HHRM

HELLENIC HYDROCARBON RESOURCES MANAGEMENT

VERIFICATION GUIDANCE

UNDER L4409/2016

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1 OVERVIEW

For all stages of the lifecycle including design, an operator/owner is required to:

1) Identify safety and environmental critical elements (SECEs) (Article 17(4a)), which are defined as *parts of an installation, including computer programmes, the purpose of which is to prevent or limit the consequences of a major accident, or the failure of which could cause or contribute substantially to a major accident*;

2) Determine the required performance of SECEs so that it is known if *safety and environmental critical elements are suitable so as to reduce the risk of a major accident to an acceptable* level (Annex I, part 2 and similar); and

3) Establish and carry out assurance routines to provide assurance that SECEs are meeting this performance (Annex IV, 1(a)).

The preferred format for defining the performance is in a performance standard (see Section 4.6). The performance standards are likely to be requested by HHRM in any RoMH or Notification assessment and must be provided to HHRM on request.

The Operator/Owner must then establish a verification scheme carried out by an Independent Verification Body (IVB) (Article 17) that provides an independent review of the above activities, through a process of audit, examination and witnessing of assurance routines. Independent verification means *an assessment and confirmation of the validity of particular written statements by an entity or an organisational part of the operator or the owner that is not under the control of or influenced by, the entity or the organisational part using those statements* and the remainder of this document gives guidance on what this means.

If the IVB finds that obligations under 1–3 above are not being met, the IVB must raise an anomaly, which the operator/owner must resolve.

The operator / owner is responsible for developing the verification scheme to include the nature and frequency of verification activities. The IVB must review the robustness of the verification scheme and the appropriateness of the assurance routines, performance standards and the SECEs. A record must be maintained of all anomalies identified by the IVB, along with the response. A comprehensive justification should be made and recorded by both the IVB and the operator / owner as to how the anomalies have been responded to. These records will be required to be made available, on request, to HHRM.

This document sets out the requirements for an notification and RoMH submissions (Section 2), requirements for acceptance of an IVB by HHRM (Section 3), the processes that are required within any verification scheme (Section 4) and the requirements for different types of scheme (Section 5).

2 ROMH AND NOTIFICATION CONTENT

Verification Scheme(s) must be described or referenced in the RoMH or notification in accordance with Table 1 and all must meet the requirements of Sections 3, 4 and 5.1.

Submission	Documentation Requirements for the Verification Schemes
Design Notification	A summary of the Verification Scheme that will be implemented during the design, construction and commissioning process (as per the requirements in section 5.2.1 and 5.2.2) (Annex I 1(9)). An initial list of SECEs and their required performance (see Section 4.6) (Annex I 1(9)).
Production RoMH	The Verification Scheme must be summarised in the RoMH and meet the requirements in Sections 5.2.2 and 5.2.3 (Annex I 2(12) and 5(a)). A statement by the operator or owner, made after considering the report of the independent verifier, that the record of SECEs and their scheme of maintenance as specified in the RoMHs are or will be suitable (Annex I 5(a) and Section 4.5).
Non-production RoMH	The Verification Scheme must be summarised in the RoMH and must meet the requirements in Section 5.3 (Annex I 3(13) and 5(a)). A summary of the work completed to verify the suitability of the installation's SECEs as per Section 5.3, which may need to include processes that meet the same aims as design and construction verification. A statement by the operator or owner, made after considering the report of the independent verifier, that the record of SECEs and their scheme of maintenance as specified in the RoMHs are or will be suitable (Annex I 5(a) and Section 4.5).
Well Operations Notification	*a report with findings of the independent well examination, including a statement by the operator of the well that, after considering the report and findings of independent well examination by the independent verifier, the risk management relating to well design and its barriers to loss of control are suitable for all anticipated conditions and circumstances* (Annex I 4(11) and Section 5.4.1). The Verification Scheme for the Well Operation must be summarised in the notification and meet the requirements in Section 5.4.2 (Annex I 4(4)).
Combined Operations Notification	As for a production RoMH, but only for any SECEs that are modified, or new.

Table 1: Verification documentation requirements for notification and RoMH Submissions

As per Annex V, Part 3, verification must be carried out for all material changes. The term "well examination" means independent verification for a well and is generally not used in this guidance.

The RoMH and Notification requirements detail the description of the verification scheme that is required in a RoMH, or notification and this reflects Annex I, Part 5 of the Law.

