



Risk-Based Structural Integrity Management of Offshore Jacket Structures

Guidance Note

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NI 624 DT R00 E**

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Bureau Veritas Marine & Offshore General Conditions

1. INDEPENDENCY OF THE SOCIETY AND APPLICABLE TERMS

1.1 The Society shall remain at all times an independent contractor and neither the Society nor any of its officers, employees, servants, agents or subcontractors shall be or act as an employee, servant or agent of any other party hereto in the performance of the Services.

1.2 The operations of the Society in providing its Services are exclusively conducted by way of random inspections and do not, in any circumstances, involve monitoring or exhaustive verification.

1.3 The Society acts as a services provider. This cannot be construed as an obligation bearing on the Society to obtain a result or as a warranty. The Society is not and may not be considered as an underwriter, broker in Unit's sale or chartering, expert in Unit's valuation, consulting engineer, controller, naval architect, manufacturer, shipbuilder, repair or conversion yard, charterer or shipowner; none of them above listed being relieved of any of their expressed or implied obligations as a result of the interventions of the Society.

1.4 The Services are carried out by the Society according to the applicable Rules and to the Bureau Veritas' Code of Ethics. The Society only is qualified to apply and interpret its Rules.

1.5 The Client acknowledges the latest versions of the Conditions and of the applicable Rules applying to the Services' performance.

1.6 Unless an express written agreement is made between the Parties on the applicable Rules, the applicable Rules shall be the Rules applicable at the time of the Services' performance and contracts' execution.

1.7 The Services' performance is solely based on the Conditions. No other terms shall apply whether express or implied.

2. DEFINITIONS

2.1 "Certificate(s)" means class certificates, attestations and reports following the Society's intervention. The Certificates are an appraisal given by the Society to the Client, at a certain date, following surveys by its surveyors on the level of compliance of the Unit to the Society's Rules or to the documents of reference for the Services provided. They cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

2.2 "Certification" means the activity of certification in application of national and international regulations or standards, in particular by delegation from different governments that can result in the issuance of a certificate.

2.3 "Classification" means the classification of a Unit that can result or not in the issuance of a class certificate with reference to the Rules.

2.4 "Client" means the Party and/or its representative requesting the Services.

2.5 "Conditions" means the terms and conditions set out in the present document.

2.6 "Industry Practice" means International Maritime and/or Off-shore industry practices.

2.7 "Intellectual Property" means all patents, rights to inventions, utility models, copyright and related rights, trade marks, logos, service marks, trade dress, business and domain names, rights in trade dress or design, rights in goodwill or to sue for passing off, unfair competition laws, rights in designs, rights in computer software, database rights, rights in confidential information, rights in confidential information (including know-how and trade secrets), methods and protocols for Services, and any other intellectual property rights, in each case where capable of registration, registered or unregistered and including applications for and renewals, reversions or extensions of such rights and all similar or equivalent rights or forms of protection in any part of the world.

2.8 "Parties" means the Society and Client together.

2.9 "Party" means the Society or the Client.

2.10 "Register" means the register published annually by the Society.

2.11 "Rules" means the Society's classification rules, guidance notes and other documents. The Rules, procedures and instructions of the Society shall into account at the date of their preparation the state of currently available and proven technical minimum requirements but are not standard or a code of construction neither a guide for maintenance, a safety handbook or a guide of professional practices, all of which are assumed to be known in detail and

carefully followed at all times by the Client.

2.12 "Services" means the services set out in clauses 2.2 and 2.3 but also other services related to Classification and Certification such as, but not limited to: ship and company safety management certification, ship and port security certification, training activities, all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board.

2.13 "Society" means the classification society "Bureau Veritas Marine & Offshore SAS", a company organized and existing under the laws of France, registered in Nanterre under the number 821 131 844, or any other legal entity of Bureau Veritas Group as may be specified in the relevant contract, and whose main activities are Classification and Certification of ships or offshore units.

2.14 "Unit" means any ship or vessel or offshore unit or structure of any type or part of it or system whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

3. SCOPE AND PERFORMANCE

3.1 The Society shall perform the Services according to the applicable national and international standards and Industry Practice and always on the assumption that the Client is aware of such standards and Industry Practice.

