
Corrosion control engineering life cycle — Risk assessment

*Ingénierie du contrôle de la corrosion au cours du cycle de vie —
Évaluation des risques*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*, Subcommittee SC 1, *Corrosion control engineering life cycle*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Corrosion control engineering life cycle — Risk assessment

1 Scope

This document specifies the general requirements for risk assessment in the life cycle of corrosion control engineering.

This document is applicable to a risk assessment of all types of corrosion control engineering programmes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 23123, *Corrosion control engineering life cycle — General requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

risk assessment

overall process of *risk identification* (3.2), *risk analysis* (3.3) and *risk evaluation* (3.4)

3.2

risk identification

process of finding, recognizing and describing the corrosion risk of all elements in the corrosion control engineering life cycle

3.3

risk analysis

process to understand the nature of the corrosion risk and the degree of damage

Note 1 to entry: Risk analysis is the basis of *risk assessment* (3.1).

3.4

risk evaluation

process of comparing the results of the *risk analysis* (3.3) and summarizing the traceability and supporting documents to determine whether the corrosion risk of all elements in the corrosion control engineering life cycle and/or its magnitude is acceptable or tolerable

3.5

consequence

outcome of an event affecting objectives

Note 1 to entry: A consequence can be certain or uncertain and can have positive or negative direct or indirect effects on objectives.

Note 2 to entry: Consequences can be expressed qualitatively or quantitatively.

Note 3 to entry: Any consequence can escalate through cascading and cumulative effects.

[SOURCE: ISO 31000:2018, 3.6]

4 General principles

4.1 Objectives

The purpose of risk assessment is to:

- a) improve the integration, systematization, mutual coordination and optimization of all elements of the corrosion control engineering life cycle;
- b) create and protect the benefits of human health and safety, cost-effectiveness, long-term operation and environmental protection.

4.2 Principles

For risk assessment to be effective, an organization should, at all levels, conform to the following principals:

- a) risk assessment should be based on ISO 23123 or other risk criteria, and should be performed on all elements of the corrosion control engineering life cycle;
- b) risk assessment is transparent and inclusive;
- c) risk assessment is dynamic, iterative and responsive to change;
- d) risk assessment takes human factors into account;
- e) risk assessment is systematic, structured and timely.

5 Risk assessment procedure

5.1 General

The risk assessment process of a corrosion control engineering life cycle includes the following steps.

- a) Identify the corresponding actual risk of all elements in the corrosion control engineering life cycle.
- b) Research and analyse whether all elements are implemented in accordance with ISO 23123.
- c) Analyse the evaluation result and submit the identified assessment report.

5.2 Risk identification

The risk of all elements of the corrosion control engineering life cycle should be identified collectively and accurately in accordance with the actual situation of the main programme.

5.3 Risk analysis

5.3.1 Objectives

The objectives should be analysed as follows.

- a) Whether the corrosion control engineering is implemented in accordance with the principles given in [Clause 4](#).

- b) Whether the objectives are implemented into the risk analysis of all elements of the corrosion control engineering life cycle, and communicated, and maintained in all aspects of the life cycle. In addition, whether the objectives adapt the corrosion control engineering life cycle and the protected main programme life cycle. The corrosion control engineering life cycle depends on, serves and assists the main programme. In some cases, it is also restricted to the main programme.

5.3.2 Corrosion sources

The corrosion sources should be analysed as follows.

- a) Whether the internal and external corrosion sources are identified comprehensively and accurately.
- b) Whether new corrosion sources generated in the implementation process are identified comprehensively and accurately.
- c) Whether the conditions of the main programme and the influence of the corrosion control engineering body are taken into account.
- d) Whether an established procedure has been identified.
- e) How the corrosion and its sources are monitored and mitigated, which shall be analysed during the lifetime of the assessment.

5.3.3 Design

The design should be analysed as follows.

- a) Whether the design takes into account all elements, links and nodes throughout the entire life cycle of the corrosion control process.
- b) Whether the design takes into account the integration, systematization, mutual coordination and optimization during the entire life cycle of corrosion control engineering.
- c) Whether a green plan has been made.
- d) Whether the design system is constantly improved to meet the requirements of the main programme.
- e) Whether the design documents are subject to the acceptance of established procedures, and whether they are to be documented and archived.

5.3.4 Research and development

The research and development should be analysed as follows.

- a) Whether all elements, links and nodes during the entire life cycle of corrosion control engineering are continuously studied, improved and developed in the implementation process and achieve the optimum benefits of safety, cost-effectiveness, long-term operation and environmental protection.
- b) Whether the entire research and development process is carried out in accordance with established procedures.
- c) Whether new materials and new technologies have been developed when existing materials and technologies fail to meet the corrosion control requirements, so that they can meet the requirements for material selection and technical application.
- d) Whether the data documentation for research and development is built for traceability.