3 APPOINTMENT OF AN IVB BY AN OPERATOR OR OWNER

3.1 Competence and Independence

3.1.1 Submission to HHRM

The operator and owner must submit its choice of IVB(s) to HHRM for acceptance in accordance with the timescale given below and these submissions must:

- **Scope** Describe, if there is more than one IVB, how they will cover the entire Verification Scheme;
- **Competence** Confirm that the IVB is certified to ISO 9001, or demonstrate that the IVB operates a quality management system for independent verification that meets the same goals; and
- **Independence** Describe how the IVB meets the independence requirements in Section 3.1.3 accounting for any previous and current associations between the operator or owner and the IVB, any potential conflicts of interest showing how such issues will be managed.

HHRM will inform the operator or owner as to the outcome of their review of the IVB; this will be as soon as is practicable, but in any event will be no later than four weeks after receipt of the submission. HHRM may refuse the IVB on the basis of the evidence provided in the submission.

Re-acceptance of an IVB is not required in relation to the submission of a material change to a RoMH or notification as long as the operator or owner is satisfied that the details relating to the competence and independence of the accepted IVB has not changed.

Section 3.1.2 gives additional competency guidance that must be met by the IVB. Whilst this information is not required in the submission to HHRM for IVB acceptance, the operator or owner must be able to demonstrate at any time that the IVB is continuing to meet these competency requirements.

The operator or owner may change IVB, subject to the requirement that the proposed choice of IVBs must be submitted to HHRM for its review and acceptance before the change is made.

3.1.1.1 Timing

The timings required for HHRM's assessment of an IVB are detailed in Table 2 and assessment of the submission by HHRM will take up to 4 weeks.

Table 2 Summary of Submissions schedules required for offshore oil and gas operations

Request for IVB acceptance for a	Schedule	Comment
- Design Notification	At the same time, or before, the design notification is submitted.	Verification must be in place from the time the design notification is reviewed by HHRM.
- Well Operation	At least 4 weeks before the well notification is submitted.	The well must be verified before submission of the well notification.
- RoMH	At least 4 weeks before the RoMH is accepted.	Acceptance of an IVB is required before a RoMH can be accepted.
- Change of IVB	At least 4 weeks before the proposed change date.	Change of IVB

3.1.2 Competence Requirements

Annex 5 Part 2(a) and (b) define competency requirements for the IVB:

a) *the independent verifier has suitable technical competence, including where necessary, suitably qualified and experienced personnel in adequate numbers who fulfil the requirements Section 3.1.3;*

b) *tasks under the scheme for independent verification are appropriately allocated by the independent verifier to personnel qualified to undertake them.*

Guidance on these aspects is given below and they can be fulfilled by suitable ISO9001 certification of an IVB's independent verification services.

3.1.2.1 Competent Personnel

The IVB must have individuals available to carry out verification with suitable knowledge, experience and training to carry out the tasks allocated to them for the type of well, or installation being verified.

They must have the competence to critically assess the operator's or owner's system for ensuring SECE are suitably designed and operated to meet performance standards. This means that the IVB will need individuals who are competent in design, maintenance systems, and the actual carrying out of maintenance, such that the IVB's individuals cover all of the technical required areas.

The IVB itself must ensure the competency of individuals through procedures to evaluate and manage competency. These procedures must include:

- Job descriptions that state minimum qualifications and minimum experience requirements;
- A definition of the required competence;
- Periodic assessments that evaluate competence and identify on-going training requirements; and
- Maintaining training records for the individuals undertaking verification activities.

3.1.2.2 Work Allocation System

The range of competencies needed to cover the wells, well-related equipment and the SECEs is extensive. It is expected that multiple technical specialists will be required by the IVB for verification, and that this takes cognisance of the number of technical specialists the operator/owner requires for its operations.

The IVB(s) must have a work allocation system that ensures that suitable numbers of competent persons carry out work under the Verification Scheme. This could take the form of a competency matrix showing the aspects of the Verification Scheme that specific persons are competent to undertake.

3.1.3 Independence

As defined in Annex V, Part 1(a) and 1(b), independence must be such that:

- *the function does not require the independent verifier to consider any aspect of a safety and environmental critical element or any part of an installation or a well or a well design in which the verifier was previously involved prior to the verification activity or where his or her objectivity might be compromised;*
- *the independent verifier is sufficiently independent of a management system which has, or has had, any responsibility for any aspect of a component covered by the scheme for independent verification or well examination so as to ensure objectivity in carrying out his or her functions under the scheme;*

Therefore, the IVB's persons carrying out verification activities must:

- Be impartial and free from direct financial or operational pressures, which could affect their judgement;
- Not verify their own work;
- Not be employed by the licensee, operator or owner (or any constituent member thereof), their parent companies or a company in the same group, and
- Not verify the work from their own organisation, a parent company or a company in the same group, if one of those organisations has a safety-related relationship with the licensee, operator or owner, such as organisations carrying out:
    - Design and construction of the installation;
    - Integrity management, or assurance services in respect of the installation;
    - Drilling and well services; or
    - Operational support where the third party's day to day operations are not under immediate control of the owner or operator.