3.2 Subject to the Services performance and always by reference to the Rules, the Society shall:

- review the construction arrangements of the Unit as shown on the documents provided by the Client;
- conduct the Unit surveys at the place of the Unit construction;
- class the Unit and enters the Unit's class in the Society's Register;
- survey the Unit periodically in service to note that the requirements for the maintenance of class are met. The Client shall inform the Society without delay of any circumstances which may cause any changes on the conducted surveys or Services.

The Society will not:

- declare the acceptance or commissioning of a Unit, nor its construction in conformity with its design, such activities remaining under the exclusive responsibility of the Unit's owner or builder;
- engage in any work relating to the design, construction, production or repair checks, neither in the operation of the Unit or the Unit's trade, neither in any advisory services, and cannot be held liable on those accounts.

4. RESERVATION CLAUSE

4.1 The Client shall always: (i) maintain the Unit in good condition after surveys; (ii) present the Unit after surveys; (iii) present the Unit for surveys; and (iv) inform the Society in due course of any circumstances that may affect the given appraisalment of the Unit or cause to modify the scope of the Services.

4.2 Certificates referring to the Society's Rules are only valid if issued by the Society.

4.3 The Society has entire control over the Certificates issued and may at any time withdraw a Certificate at its entire discretion including, but not limited to, in the following situations: where the Client fails to comply in due time with instructions of the Society or where the Client fails to pay in accordance with clause 6.2 hereunder.

5. ACCESS AND SAFETY

5.1 The Client shall give to the Society all access and information necessary for the efficient performance of the requested Services. The Client shall be the sole responsible for the conditions of presentation of the Unit for tests, trials and surveys and the conditions under which tests and trials are carried out. Any information, drawings, etc. required for the performance of the Services must be made available in due time.

5.2 The Client shall notify the Society of any relevant safety issue and shall take all necessary safety-related measures to ensure a safe work environment for the Society or any of its officers, employees, servants, agents or subcontractors and shall comply with all applicable safety regulations.

6. PAYMENT OF INVOICES

6.1 The provision of the Services by the Society, whether complete or not, involves, for the part carried out, the payment of fees thirty (30) days upon issuance of the invoice.

6.2 Without prejudice to any other rights hereunder, in case of Client's payment default, the Society shall be entitled to charge, in addition to the amount not properly paid, interests equal to twelve (12) months LIBOR plus two (2) per cent as of due date calculated on the number of days such payment is delinquent. The Society shall also have the right to withhold certificates and other documents and/or to suspend or revoke the validity of certificates.

6.3 In case of dispute on the invoice amount, the undisputed portion of the invoice shall be paid and an explanation on the dispute shall accompany payment so that action can be taken to solve the dispute.

7. LIABILITY

7.1 The Society bears no liability for consequential loss. For the purpose of this clause consequential loss shall include, without limitation:

- Indirect or consequential loss;
- Any loss and/or deferral of production, loss of product, loss of use, loss of bargain, loss of revenue, loss of profit or anticipated profit, loss of business and business interruption, in each case whether direct or indirect.

The Client shall save, indemnify, defend and hold harmless the Society from the Client's own consequential loss regardless of cause.

7.2 In any case, the Society's maximum liability towards the Client is limited to one hundred and fifty per-cent (150%) of the price paid by the Client to the Society for the performance of the Services. This limit applies regardless of fault by the Society, including breach of contract, breach of warranty, tort, strict liability, breach of statute.

7.3 All claims shall be presented to the Society in writing within three (3) months of the Services' performance or (if later) the date when the events which are relied on were first discovered by the Client. Any claim not so presented as defined above shall be deemed waived and absolutely time barred.

8. INDEMNITY CLAUSE

8.1 The Client agrees to release, indemnify and hold harmless the Society from and against any and all claims, demands, lawsuits or actions for damages, including legal fees, for harm or loss to persons and/or property tangible, intangible or otherwise which may be brought against the Society, incidental to, arising out of or in connection with the performance of the Services except for those claims caused solely and completely by the negligence of the Society, its officers, employees, servants, agents or subcontractors.

9. TERMINATION

9.1 The Parties shall have the right to terminate the Services (and the relevant contract) for convenience after giving the other Party thirty (30) days' written notice, and without prejudice to clause 6 above.

