

THE ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

Risk based inspection

Guide to effective use of the RBI process

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ENGINEERING EQUIPMENT AND MATERIALS USERS ASSOCIATION

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- Providing the organisation within which networking, information sharing and collaboration among users on non-competitive technical matters can take place
- Influencing the way written regulations are interpreted and applied in practice
- Promoting and presenting members' views, and encouraging the application of good sound engineering practices
- Developing user guides, specifications, training and competency schemes
- Facilitating members' participation in national and international standards making
- Influencing relevant national and European legislation and regulation.

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Comments are considered by the relevant EEMUA Technical Committees and may be incorporated in future editions of this Publication. New editions are publicised on the EEMUA website.

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Foreword

The British Health and Safety Executive (HSE) is interested in the application of the risk-based inspection (RBI) process across industry. The EEMUA Committee of User Inspectorates (CUI) believes that, whilst the RBI process is seen as an important methodology for identifying and targeting inspection programmes, further guidance on good practice and its application is warranted. The EEMUA CUI therefore set up a Working Group with the objective of producing this document to give general guidance for those interested in applying or developing an RBI approach to inspection. This guidance has been produced predominantly for application on pressure systems and equipment, but it is considered that the guidance is also of use to all those involved in risk-based inspection of other mechanical plant.

The basic premise is that the integrity of industrial plant, or other such asset, can be determined and monitored consistently by using risk-based methodologies.

This EEMUA document has been developed to assist in the interpretation and use of the HSE Report CRR 363/2001 'Best Practice for Risk Based Inspection as a Part of Plant Integrity Management'.

This HSE document incorporates as Appendix B an audit tool that allows users to assess their own RBI system. This is also the tool the HSE will use to assess Users' RBI systems in the workplace.

Mechanical integrity is maintained by operating industrial plant within defined limits and executing process monitoring, fabric maintenance and inspections with suitable techniques, location and frequency. The inspection techniques can be either non-invasive or invasive and may be applied when the plant is in-service or out of service.

The inspection intervals derived from the RBI procedure may be longer or shorter than the calendar-based inspection interval previously prescribed by legislation. In such cases, the results of the RBI study will need to be supported by a comprehensive audit trail to enable a third party to assess the engineering judgement that supports the proposed inspection plan.

There is not an intention here to comment on, or place support with, any of the methods of RBI currently being used within industry. Both qualitative and semi-quantitative assessment are of value when used correctly.

However, in either case:

- The selected process needs to be consistent in its application.
- The selected processes should be transparent and auditable.
- The team competency and the RBI assessment process has to lend itself to the identification of all potential and active degradation mechanisms applicable to each item of plant.
- The resulting inspection plan and interval needs to be such that the residual risk for each of the identified damage mechanisms is within defined acceptable limits.

Inspections need to be both effective in locating defects and capable of identifying the likely damage mechanisms. The end result of the RBI process should be a complete and thorough inspection and process monitoring plan for an asset. The plan should result in:

- Increased reliability, safety and availability
RBI is a proactive tool for identifying critical items of equipment. Better understanding of the probability and consequences of failure will lead to more effective means of control being practised. This will directly reduce the susceptibility to failure; and as a result will directly increase the safety, reliability and availability of the asset.
- Reduced scope of work for shutdown inspection
RBI provides the analysis for lengthening or shortening inspection intervals and / or reducing the maintenance and inspection scope of the less critical items. Additionally, many equipment items may be monitored by in-service methods instead of the traditional out of service methods. This can result in shorter and / or less frequent shutdowns, which has several benefits. It reduces direct costs and allows higher unit availability. It will also eliminate the risks associated with preparing, entering and reinstating items of equipment when the work is not essential. In cases where degradation is found, on-line monitoring can help to scope any remedial work that is necessary before the routine total plant maintenance shutdown.

The RBI process selected must be implemented in accordance with any regulations governing the particular industrial plant or system concerned. A number of standards and guidance documents are available and are listed in the reference section of this document.

An audit trail showing all the decision processes has to be established and maintained.

RBI can be used to manage both SHE (Safety, Health & Environment) and Business risks. These however are independent and the SHE risk and Business risk can never be combined or averaged. They are to be treated and addressed separately.

RBI is a “live” programme of work and consequently it is necessary to include updating of the asset integrity database with the results of inspections, monitoring and process asset changes.

Since RBI reflects the state of the assets at the time the data are collected, it is essential to keep RBI data up to date with asset changes and inspection results. This will progressively remove uncertainties in the assessments and calculations, and establish an effective inspection programme.

This publication has used the format of the HSE audit tool as a basis to produce a practical guide.

Acknowledgement

The assistance of the Health & Safety Executive in the preparation of this Publication is gratefully acknowledged.

1. Assessing the requirements for risk-based inspection

1.1 Is RBI for us?

The advantage of an RBI approach to plant integrity, and evaluation of risk, is the ability to identify and target inspection programmes regarding the condition of the plant.

The focus of the RBI process should be seen as a genuine attempt to mitigate risk and ensure a safe working environment. In any particular application, RBI might reduce inspection costs or increase them. The resulting higher, or lower, inspection cost might raise or lower plant maintenance costs. There is no standard relationship. Any cost savings should be a by-product and not the fundamental reason for implementing the RBI approach. It has to be seen as a method of targeting resources to the critical and unreliable sections of plant, at the equipment item or component level, where the safety, health and environmental (SHE) risks, or the business risks, are not acceptable to the site or the governing regulations.

The RBI assessment process requires the production of an auditable trail that clearly defines the decision making process. The use of RBI will impact on all areas of the plant operation. RBI is not just concentrated on the inspection activities.

The benefits of the RBI approach are that:

- RBI should provide evidence of targeting SHE and business risk.
- RBI should focus people's energy and resource.
- RBI should develop a better understanding of plant deterioration mechanisms.
- RBI should focus inspection into gathering relevant information.
- RBI should give a better control and prevent unexpected equipment outages.
- RBI may replace shutdown inspections with in-service approaches, providing that the inspection effectiveness can be ensured.
- RBI should help utilise available resources (people, equipment, techniques and so forth) to optimise inspections.
- RBI promotes a better understanding of how process and upset conditions affect the degradation of the pressure envelope.
- RBI may save costs by removing unnecessary inspections.
- RBI should help identify and eliminate gaps in the existing integrity management process at a site.
- RBI provides an auditable path for integrity management and inspection plan decisions.

Whichever RBI method is chosen:

- The selected process has to be consistent in its application.
- The selected process has to be transparent and auditable.
- The team competency and the RBI assessment process have to ensure the identification of all potential and active damage mechanisms.
- The resulting inspection plan and interval are such that the risk level for the items of equipment are maintained within acceptable defined limits.
- The inspection methods are effective and capable of detecting and characterising the expected damage.