3.2 Multiple IVBs

Verification may be carried out by more than one IVB provided the operator or owner ensures that the entire content of the Verification Scheme is completed. Where more than one IVB is appointed, the operator's or owner's Safety and Environmental Management System must document the interface and communications between all parties, together with clear roles and responsibilities.

Should different IVBs cover topsides and wells, there may be an overlap between these two aspects. To avoid duplication, where appropriate, verification carried out for one part may be cited as part of the other, provided that there is no gap between them whereby, for example, a part of the well, or an SECE is not covered by any Verification Scheme.

Example

For a well operation carried out from a non-production installation, an approach to different IVBs covering the wells and topsides could include:

- The operation of the mud and BOP is part of the topsides scope;
- The fact that the mud design and BOP is appropriate for the well operation is part of the wells scope;
- The fact that the BOP is appropriate for the well is part of the well scope; and
- The casing design is part of the Well scope.

3.3 Change of IVB

To change IVB, or add an additional IVB, they will need to be approved by HHRM.

The operator or owner must ensure that the following are made available to the incoming IVB (as applicable to their scope of verification):

- The current status of all verification activities; and
- The list of open anomalies with the actions and planned closure dates.

The operator or owner must ensure the accuracy of all records and that continuity of verification activities is maintained through a change of IVB.

4 VERIFICATION SCHEME PROCESSES

4.1 Overview

An operator's or owner's Verification Scheme defines the work and process whereby the IVB verifies that the performance requirements for the SECEs (preferably expressed as performance standards – see Section 4.6) are suitably defined and that the SECEs operate to them throughout the lifecycle of the installation and, where relevant, well integrity is maintained. For each performance criterion for each SECE, the Verification Scheme must define the verification activities that the IVB carries out.

The Verification Scheme is comprised of the activities carried out by the IVB to:

- Verify the suitability and completeness of the chosen SECEs (Section 5);
- Verify the suitability of the performance standards for the SECEs;
- Verify that the SECEs meet the performance standards from the commencement of operations onwards, which will include activities carried out by the IVB from the design stage onwards;
- Raise and accept closure of anomalies (see Section 4.3); and
- Make records of verification (see Section 4.4).

As part of the above, the Verification Scheme must include review of procedures used to manage the performance of SECEs including, but not limited to, procedures used to:

- Assess the safeguards that may be needed should an SECE fail (Section 5.2.3.4);
- Determine under what conditions maintenance can be deferred (Section 5.2.3.3);
- Determine maintenance intervals (e.g. risk-based inspection) (Section 5.2.3.3); and
- Provide for dispensation to deviate from a defined well policy, or part of a performance standard (e.g. non operation of a downhole safety valve – Section 5.2.3.5).

Finally, the IVB must review the verification scheme itself in certain circumstances (see Section 4.5).

4.2 Working with the Operator or Owner

Annex V Part 2(c)-(d) define requirements for how the IVB works with the Operator or Owner:

a) *suitable arrangements are in place for the flow of information between the operator or owner and the independent verifier;*

b) *the independent verifier is given suitable authority to be able to carry out the functions effectively.*

The above should be part of the owner/operator's management system in relation to verification.

4.3 Anomalies

If, in carrying out the Verification Scheme, the IVB determines that the operator or owner is not in compliance with its performance standards, or associated procedures, or will, or is not maintaining well integrity, (the bulleted lists in the sections above), the IVB must raise an anomaly, which is defined as:

> An ***anomaly*** is a failure identified by the IVB of either the operator's or owner's system for maintaining well integrity, or the performance of an SECE, or the associated assurance processes, or the Verification Scheme itself, at any point of the lifecycle.

For any anomaly raised, the operator or owner and the IVB, must endeavour to agree the required action and the time within which this action must be completed such that the SECE achieves the performance standard, well integrity is maintained, or the anomaly is otherwise satisfactorily closed-out.

The operator or owner must obtain the IVB's agreement that the planned closure date for rectification of the anomaly is as soon as is reasonably practicable and this may take into account other temporary risk reduction measures that have been put in place.

The IVB must assess whether the action taken by the operator or owner to correct or otherwise close-out the anomaly is suitable, but is not responsible for completing the action, as responsibility for completing the required action/s lies with the owner/operator. If, in executing the action, the operator/owner finds that substantially more work is required to rectify the anomaly, a new action and close-out date can be agreed with the IVB.