9.2 In such a case, the class granted to the concerned Unit and the previously issued certificates shall remain valid until the date of effect of the termination notice issued, subject to compliance with clause 4.1 and 6 above.

10. FORCE MAJEURE

10.1 Neither Party shall be responsible for any failure to fulfil any term or provision of the Conditions if and to the extent that fulfilment has been delayed or temporarily prevented by a force majeure occurrence without the fault or negligence of the Party affected and which, by the exercise of reasonable diligence, the said Party is unable to provide against.

10.2 For the purpose of this clause, force majeure shall mean any circumstance not being of a Party's reasonable control including, but not limited to: acts of God, natural disasters, epidemics or pandemics, wars, terrorist attacks, riots, sabotage, impositions of sanctions, embargoes, nuclear, chemical or biological contamination, laws or action taken by a government or public authority, quotas or prohibition, expropriations, destructions of the worksite, explosions, fires, accidents, any labour or trade disputes, strikes or lockouts

11. CONFIDENTIALITY

11.1 The documents and data provided to or prepared by the Society in performing the Services, and the information made available to the Society, are treated as confidential except where the information:

- is already known by the receiving Party from another source and is properly and lawfully in the possession of the receiving Party prior to the date that it is disclosed;
- is already in the possession of the public or has entered the public domain, otherwise than through a breach of this obligation;
- is acquired independently from a third party that has the right to disseminate such information;
- is required to be disclosed under applicable law or by a governmental order, decree, regulation or rule or by a stock exchange authority (provided that the receiving Party shall make all reasonable efforts to give prompt written notice to the disclosing Party prior to such disclosure).

11.2 The Society and the Client shall use the confidential information exclusively within the framework of their activity underlying these Conditions.

11.3 Confidential information shall only be provided to third parties with the prior written consent of the other Party. However, such prior consent shall not be required when the Society provides the confidential information to a subsidiary.

11.4 The Society shall have the right to disclose the confidential information if required to do so under regulations of the International Association of Classifications Societies (IACS) or any statutory obligations.

12. INTELLECTUAL PROPERTY

12.1 Each Party exclusively owns all rights to its Intellectual Property created before or after the commencement date of the Conditions and whether or not associated with any contract between the Parties.

12.2 The Intellectual Property developed for the performance of the Services including, but not limited to drawings, calculations, and reports shall remain exclusive property of the Society.

13. ASSIGNMENT

13.1 The contract resulting from these Conditions cannot be assigned or transferred by any means by a Party to a third party without the prior written consent of the other Party.

13.2 The Society shall however have the right to assign or transfer by any means the said contract to a subsidiary of the Bureau Veritas Group.

14. SEVERABILITY

14.1 Invalidation of one or more provisions does not affect the remaining provisions.

14.2 Definitions herein take precedence over other definitions which may appear in other documents issued by the Society.

14.3 In case of doubt as to the interpretation of the Conditions, the English text shall prevail.

15. GOVERNING LAW AND DISPUTE RESOLUTION

15.1 The Conditions shall be construed and governed by the laws of England and Wales.

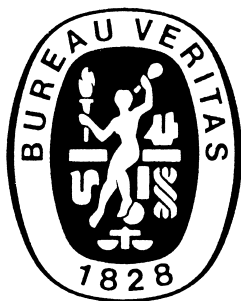
15.2 The Society and the Client shall make every effort to settle any dispute amicably and in good faith by way of negotiation within thirty (30) days from the date of receipt by either one of the Parties of a written notice of such a dispute.

15.3 Failing that, the dispute shall finally be settled by arbitration under the LCIA rules, which rules are deemed to be incorporated by reference into this clause. The number of arbitrators shall be three (3). The place of arbitration shall be London (UK).

16. PROFESSIONAL ETHICS

16.1 Each Party shall conduct all activities in compliance with all laws, statutes, rules, and regulations applicable to such Party including but not limited to: child labour, forced labour, collective bargaining, discrimination, abuse, working hours and minimum wages, anti-bribery, anti-corruption. Each of the Parties warrants that neither it, nor its affiliates, has made or will make, with respect to the matters provided for herein, any offer, payment, gift or authorization of the payment of any money directly or indirectly, to or for the use or benefit of any official or employee of the government, political party, official, or candidate.