5.3.5 Materials, technology, manufacturing, construction, storage and transportation, installation and commissioning, and repair

Each of these elements should be analysed as follows.

- a) Whether the selected element is corrosion-resistant and can achieve the optimum benefits of safety, cost-effectiveness, long-term operation and environmental protection.
- b) Whether the selected element is based on the relevant inspection standards.
- c) Whether the selected element has corresponding specific performance and supporting implementation cases.
- d) Whether the selected element is coordinated, optimized and supported with other elements.
- e) Whether the selected element has been identified by established procedures, and whether it is to be documented and archived.

5.3.6 Acceptance inspection

The acceptance inspection should be analysed as to whether it has been implemented in accordance with ISO 23123 before operation.

5.3.7 Operation

The operation should be analysed as to whether to increase monitoring during the operation of the corrosion control engineering life cycle on the basis of the acceptance inspection to ensure a real-time forewarning.

5.3.8 Maintenance

The maintenance should be analysed as to whether to carry it out in accordance with the corresponding maintenance manual, and whether to maintain the monitoring equipment in good condition.

5.3.9 Scrap and disposal

The scrap and disposal should be analysed as follows.

- a) Whether scrap and disposal are carried out in accordance with the green plan formulated at the design stage.
- b) Whether the recyclable equipment is recycled.
- c) Whether the social responsibility for the equipment to be scrapped and disposed is clearly defined to prevent environmental pollution.
- d) Whether scrap and disposal are subject to the acceptance of the established procedures, and whether they are to be documented and archived.

5.3.10 Documents and records

The documents and records should be analysed as follows.

- a) Whether the documents and records established for all elements of the corrosion control engineering life cycle are reasonable, scientific and traceable.
- b) Whether the documents and records are audited regularly to ensure the corrosion control information has been completed.

5.3.11 Resource management

The resource management should be analysed as follows.

- a) Whether each element, link and node has relevant requirements for corresponding and appropriate personnel, process tooling, testing equipment, work site and supervision, etc.
- b) Whether the human resources, equipment, materials, technology, methods, environment and other resources have been managed in an overall way to meet the principles given in [Clause 4](#).

5.3.12 Comprehensive assessment

The comprehensive assessment should be analysed as follows.

- a) Whether all elements of the corrosion control engineering life cycle have a comprehensive assessment in accordance with the specified requirements.
- b) Whether to provide assessment reports, which can be used to guide the improvement of the engineering design of the life cycle of corrosion control engineering.

5.4 Risk evaluation

5.4.1 Evaluation principle

In order to achieve the objectives given in [4.1](#), ensure that the risk assessment of the integration, cost-effectiveness, effectiveness and remedial measures of the corrosion control engineering life cycle is conducted in accordance with ISO 23123.

5.4.2 Evaluation method

5.4.2.1 The risk evaluation should be carried out in accordance with the actual situation of the main programme. The corrosion control engineering should be carried out in accordance with ISO 23123.

5.4.2.2 The risk evaluation method should be carried out and analysed as follows.

- a) Whether its implementation has the corresponding basis.
- b) Whether it has traceable and supporting documents.
- c) A spot check and trace should be carried out.
- d) The data quality, completeness, sensitivity and consistency of the conclusion should be checked during the process of risk evaluation.
- e) The conclusion of the risk evaluation should be subject to the acceptance of the corresponding procedures and should be completely transparent.
- f) The assessment records can be carried out item by item in accordance with the risk assessment form provided in [Annex A](#).

5.4.3 Risk assessment report

5.4.3.1 A risk assessment report should be issued.

5.4.3.2 The risk assessment report should provide clear conclusions on whether all elements in the corrosion control engineering life cycle have been implemented in accordance with ISO 23123, and should offer suggestions and new supplements.

5.4.3.3 The risk assessment report should provide clear conclusions and recommendations on whether all elements are optimized and coordinated.

5.4.3.4 The risk assessment report should be identified in accordance with established procedures.

5.4.3.5 The risk assessment should emphasize whether the report involves safety issues. If safety is involved, solutions to the corresponding issues should be established.

5.4.3.6 A duty system for the risk assessment should be established, in order to identify the liability subjects in cases where there are safety-related issues.

5.4.3.7 The risk assessment report should be used as a traceable and supporting document to improve and supplement ISO 23123.

6 Quantitative analysis of risk

This document does not give the quantitative analysis of risk. For information, [Annex B](#) provides a basic principle about a quantitative analysis of risk.

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