4.4 Records of Verification

The operator and owner must ensure that there are arrangements in place for making and keeping verification records for the lifetime of the installation showing:

- The IVB's review of the SECEs, performance standards, assurance routines and procedures and Verification Scheme (section 3.2.3);
- Verification activities carried out, such that it is clear what verification that has been carried out on what equipment, documents, or records, regardless of the outcome (i.e. positive reporting of all verification activities, not just when an anomaly is raised);
- The IVB's verification anomalies, including a record of the:
    - Anomaly itself;
    - Planned date for closure of any anomaly; and
    - IVB's acceptance of the closure of any anomaly.

4.5 Review of Verification Scheme

The IVB must review the Verification Scheme and the operator's or owner's SECEs, performance standards and assurance processes if these:

- Have not previously been in operation on the installation or well;
- Is for a non-production installation coming into Greek jurisdiction; or
- Have been revised for any reason, in which case only the modified part needs review.

The review must cover the suitability of the:

- Chosen set of SECEs;
- Performance standards for these SECEs;
- Assurance (including maintenance, and inspection) routines used by the operator or owner to ensure performance including their frequency (covering risk based inspection - RBI);
- Assurance processes used in the management of SECE performance (e.g. operational risk assessment and deferred maintenance); and
- Verification Scheme itself, which must define suitable review that allows the IVB to make a judgement as to whether the operator or owner is following their own assurance processes for the SECEs from design through to on-going operations.

Notwithstanding this, the IVB must also review the Verification Scheme as they work on it and raise anomalies in relation to it if it does not meet the requirements within this document, or is otherwise unsuitable. This is especially important if there is a change in IVB.

4.6 Performance Standards

The performance standard for a SECE defines what is required of it to meet its hazard management role such that risks are reduced to a level that is ALARP. As far as possible, each performance standard must be expressed in quantitative terms such that initial and continued performance can be measured and assessed. As a minimum, the performance standards, must define:

- **Functionality**: A statement of the performance required of the SECE to fulfil its role either as a passive or active system;
- **Availability**: A statement of the required availability of the SECE. Most safety systems will need to be available at all times;
- **Reliability**: For some active systems, the minimum required reliability needs to be stated (further detail in Section 4.6.1);
- **Survivability**: The required performance of the system following an emergency (if any); and
- **Interactions**: The identification of the dependency of the SECE on the operation of other SECEs.

The performance as defined by the first four parts above must be shown to be achieved initially by the design and construction of the SECE (termed initial suitability) and on an on-going basis during operations (termed continued suitability). The performance standards should include references as to how the design part of initial suitability is achieved (this will normally be by reference to a design document, or engineering assessment) and identify how continued suitability is achieved (normally by reference to assurance processes involving monitoring, inspection and maintenance).

The performance standards need not describe the actions to be taken when the failure of a SECE is identified (by whatever means), but this is one of the key processes in the SEMS (often referred to as operational risk assessments). Appendix A gives an example performance standard format.

4.6.1 Reliability Targets

For active systems there is always the possibility that the systems will not operate on demand. Therefore, reliability targets for operation on demand are required in for components of active systems where their reliability can be measured with sufficient certainty (such that corrective action can confidently be taken if the reliability target is not met). Therefore, in line with Annex IV, part 1(a), reliability targets must be provided for at least the following systems:

- Flammable and toxic gas detectors;
- Fire and smoke detectors;
- Emergency shutdown valves and blowdown valves;
- Safety critical process instrumentation and pressure safety valves;
- Firewater pumps (to start);
- TEMPSC (launch and engine start systems); and
- HVAC (dampers to close).

For systems where reliability is achieved by redundancy and there is no effect on the performance standard of a single failure, it may not be necessary to define reliability targets.

> Example
>
> Emergency lighting could be expected to have very high reliability, but each individual light may have a much lower reliability with the overall lighting level target still being achieved and so a target reliability for each light is generally not required.

5 IVB VERIFICATION REQUIREMENTS

5.1 All Verification Schemes

5.1.1 Overview

A Verification Scheme must include all of the following:

- Review of design documents used to justify criteria in performance standards;
- Witnessing of tests;
- Visual examination;
- Review of maintenance and inspection records; and
- Review of procedures used in the management of SECEs such as deviations and dispensations.

The verification activities that need to be carried out and their frequency will vary between SECEs, also between different equipment items that make up an SECE, and the well.

5.1.2 Sample Size and Frequency of Verification

Verification is carried out by assessing and reviewing a cross-section of the operator's or owner's processes used to define and maintain SECEs and well integrity such that risks are ALARP. Performance standards need to be defined by the operator and owner for each safety critical function of each SECE. Each function does not necessarily require to be verified every year, or every time an operator or owner carries out maintenance on it. The sample size and frequency of reviewing a function of a SECE must be such that the IVB is carrying out sufficient verification over the installation to be able to satisfy itself that the SECE is initially and will continue to meet its performance standard, or well integrity will and is being maintained.