16.2 In addition, the Client shall act consistently with the Society's Code of Ethics of Bureau Veritas. <http://www.bureauveritas.com/home/about-us/ethics-and-compliance/>



GUIDANCE NOTE NI 624

Risk-Based Structural Integrity Management of Offshore Jacket Structures

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SECTION 1

GENERAL

1 General

1.1 Context

1.1.1 The API-RP-2SIM has emphasized the value of using risk-based approach to develop effective inspection strategy and program. It provides general guidelines to assign a risk category to a platform and details on the inspection strategy derived from the risk results. It sets out, also, the main factors to consider in assessing platforms' risks when owner/operators decide to adopt specific risk categorization e.g. detail risk assessment techniques or complex risk matrices.

The Society contributed to the joint industry project for the development of the API-RP-2SIM. It has produced risk-based structural integrity methodologies for offshore jacket platforms based on API recommendations. It has, also, developed a fatigue-based probabilistic method to determine inspection frequency of tubular welds with higher likelihoods of fatigue failure.

1.2 Scope of the document

1.2.1 This Guidance Note sets out the main recommendations and requirements of the API-RP-2SIM for implementing a risk-based structural integrity management for offshore jacket platforms. It includes, also, relevant guidance from other international standards and from reference reports and papers.

The Society service offer is also presented. It includes methods which apply, respectively, to a fleet of platforms, a platform unit and the structural components. It implements all types of risk assessment from qualitative to fully quantitative.

1.3 Overview of API guidance

1.3.1 The API-RP-2SIM includes guidance for risk-based approach to structural integrity management of offshore jacket platforms. It provides general guidelines for assigning a risk category to the platforms in terms of the exposure category and the likelihood of failure. The exposure category is defined with respect to life safety exposure and consequence of failure including the environmental and the economic impact. A description of the relevant factors to consider for determining the life safety exposure category and the level of consequence of failure is also given. The standard allows qualitative, semiquantitative, or fully quantitative methods to be used in assessing the level of likelihood of failure. However no detail is given on how to implement those methods. Only general guidelines are defined for the assessment of the likelihood of failure category.

The risk-based inspection strategy is specifically concerned with the routine underwater inspections. However, it requires that a baseline inspection was conducted and it should use the findings from the above-water inspections and the eventual post-event inspections. The API-RP-2SIM gives detailed recommendations for determining inspection strategy from the risk categorization, including risk-based inspection intervals and work scope, survey techniques and deployment methods. Typical ranges of risk-based inspection intervals are provided with respect to the platform risk level along with a description of the inspection scope of work. The associated risk-based inspection program has to be a minimum level II survey, according to the API classification of survey levels, but has to specify if higher survey levels (e.g. level III and IV) are required.

When risk-based approach is not adopted, API provides a default inspection program including pre-defined in-service inspection intervals and survey levels based on the exposure category only.

The recommended practice provides, in addition, general guidelines on risk reduction options when a jacket platform is deemed as no longer fit-for-purpose.

1.4 Overview of the Society's methods

1.4.1 The Society has developed three methods for risk assessment and inspection plan development as part of the risk-based structural integrity management of offshore jacket platforms, namely:

- a high level risk-based SIM method
- a risk-based SIM method for a jacket platform
- and a fatigue-based probabilistic method.

1.4.2 The high level method applies to a fleet of jacket platforms and uses a qualitative risk assessment method. It allows a risk category to be assigned to each platform of a fleet and inspection intervals and general inspection requirements to be developed based on the API guidance and the inspection trends. The risk assessment method serves as a mean to provide relative risk ranking of the platforms in a fleet, in order to identify the platforms most at risk and which require more inspection focus or a detailed risk analysis. It can also serve as a mean to compare given inspection strategies in order to identify the best one with respect to the risk impact or to another specific decision criteria adopted by owner/operators.

