2 is being developed API BRD instructions. ASME qualitative risk assessment methods in case of need, be extended to component level equipment. In the ASME, the term "quality" means "judgment", meaning based on expert opinion. Similar API, qualitative analysis results are displayed on a 5 × 5 matrix.

Compare Risk Based Inspection quantity of API and ASME (Probability of failure)

API BRD of classified data set of a (generic) related to equipment failure frequencies common in the process industries, to determine the basic failure rate (incidents per year) use. The advantage of this method is a starting point for implementing RBI fault, but it is not connected to the data with some industries. The frequency approach to the reality of disability equipment, the coefficient of variation to the basic disability rates apply as follows: Factor Change Equipment (Equipment Modification Factor) FE and evaluating systems (System .Evaluation factor) FM factors changing the equipment FM, details of each component of the equipment and the environment in which the equipment is under operation recounts. Factor

Assessment, FE, facility management systems are impact on mechanical and safety equipment in any industrial unit's perfect states. The correction factors differences between parts of a picture of the plant. ASME method is from recording information and data available to power the industry. This action, if the availability of such data, simplifies the work will be immense. ASME also uses risk assessment methods and reliability of structures SRRA, (Structural Reliability and Risk Assessment) uses are evaluated where fatigue crack growth through the elastic-plastic fracture mechanics. The use of such a technique because of the availability of crack growth models, probability of detection, and assess the likelihood of degradation on the level of trust structures (probability of failure) is possible. However, ASME way to run in the absence of such models and data not provided. [4, 5]

The consequences of failure

In the API BRD consequences of failure of equipment, including the four categories: the flammable and explosive, toxic, environmental, and loss (outcome) tax. Based on the model calculations carried out for the release of the contents. The final results in the form of one or more of the following units displayed.

A. Financial losses (dollars per year)
B. Equipment damage (in square feet)
C. Effects on health (in square feet)
D. Environmental impacts (dollars per year)

ASME method of different techniques used to measure outcomes. In plants with light-water reactor, resulting in core damage probability expressed in any event. For fossil fuel power plants, industrial and outcomes data directly for the cost of electric power purchased for temporary is expressed replacement, because of the power failure. The tree events (Event Tree) is used to determine the consequences of failure fossil fuel power plants is a very complicated technique. The final results of analysis by ASME in the form of one or more of the units shown below:

A. Perhaps in damage to the core.
B. Economic losses (dollars per year).
C. Casualty (destroyed boilers).

RESULTS

Research ASME, key areas required to produce risk-based inspection instructions, but the instructions provided has been developed. API BRD projects relying on the efforts of ASME, practical and relatively simple tools for real advantage of the benefits of Risk Based Inspection, it is also reasonable to spend time and effort, provided that, contrary to ASME, understanding it is easier for the public.

Introducing European Project

RIMAP project with the support of more than 50 European companies, which Europe is an unprecedented industrial cooperation, with the aim of providing methods, tools, codes and standards related to risk-based inspection and maintenance, has started from March 2001. Technically, the industries covered by the project into four categories petrochemical industry, power industry, steel industry and the chemical industry are divided. "Risk" is the RIMAP combination of impact and probability of failure. Consequences of safety, health, environmental and economic RIMAP considered at the instructions in the techniques.

RIMAP consists of five steps:

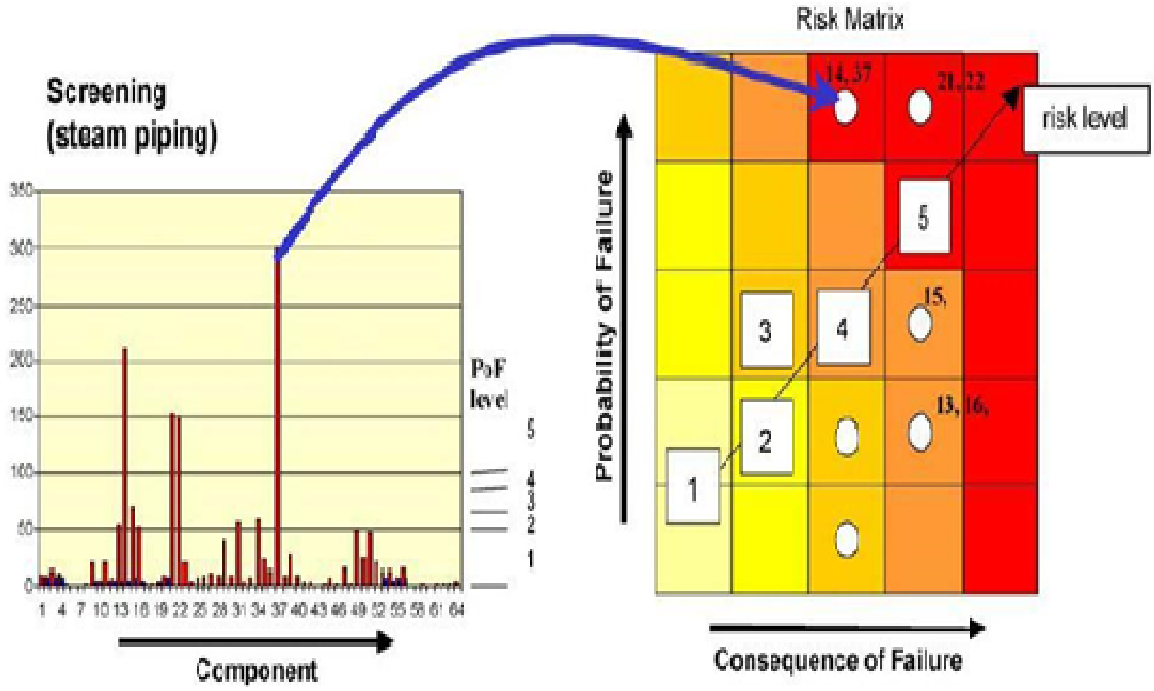
RIMAP consists of five main technical points is:

1. Preliminary analysis
2. Collection and verification of data
3. Risk analysis at different levels
4. Decision-making and optimization
5. Implementation

In addition to these steps, risk analysis at different levels of accuracy and depth of analysis required is actually as well as qualitative analysis, quantitative and semi-quantitative in its API BRD. These levels are:A. Screening (low-level analysis), B. Mid-level analysis, C. Detailed analysis.

Measuring POF (probability of failure) in a pilot study (screening level, a bit) according to the progress of fatigue cracks (Fatigue) and Creep (Creep) is. After the classes POF (level 1 to 5 form (3 classes related to the consequences of failure, due to leakage combined with the cost of repair / disinvestment, are defined.

According to POF and COF values were calculated, on a matrix of parts and equipment risk (Figure.3) displayed and they determined critical. according to the RIMAP, for critical parts to a more detailed analysis, considering all the problems / possible outcomes of the case. for this purpose also have developed software (software (RIMAP / MPA that analysis. Among the more is detailed "analysis" and "detailed analysis" done by it. After analysis, the inspection proper, the incidence rate of inspection and timetables may appear.



[6, 7].

Figure.3 Risk Matrix RIMAP after screening equipment [6]

As the text is clear, it is possible the successful implementation of RBI / RBLM not seem like an easy process. Large volumes of data, modeling, software and similar tools, especially for a detailed quantitative analysis are required. On the other hand, technology transfer, personnel training and expert teams, and culture of other problems in the implementation of the RBI within the country. However, in scientific circles due to Risk Based Inspection is on the rise, but there may be problems with the lack of sufficient information, the main reason for not paying enough attention to the issue of industry executives is Risk Based Inspection, with the help of universities and research centers is entirely feasible and available. As a result, according to the proven benefits of implementing risk-based inspection, be sure that the industry respected directors as soon as more and more serious practical steps to implement it. At the end of some of the most important benefits of RBI noted.

- Reduce the frequency of inspections and the implementation of them; shorten the time Overhaul (Overhaul), the optimal interval for time and cost-effective inspection techniques used and inspections.
- Focus inspection activities on the components and more critical equipment that enhances safety and the level of trust units.
- Use risk-based approach to inspection and maintenance creates the necessary transparency in decision-making processes and optimize the respective policy.

Table.1. Codes and standards in the field of Risk Based Inspection

API	API 581 Risk-Based Inspection Resource Document (API, 2000a)
	API 580 Risk-Based Inspection, draft May 2000 (API, 2000b)
	ASME "Risk-Based Inspection Guidelines, Handbook for Fossil Fuel-Fired Power Plants," 1996
	"Risk-Based In-Service Testing—Development of Guidelines, Volume 2: Light Water Reactor Nuclear Power Plant Components," 1996
ASME	"Risk-Based In-Service Testing—Development of Guidelines, Volume 1: General Document," 1996
	"Risk-Based Inspection Development of Guidelines: Volume 2—Part 2, 1996
	"Risk-Based Inspection Development of Guidelines: Volume 3, Fossil Fuel-Fired Electric Power Plants," 1995
	"Risk-Based Inspection Development of Guidelines: Volume 2—Part 1, Light Water Reactor Nuclear Power Plant Components," 1993
EPA	Risk Management Programs for Chemical Accident Release Prevention, 40 CFR Part 68, Proposed Rule, Docket A-91-73
OSHA	OSHA Process Safety Management of Highly Hazardous Chemicals Standard, Title 29, Code of Federal Regulations (CFR) Part 1910.119 (FR 57(36))
RIAMP	Risk Based Inspection and Maintenance Procedures for European Industry (2000)

CONCLUSION

Compare the position of Europe in the field of Risk Based Inspection (RBI) and Risk Based Life Management (RBLM) relative to the position of the United States, is showing the same activities, but more coverage of the subject in the United States. United States documents, especially documents API (such as API579, API580 and (API581, are more practical and more continuous. Standing next European documents such as PED97 / 23 Directive [6] Seveso II can be considered as the result of activities of European organizations, but still more work to complete the system and fill the empty spaces of these documents is required. Due to technical inspection on enamel risks in process industries and power can be reduced in the future, technical failures and financial losses associated with more attention to the requirements of health, safety and the environment.

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