For many SECEs, there are a number of similar, or even identical, components in operation, e.g. gas detectors, pressure safety valves and hydrocarbon-containing pipework. While the operator/owner's assurance processes must cover all of these components on a regular basis, verification (during operations likely to be witnessing of tests and examination of maintenance records) only needs to be carried out on a sample of them at a frequency such that the IVB can be satisfied that the components either individually (e.g. PSVs, where each one must operate), or together (e.g. emergency lights, where normally only a proportion need to operate) meet the performance standard.

The frequency of verification of a particular function depends on the frequency of the operator's or owner's inspection and maintenance processes that provide assurance to the operator or owner that SECEs are meeting their performance standards, and also varies for different types of verification, as illustrated in the example below. The verification of most performance standards may be by a combination of maintenance record review and visual examination or witnessing of tests, but the allocation between these activities varies for different SECEs.

Example

Pressure safety valves (PSVs) are normally inspected at intervals of between 1 and 6 years depending on the past performance and risk associated with non-operation of the PSV. On a production installation, there are several hundred PSVs meaning that sufficient certainty can be gained that inspection tests are being carried out correctly, and inspection records reflect actual tests, without witnessing all of the tests (which may or may not be carried out on site). The operational part of the Verification Scheme for PSVs must include at least (numerical values replaced by xx and yy):

- Witness the minimum of xx PSV and yy% of all PSV lift tests (pop tests) each year including, if any exist, some that failed their previous test;
- Annual review of appropriateness of PSV deferred maintenance assessment for minimum of xx PSVs and yy% of total deferrals (or all deferrals if fewer than this exist); and
- Bi-annual review of the operator / owner's assessment of PSV reliability.

Example

The owner/operator should consider the number of tests on components of an SECE that are required to be witnessed to allow the ICB to make a decision on whether the test is being carried out correctly and that sufficient certainty can be gained that the recorded test results mirror the actual test results. For example:

- A high integrity pressure protection system, preventing the over-pressurisation of a separator, may require the IVB to witness tests of 100% of the system; and
- A fire and gas detection system with many detectors may require the IVB to witness only a proportion of the detector tests (i.e. less than 100% of them).

5.1.3 Non-IVB Activities

5.1.3.1 Vessel Classification

Work done to satisfy vessel classification for mobile, offshore installations under the auspices of the International Maritime Organisation (IMO) may be used to satisfy aspects of a Verification Scheme. The operator or owner must ensure that this work meets the requirements of the Verification Scheme, including suitable records being kept (see Section 4.4), and that the organisation carrying out the work meets all the IVB requirements (see Section 3.1). In this instance, the IVB and the operator or owner must agree that the classification organisation meets all of the IVB requirements, including independence from the operator's and owner's assurance activities, and this assessment may be subject to inspection by HHRM.

An example relating to vessel classification is given below.

Example

A MODU firewater pump test is witnessed by the vessel's classification society and found to meet all of the criteria in the performance standard. The Verification Scheme also requires an IVB to witness a firewater pump test. If the classification society meets the IVB requirements for this Verification Scheme, then its witnessing of the test will also satisfy this aspect of the Verification Scheme.

This is only possible if the vessel classification activity covers all the Verification Scheme requirements.

5.1.3.2 Notified Bodies

Under the Pressure Equipment Directive (PED) (97/23/EC) and ATEX Workplace Directive (99/92/EC), Notified Bodies check and review a manufacturer's processes such that the manufacturer is able to CE mark a product, which confirms that it meets the relevant directive. If the directive is the criteria in the performance standard of an SECE, it is sufficient for the IVB to check the authenticity of the declaration of conformity for the equipment to confirm this aspect of the performance standard. The operator or

owner and IVB must agree that this is a suitable approach to allow the IVB to meet the requirements of the Verification Scheme and make a judgement as to whether the operator's or owner's assurance processes to meet the performance standard are operating as intended.

> Example
>
> A criteria in the performance standard for an item of pressure-containing equipment is that it meets the Pressure Equipment Directive (97/23/EC). This can be verified by a review of the declaration of conformity (with the Notified Body's name and number) and a visual inspection of the CE marking. For some equipment items, the verification scheme may require additional verification of welding qualifications or witness of pressure strength tests to be carried out by the IVB.

5.1.3.3 Other Code Requirements

Performance standards may include the requirement for equipment to meet a particular code that is recognised as meeting current Good Practice. Verification of this aspect can be by reviewing and confirming the applicability of work undertaken by another third party that meets the IVB requirements in Section 2.1. The operator or owner and the IVB must agree that the other party meets the independence requirements for an IVB and, regarding competency, that they are accredited to recognised standards in Greece (e.g. ISO9001 and ISO17020) that means that they meet the IVB competency requirements for their workscope.