1.4.3 The risk-based SIM method for a jacket platform provides a global risk assessment which allows inspection interval and inspection requirements based on API guidance to be defined. It provides also local risk ranking of the platform's structural components, which allows, if required, the local inspections' scope of work to be defined. The global risk assessment allows using of the qualitative

approach of the high level method or structural analysis results (e.g. reserve strength ratio) to develop inspection planning. The local risk ranking uses a semi-quantitative approach based on the results from in-place analysis and fatigue analysis. The method should be applied, following the high level method, on the platforms the most at risk and which require a more detailed risk analysis.

1.4.4 The fatigue-based probabilistic method uses a full probabilistic approach to develop inspection planning for a platform's welded joints subject to fatigue. It requires a fatigue analysis and several ultimate strength analyses to be carried out. The fatigue analysis allows the welded joints with higher likelihood of fatigue failure to be identified. The ultimate strength analyses include a pushover analysis of the structure in its intact condition and pushover analyses of the structure in damage condition assuming a fatigue failure on the identified higher-fatigue welded joints taken separately. Structural reliability methods are used to compute the probabilities. The probabilities of fatigue failure of the selected welded joints and the probabilities of collapse failure of the associated damaged structures are computed. Those probabilities are then combined to derive the probability of collapse failure of the platform. The optimal inspection plan is given by the one that minimizes the expected operational cost, including inspection and maintenance cost and failure cost. This method suits the jacket platforms for which the welded joints that are critical for the structural integrity (e.g. end connections of primary members) are reported to have higher likelihood of fatigue failure.

1.5 Organization of the document

1.5.1 In addition to the current introductory section, this Guidance Note includes two sections. The first one addresses the key elements the risk-based SIM of offshore jacket structures according to the API-RP-2SIM supplemented with relevant guidelines from other international standards and reference reports and papers. The second one presents the Society service provision, including the high level SIM method, the SIM method for one jacket platform and the fatigue-based probabilistic method.

2 References

2.1

2.1.1

a) API-RP-2SIM, Structural Integrity Management of Fixed Offshore Structures, 1st ed., Washington: API Publishing Services, 2014.

b) API-RP-2A-WSD, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms-Working Stress Design, 22nd ed., Washington: API Publishing Services, 2014.

c) API-RP-2A-WSD, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms-Working Stress Design, 21st ed., Washington: API Publishing Services, 2000.

d) API-RP-580, Risk-Based Inspection Technology, 2nd ed., Washington: API Publishing Services, 2009.

e) API-RP-581, Risk-Based Inspection Technology, 2nd ed., Washington: API Publishing Services, 2008.

f) API-581-BRD, Base Ressource Document - Risk-Based Inspection Technology, 2nd ed., Washington: API Publishing Services, 2000.

g) ISO 19902:2007, Petroleum and natural gas industries - Fixed steel offshore structures, ISO, Ed., Geneva: ISO, 2007.

h) ISO 19901-9, Structural integrity management Offshore structures, ISO, under preparation.

i) MSL, "Rationalization and Optimization of Underwater Inspection Planning consistent with API-RP-2A section 14": JIP Final Report, 2000.

j) Atkins, "Development of Guidance on Structural Integrity Management of Fixed Offshore Structures": JIP Final Report, 2011.

k) Nelson A., Technical Performance Measures for North Sea Jacket Structures, HSE Research report, 2003.

l) DeFranco S., O'Connor P., Tallin A., Roy R. and Puskar F., Development of a Risk Based Underwater Inspection (RBUI) Process for Prioritizing Inspections of Larger Numbers of Platforms, OTC 10846, 1999.

m) Turner J. W., Wisch D. J. and Guynes S. J., A Review of Operations and Mitigation Methods for Offshore Platforms, OTC 7486, 1994.

n) Faber, M. H., Risk-based inspection: The framework. Structural engineering international, 12(3), 186-195, 2002.

o) Goyet J., Boutillier V. and Rouhan A., Risk-based Inspection for Offshore Structures, Ships and Offshore Structures, 8 (3-4), 303-318, 2013.

