Guidance on cost-benefit analysis for asset integrity: Cost-benefit analysis for repair and rectification of identified inspection anomalies

energy institute

GUIDANCE ON COST-BENEFIT ANALYSIS FOR ASSET INTEGRITY: COST-BENEFIT ANALYSIS FOR REPAIR AND RECTIFICATION OF IDENTIFIED INSPECTION ANOMALIES

First edition

June 2022

Published by
Energy Institute, London
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Registered charity number 1097899

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The EI gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies:

ADNOC
BP Exploration Operating Co Ltd
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Total E&P UK Limited
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Uniper
Valero
Vattenfall
Vitol Energy
Woodside
World Fuel Services

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ISBN 978 1 78725 333 9

Published by the Energy Institute

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FOREWORD

This document has been developed to provide a structured approach and guidance to determine the most cost-effective course of action to carry out repair or other remedial action on asset anomalies which have been identified during inspection. The aim of this document to assist Integrity Management professionals justify their chosen course of remedial action both technically and financially to Asset Management within their organisations.

This guidance has been developed primarily to support offshore oil and gas assets. All examples and case studies are from oil and gas installations; however, this approach is generic and could be used on other asset types. A variety of different practical examples based on real cases is presented to demonstrate the range of applications, from dealing with a single anomaly, multiple anomalies, the use of inspection to increase knowledge of degradation state, and the use of engineering studies, when costing preventative repairs and provision of a remedial framework.

Although it is anticipated that this publication will assist those involved in the integrity management of assets, the information contained in this publication is provided as guidance only. While every reasonable care has been taken to ensure the accuracy of its contents, the EI, and the technical representatives listed in the acknowledgements, cannot accept any responsibility for any action taken, or not taken, on the basis of this information. The EI shall not be liable to any person for any loss or damage which may arise from the use of any of the information contained in any of its publications.

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Suggested revisions are invited and should be submitted to the Technical Department, Energy Institute, 61 New Cavendish Street, London, W1G 7AR.

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Steering Group Chair

ACKNOWLEDGEMENTS

The Energy Institute (EI) wishes to record its appreciation of the work carried out by the following individuals over the project duration.

Steering Group Members:

Sami M Al-Ghamdi	Saudi Aramco
Ismenia Alvarez	Apache
Fran Chalmers	PIM, then Genesis Oil and Gas
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1 INTRODUCTION

A cost-benefit analysis (CBA) is the process used to measure the benefits of taking an action minus the costs associated with that same action (Hayes, *Cost benefit analysis*). CBA requires the user to attempt to quantify their reasoning – revealing which aspects of a problem they have taken into account (The Regulatory Review, *Cost-benefit analysis*).

This document provides guidance for utilising CBA when determining the most cost-effective course of action to repair or rectify previously identified asset integrity inspection anomalies. Appraisal of all present and future costs and benefits is challenging with respect to asset integrity. It can be difficult to frame the economic and business considerations holistically. Challenges often arise when competing work provides short-term benefits in terms of production gains that are easier to predict, rather than averting potential asset integrity-related production losses. One of the greatest difficulties in gaining asset management approval for maintenance, repair and rectification of identified inspection anomalies is the lack of a systematic method for assessing remedial options. Such an approach would help demonstrate the cost-benefit of, for example, early versus late intervention and highlight the true costs associated with delaying rectification of non-urgent integrity issues.

The purpose of this document is to provide such a systematic approach for Integrity Management professionals to assess and justify budgetary requirements for inspection, maintenance, repair and rectification work and effectively communicate recommendations to gain support from Asset Management.

The methodology used is based on a flowchart, which can be used to demonstrate and justify that a robust auditable decision has been made as to the choice of remedial action for a given anomaly or group of anomalies. The flowchart is intended to prompt the consideration of different remedial options and to assist in identifying the various key cost factors associated with these. By using the flowchart, the relevant implications and costings can be identified and addressed in a systematic way, including areas which may sometimes be overlooked, such as costs associated with the decision-making process, impact of inspection and risk of failure prior to repair.

The use of the flowchart to identify viable action scenarios for comparison (including do nothing), and the cost factors associated with each, forms the start of a three-stage process which progressively seeks more detailed costings until a recommended course of action can be identified. This guidance therefore provides an auditable route to identifying all the costed factors which have been taken into account as part of the analysis and decision-making process and the quantified reasoning behind any recommendations. This CBA complies with the decision-making criteria required by the ISO 55001 standard for asset management.

The benefit of implementing this approach should be improved analysis of anomaly-related issues, more open consideration of remedial options and their cost implications, which in turn will result in clearer decision-making and more cost-effective asset management over an asset's lifetime.

The structure of the document is as follows:

Example use cases

The process for carrying out the CBA is illustrated using worked examples for different types of anomalies and equipment. Six case studies are presented in full in the Annexes but are outlined in section 4. These examples are chosen to highlight different potential applications of this guidance document and are outlined at the start of the document to provide examples throughout the document.

Cost-benefit process

The overall process is described in section 5 which outlines the use of the flowchart to support progressively more detailed costings until a recommendation can be made as to a course of action to deal with a specified anomaly.

Flowchart

A flowchart has been developed to provide a framework to enable a systematic CBA of different remediation options following the identification of an anomaly by inspection. The flowchart will:

– provide prompts to identify all possible action scenarios after the identification of an anomaly, and
– provide prompts to gather all costs associated with each scenario.

The structure of the flowchart is outlined in 6.1, with more detailed explanation and guidance on the use of each element in 6.2.

Costings

Section 7 covers a discussion on costings. The identification of costings and benefits are discussed, as well as how to deal with the risk of failure as a cost and how to calculate the present value of future costs. Different approaches to derive overall costs are also reviewed, along with identifying which costs it would be most beneficial to revisit to improve cost estimates.

2 SCOPE

The CBA methodology presented here is not a generalised approach and is specifically designed to identify and cost different repair and rectification options after the identification of one or more anomalies on process equipment. It is based on the assumption that the intention is to return the equipment to a similar level of productivity and risk profile as was present prior to the occurrence of the anomaly. Therefore, no consideration of costing to demonstrate improved productivity or profitability is required. Terms such as 'return on investment' or 'payback period', which provide comparison of changes in profitability over different time periods have therefore not been included. This analysis provides a systematic approach to identify and gather relevant costs and benefits for repairs and provides a method to correct for future changes in the relative value of money over time to support 'now or later' type decisions.