This party does not need to be accepted by HHRM, but may be subject to audit and inspection if used in the verification process. This arrangement can only cover verification of adherence to a recognised code in Greece and so is unlikely to cover all the SECE requirements for a particular SECE.

Two examples are given below where verification can and cannot be carried out by review of another party's work.

> Example
>
> The verification that emergency lighting meets a particular code as required by its performance standard can be made through review of documentation from another party (meeting the IVB requirements) that it meets the code.
>
> Verification of the time that the emergency lighting operates needs to be made by the IVB witnessing a test.

> Example
>
> The performance standard for a production tree states that it needs to be rated to 10,000psi. This can be by verifying that there is a valid third party certification (from a third party that meets the IVB requirements) that states that the production tree is rated as such.
>
> The wing valves in the same production tree need to close in 30s, which must be verified by witnessing of a test during the commissioning process.

5.2 Production Installation

The verification requirement for a production (and non-production) installation is (Article 17(4)a):

> *to give independent assurance that the safety and environmental critical elements identified in the risk assessment for the installation, as described in the report on major hazards, are suitable and that the schedule of examination and testing of the safety and environmental critical elements is suitable, up-to-date and operating as intended.*

Guidance on the required the Verification Scheme during design, construction, commissioning (including commissioning up until the commencement of operations), and production[1] are given below.

5.2.1 Design

Design covers the process of determining what will be constructed and how it will be operated.

The IVB must verify that the ***ALARP Guidance*** has been followed with respect to the decisions that have been made as to the choice of SECEs and their performance standards. The verification need not repeat the work done by the designer, but it must be in sufficient detail for the IVB to be satisfied that the design will meet these requirements. To do this, the IVB must review a suitable sample of the documentation, calculations etc that are part of an ALARP demonstration or justification for the chosen performance standards and not merely rely on the reputation, or past experience of the organisation that has carried out the analysis.

Example

If a tie-back to an installation does not have a subsea isolation valve (SSIV) on the pipeline, the IVB should review the ALARP assessment for this decision and check any risk calculations used in it. If there is an SSIV and it is given a performance standard for maximum allowable time to close, the IVB should verify this time, but it is less likely that this needs to include a review of calculations since reasonable changes in closure time are likely to be less critical than whether a SSIV exists at all.

Example

Oil and gas containing pressure vessels are safety critical and, for a sample of the pressure vessels, calculations for the strength would need to be checked such that sufficient certainty in the correctness of them all can be gained. Use of a suitable software package may mean that less checking is needed to gain sufficient certainty. In some instance this may involve repeating calculations.

5.2.2 Construction and Commissioning

Before the Commencement of Operations, the IVB must have verified that each SECE meets its performance standard. This verification may be by a combination of document review (e.g. testing records, technical deviations, close-out packs, etc) and witnessing (e.g. commissioning tests to demonstrate that performance standards are met). The combination of review, witnessing and examination must be such that the IVB can gain confidence that the SECEs are meeting their performance standard initially. Two examples of the mix of activities that provide this confidence are given below.

[1] The split into these areas is given to aid the description of the requirements, but does not necessarily mean that the Verification Scheme must be split in the same way.

Example

Additional emergency lighting is being provided for a new module. In this case, the verification activities must include at least:

- Through review of procurement records, that the lights meet the code required in the performance standard;
- Once the emergency lights are installed:
  - That they operate for the required time on loss of normal power; and
  - Witness that the lighting levels defined in the performance standard are achieved.

Verification must not be left until the end of the construction process so as to improve the possibility of resolving anomalies satisfactorily and avoiding any tendency to accept the degraded situation that led to the anomaly being raised. Verification must be carried out throughout the construction process from the end of design through to the commencement of operations, including commissioning of those SECEs that can be commissioned before this. Verification is likely to be carried out in stages, but the full verification scope must ensure that all the performance criteria defined in the performance standard are verified.

Example

Gas detector locations and their response time (as required by the performance standard) must be verified by witnessing a suitable test once installed in location.

Example

Verification of a new riser ESD valve must include witnessing of:

- The test of the valve at its place of fabrication to determine whether its passing rate meets the performance standard; and
- Test of the time taken for the valve to close once installed on site to determine whether it meets its performance standard.

In order that the IVB identifies anomalies as early as possible, some verification may be carried out at the procurement stage, such as review of a suitable sample of procurement documents (e.g. procurement orders, datasheets and delivery notes, etc). This may prevent an anomaly from only being identified during the commissioning stage when it is more difficult to rectify.

5.2.3 Production

A Verification Scheme during the production phase must include all of the following:

- Witnessing of tests;
- Visual examination;
- Review of maintenance and inspection records; and
- Review of related assurance procedures (e.g. deferral, operational risk assessment).