3 Acronyms

3.1

3.1.1

ACFM	: Alternating Current Field Measurement
ACPD	: Alternative Current Potential Drop
API	: American Petroleum Institute
CoF	: Consequence of failure
CP	: Cathodic Protection
CVI	: Close Visual Inspection
ECD	: Eddy Current Detection
ETA	: Event Tree Analysis
FEM	: Finite Element Model
FFP	: Fitness-For-Purpose
FMD	: Flooded Member Detection
FORM	: First Order Reliability Method
FTA	: Fault Tree Analysis
GPS	: Global Positioning System
GVI	: General Visual Inspection
HAZID	: HAZard IDentification
JIP	: Joint Industry Project
LAT	: Lowest Astronomical Tide

LoF : Likelihood of Failure
 MPI : Magnetic Particle Inspection
 NDT : Non Destructive Testing
 PA : Phase Array
 PLL : Potential Loss of Life
 POB : Personnel On Board
 PoD : Probability of Detection
 PoF : Probability of Failure
 QRA : Quantitative Risk Assessment
 RAC : Risk Acceptance Criteria
 RAO : Response Amplitude Operator

RBI : Risk-Based Inspection
 ROC : Receiver Operating Curve
 ROV : Remote Operating Vehicle
 RP : Recommended Practice
 RSR : Reserve Strength Ratio
 RT : Radiographic Technique
 SCF : Stress Concentration Factor
 SIM : Structural Integrity Management
 SMR : Strengthening Modification and Repair
 TOFD : Time of Flight Diffraction.

SECTION 2

RISK-BASED STRUCTURAL INTEGRITY MANAGEMENT OF OFFSHORE JACKET PLATFORMS

1 Introduction

1.1 General

1.1.1 Risk-based SIM uses risk analysis to develop SIM strategy, including inspection strategy and risk reduction measures, with respect to the actual risk level.

1.2 Inspection plan

1.2.1 The overall inspection plan for offshore jacket structures includes the following types of inspections:

- routine above-water inspections to evaluate the condition of the platform topsides and which should be conducted on an annual basis
- a baseline underwater inspection to determine the as-installed condition of the platform
- routine underwater inspections to evaluate the condition of the underwater portion of the platform and appurtenances
- and special or post-event inspections to determine the condition of the platform after events such as extreme metocean event or collision.

Among them, only the routine underwater inspections can be driven by the platform risk level. However, implementing risk-based routine underwater inspections requires that a baseline inspection was conducted and should take into consideration data from the other inspections types e.g. above-water inspections and post-event inspections.

A risk-based routine underwater inspection provides:

- an inspection interval or a next inspection date consistent with the platform risk level
- the inspection coverage
- the inspection techniques to be used
- and the expected residual level of risk after inspection or the mitigation actions.

In particular, inspection coverage can specify the critical structural details from a risk point of view and which have to be inspected or a percentage of structural details to be inspected in order to provide representative condition data on the overall structure.

1.3 Risk reduction

1.3.1 Whenever the estimated risk level for the platform is higher than an acceptable limit, modifications on the platform should be considered to reduce this risk level. Two categories of risk reduction measures can be carried out:

- Exposure mitigation e.g. reduction of hydrocarbon inventory, reduction of the manning level
- Likelihood reduction e.g. deck load reduction, global or local strengthening.

1.4 Benefits of risk-based approach for SIM

1.4.1 Risk-based approaches allow owners/operators to develop inspection strategies which prioritized the structural items the most at risk. This results in:

- an overall reduction in risk
- a cost optimization as the approach aims at providing an effective inspection plan
- an effective data collection as data need not be collected for all the structural items but higher priority should be given to those more at risk. Thus, more effort can be spent on those structural items, which allows more accurate information to be collected
- and an understanding and acceptance of current risk as the approach is based on the assessment of the current condition of the structure under study.

1.5 Issues for jacket offshore structure

1.5.1 The implementation of a risk-based approach for the SIM of jacket offshore structures raises some specific issues, described in the following sections.

1.5.2 Availability of the platform's data

Some useful data (e.g. fabrication and installation data, baseline inspection records or other previous inspection records) may not be available, especially for ageing platforms. This is mostly because those records don't exist or because the operator is not aware of what data he has, where those data are being kept and who is in charge of data management.

There are two main ways to deal with missing data:

- The first and recommended option is to consider survey to collect the necessary information. This option is more expensive but it will provide accurate data on the platform condition and allow for an accurate risk level assessment.

- The second one is to perform the risk analysis using appropriate conservative assumptions where the information is missing. This option is simple but could result in a rough risk assessment.