Guidance in relation to these methods is given below.

5.2.3.1 Witnessing of Tests

Where SECEs have an active performance standard (e.g. activation of deluge, detection of flammable gas, etc) the IVB must witness a sample of their testing. The purpose of witnessing a test is to verify that it is being carried out correctly and that the results recorded are accurately reflected in the maintenance management system in order that sufficient certainty can be gained in the operation of the maintenance management system.

> Example
>
> The active performance standards that require the IVB to be physically present to witness tests include, but are not limited to:
>
> - Emergency shutdown valve closure time;
> - Emergency shutdown valve leakage rate;
> - Fire water pump starting methods;
> - Fire water pump flow rate;
> - Gas detector response time; and
> - Gas detector alarm levels.

5.2.3.2 Visual Examination

Where SECEs have a passive performance standard (e.g. dimensions, quantity, condition, etc) the IVB must visually examine a sample of the SECEs.

> Example
>
> Passive performance standards that require the IVB to visually examine the SECE include, but are not limited to:
>
> - Escape routes;
> - Emergency exit doors;
> - Blast walls; and
> - Passive fire protection.

5.2.3.3 Review of Maintenance and Inspection Records

As part of the verification process, the IVB must review the maintenance and inspection records to confirm that the assurance process is robust and that scheduled maintenance and inspection has been completed on time and in accordance with documented procedures.

As part of checking the records, the IVB must verify that the scheduled maintenance will reveal any failure mode of the SECE such that preventative or remedial action can be carried out. The IVB must also review the frequency of a particular maintenance activity to ensure that it is appropriate, taking into account as appropriate the:

- Historical failure rate of the equipment; and
- Risk resulting from failure occurring accounting for the level of redundancy against such a failure.

As part of the review of maintenance and inspection records, the IVB must review the application of any procedures that are used to defer maintenance.

The IVB must review that the maintenance and inspection records refer to the as-found condition of the equipment and identify any remedial action that was required to reinstate SECEs or well integrity to meet the required performance standards.

Review of maintenance records must also be carried out to verify whether reliability criteria within the performance standards are being met. This is likely to be done on a sample basis (see Section 5.1.2 for further details).

5.2.3.4 Review of Operational Deviations

The IVB must verify that risk assessments used to justify continued operation with a failed SECE (often termed operational risk assessment or deviation) are suitable and consider:

- The risks associated with the failure of the SECE;
- The impact of deviations or dispensations from the operator's or owner's policies or procedures; and
- How the risk remains ALARP, taking into account any additional risk reduction measures that are implemented.

In verifying this, the IVB must also review whether the procedures to manage SECE failures and associated deviations or dispensations are adequate.

5.2.3.5 Wells

The IVB must verify the process for ensuring operation of SECEs and well integrity is maintained at all times through implementation of a suitable well integrity management system. This must cover all wells, including those that are suspended, and verification of routine operation and maintenance activities for not falling under the definition of a Well Operation. This verification must cover at least review of:

- Preventative maintenance of above ground pressure control equipment, condition monitoring, inspection and maintenance of the well completion;
- Inspection and testing of safety critical valves (e.g. subsurface safety valves, gas lift valves, production master valves); and
- Deviations from normal operations.

Verification may be by document review, or witnessing of tests. There must be some witnessing of the operation of safety critical valves.

5.3 Non-Production Installation

The verification requirements for a non-production installation are as for a production installation carrying out a production operation. This is in addition to the requirements for verification for the well operation itself.

Furthermore, Annex I 5a requires a RoMH to include *a statement by the operator or owner, made after considering the report of the independent verifier, that the record of safety critical elements and their scheme of maintenance as specified in the report on major hazards are or will be suitable*. Beyond the suitability of ongoing maintenance itself (see Section 4.5), for verification to show that SECEs are suitable, it must consider the whole history of them as necessary. For a system such as emergency lighting, or gas detection, this is not expected to be beyond review that the design and current operation of these systems is appropriate, but for systems such as structural integrity, the full history of the non-production installation (including in other jurisdictions) is likely to have to be considered. In this latter

case, the level of review is for a process that meets the same aims as design and construction verification as detailed in Section 5.3. Work done previously (e.g. previous class or flag state surveys for a floating installation) may help in this regard; see Section 5.1.3.1 for further guidance. The RoMH must summarise the work completed to achieve this. This part of the annex also triggers the review outlined in Section 4.5.

5.4 Well Operation

The verification requirement for a well operation is (Article 17(4)b):

> *to give independent assurance that the well design and well control measures are suitable for the anticipated well conditions at all times.*

In a well operation, any equipment used to control or contain the well pressure must be included in the Verification Scheme. This includes downhole equipment for well pressure containment and equipment at or above the surface such as the wellhead, blow-out preventer (BOP) and/or production tree.