1.5.3 Accuracy of the risk assessment

Platform collapse failures are rare events. Therefore, there are little data to develop comprehensive collapse failure statistics of jacket platforms like other items such as machinery or equipment.

In an attempt to compute the risk level accurately, model-based quantitative methods are used. However, these methods usually require more data and more computational effort. Moreover, care should be taken in formulating the model of the damage mechanism and in selecting the probabilistic distributions that represent the uncertainties involved. It is usually recommended that a knowledgeable person be involved in implementing such methods.

Most often a relative risk ranking approach is used. It consists in assessing the risk level based on experience with other structures taken as a benchmark. In this case, detailed quantitative assessment is not necessary, but simply assigning scores to the structural items with respect to relevant factors that influence the risk level can be well enough. The scoring process can be carried out in a systematic way with a dedicated mathematic formulation or by gathering experts' opinion through dedicated workshops or meetings. Even if this relative risk ranking does not allow the ideal inspection strategy to be determined, it shows on what structural items the risk management effort should focus: the higher ranked ones.

1.5.4 Relationship between risk level and inspection frequency

There is no objective means to link the results of a relative risk ranking assessment to an inspection plan, especially to an inspection frequency, as the risk values are not absolute. In this case, risk-based inspection strategies rely on:

- standards' requirements or recommendations, which gather the good practices of the dedicated industry
- and experts' opinion, who could provide inspection strategies all the more suitable as their level of expertise is higher.

However, relative ranking can allow different inspection strategies to be compared, by simply measuring their respective risk impacts, in order to find the best one. In this case, the ability of the risk ranking process to properly compare inspection strategies should be validated first.

1.6 Risk-based SIM framework

1.6.1 The overall SIM process consists of four primary elements: DATA, EVALUATION, STRATEGY and PROGRAM (see Fig 1):

- DATA relates to the implementation of a data management system for collecting, compiling and updating the platforms' data.
- EVALUATION aims at assessing the impact that new platforms' data have on the structural integrity and leads to carry out risk categorization and structural analysis for the assessment of fitness-for-purpose and to consider risk reduction actions when the estimated risk level is higher than an acceptable limit.
- STRATEGY relates to the development and the implementation of inspection strategy and possibly risk reduction actions from the results of the evaluation step.
- PROGRAM refers to the execution of the inspection and the possible risk reduction scope of work, including the requirements for the recording and the reporting of the inspection findings.

The SIM process provides the opportunity for owners/operators to adopt risk principles to develop in-service inspection strategy according to the framework depicted in Fig 2.

Figure 1 : SIM process

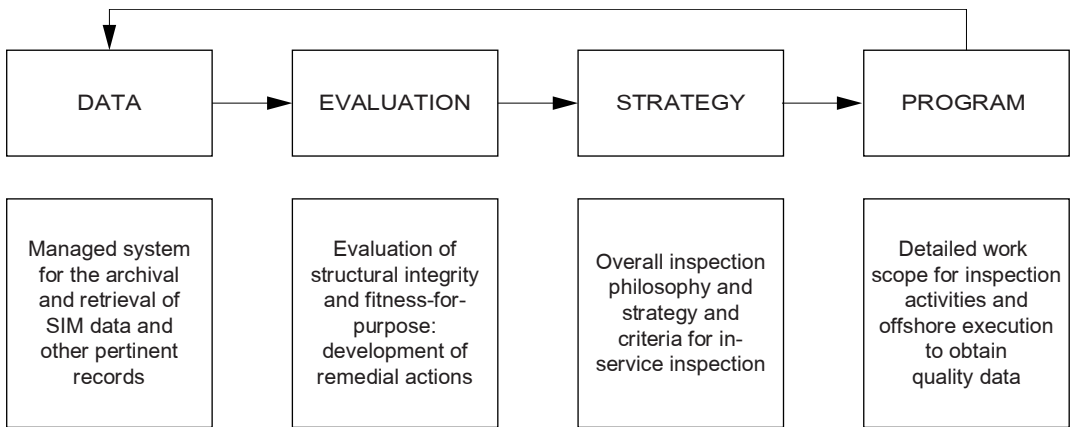
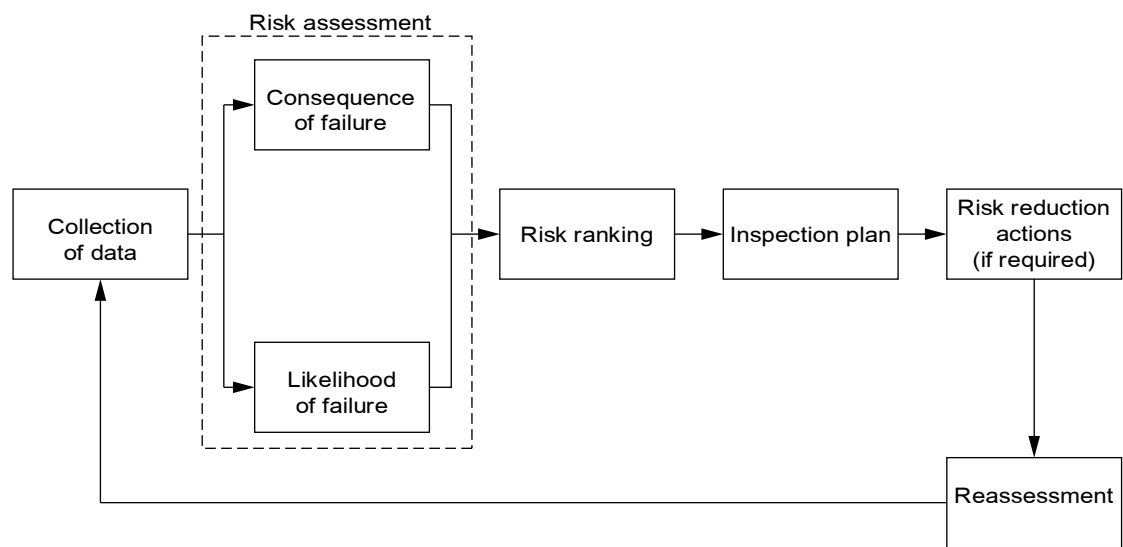


Figure 2 : Framework for developing risk-based in-service inspection strategy



However, before starting the risk-based SIM framework itself, some key issues have to be addressed:

- The objectives of the risk assessment should be clearly stated (e.g. risks understanding, reducing costs, establishing risk criteria).
- The team involved in the risk-based SIM process has to be formed and the competencies, roles and accountabilities of its members have to be defined.
- The scope of the risk-based SIM should be defined. Risk-based SIM could be applied to a fleet or to a platform including eventually its individual structural details. For this purpose, an initial screening could be performed to identify the structural items that are most susceptible to failure under the design event. Those structural items can be a group of platforms when the analysis is performed at a fleet level or a group of structural details when the analysis is performed for one platform only.
- The settings of the risk-based SIM have to be defined, namely:
 - the applicable standards or codes
 - the inspection plan period
 - and the period of validity of the results and when they have to be revisited.
- A type of risk assessment should be selected (e.g. qualitative or quantitative) with respect to the objective of the risk assessment.
- The resources and time required have to be estimated.

2 Collection of data

2.1 Purpose

2.1.1 The collection of data and information aims at providing the necessary input:

- to assess the potential factors and their respective influence on the platform's susceptibility to failure
- to give values to the required inputs for the calculation of the likelihood and consequence of failure
- to assist in inspection planning.

2.2 Typical data

2.2.1 SIM data are divided into two broad categories: platform's characteristic data and platform's condition data:

- The platform's characteristic data is the baseline data that represents the structure at installation. The characteristic data includes:
 - general platform data
 - design data
 - fabrication data
 - and installation data.
- The platform condition data represents the changes to the characteristic data that may occur during the life of the platform. The condition data includes the following:
 - in-service inspection data
 - damage evaluation data
 - corrosion protection data
 - SMR data
 - platform modifications
 - condition monitoring data
 - and operational incident data.

The list of typical platform's data for the SIM process provided in the API-RP-2SIM is repeated in appendix for information.

2.3 Source of data

2.3.1 The main sources of data are the following:

- design report including initial drawings
- fabrication report
- installation report
- most recent engineering assessment report including drawings
- site conditions report including metocean climate data and soil data
- in-service inspections records
- cathodic protection records
- incidents investigation reports