The emphasis of the Verification Scheme for a well is to ensure that the design of a Well Operation and the Well Operation itself are appropriate for the geological conditions anticipated and that the use of any pressure control equipment proposed is fit for purpose, in order to eliminate uncontrolled escape of fluids from the well and ensure that risk is ALARP. The requirements for the Verification Scheme during these stages are given below. This will include the review of relevant policies and procedures used by the Operator and contractors as far as they affect the well integrity and operation of well-related SECEs.

5.4.1 Design (for a Well Operation)

The IVB must verify the well design including the design of the drilling process for the Well Operation. This verification must be by review of design documents (e.g. well engineering drawings, equipment specifications, calculations, datasheets, etc) and may include checking some design calculations. The well and drilling process will be designed within a certain envelope in which the Operator has assessed the risk to be ALARP. Verification must cover the range of possibilities within the defined envelope and must confirm that well integrity will be maintained and the SECEs will meet the performance standards such that hazards are managed and risks ALARP.

Verification must cover all aspects of the well design pertaining to its integrity and SECEs, including a review of at least:

- The assessment and prediction of subsurface conditions to ensure that all relevant information has been considered;
- The casing and cement design and specification;
- The proposed mud properties to ensure that they are suitable to achieve well control;
- Direct pressure and temperature measurement and/or use of predictive methods to verify anticipated geological conditions;
- The suitability and frequency of pressure testing methods proposed to demonstrate integrity;
- The design and specification of pressure control equipment, taking into account anticipated subsurface pressure and temperature conditions; and
- How well abandonment will be achieved.

The well notification must include the IVB's report on the *findings of the independent well examination, including a statement by the operator of the well that, after considering the report and findings of independent well examination by the independent verifier, the risk management relating to well design and its barriers to loss of control are suitable for all anticipated conditions and circumstances* (Annex I 4(11)).

5.4.2 Well Operation

The IVB must verify that the Well Operation is carried out in accordance with the design and the well programme. This verification must be by a review of a suitable sample of documents (e.g. drilling procedures, material certificates of casing, installation procedures, and testing records). This must include, but is not limited to, verification that:

- The material/equipment that is to be placed in the well (e.g. casing) meets the design requirements. This may be carried out by an external party as outlined in Section 5.1.3 and the requirements of that section also apply here.
- The installation and pressure testing of the well casings and cement to ensure that no leak paths exist;
- The periodic assessment of actual subsurface conditions (e.g. leak-off test, formation integrity test, pore pressure prediction and actual pore pressure measurements using formation evaluation tools) and any consequent changes to the well design are being carried out;
- Well control procedures (including periodic BOP testing and emergency drills) during the Well Operation are appropriate; and
- The well has been suitably completed by examination of the final pressure containment logs and, as appropriate, handover documentation that signifies the end of the Well Operation.

Verification during the well operation itself must be carried out by the IVB and records of the review and any anomalies identified kept by the Operator. HHRM may request these documents during an inspection of the well operation.

5.4.3 Abandoned Well

For the process of abandoning a well, the same verification requirements apply as for any other Well Operation.

In addition, the IVB must verify that the well has been suitably sealed so as to permanently maintain its pressure boundary by a review of a suitable sample of documents (e.g. abandonment procedures and records and pressure test results). The IVB must verify that the process for re-pressurisation of all the formations to virgin pressure, potential changes in fluid composition in the wellbore and the deterioration of well over time have been taken into account.

Once a well has been abandoned it will not be subject to verification.

Appendix A Example Operational Performance Standard and Verification Scheme

In the example below some numerical criteria are replaced by XXX. Modifications to the system are covered by management of change procedures.

SECE: 001 FIREWATER PUMPS

GOAL To provide firewater for fire protection systems

Extent of System	**Interfaces**
• Firewater pumps • Firewater Pump Enclosures • Diesel Day Tanks	• Fire and Gas System • Emergency Shutdown System • Firewater Ringmain • Foam Systems

FUNCTIONALITY

ID	Performance Criteria	Basis for Performance Criteria	Assurance of Performance Criteria	Verification			
				Activity	Phase	Sample	Frequency
F1	Three 100% capacity firewater pumps each fed from a dedicated diesel tank Each fire pump to deliver a minimum acceptance flow of xxxx m^3/hour at xxx barg	Basis of Design for firewater (including ALARP Demonstration) Hydraulic analysis report for firewater system NFPA 20 Centrifugal Fire Pumps Fire Protection Philosophy.	Design and testing during commissioning	F1.1 Review design and modification records to confirm initial suitability and management of change procedure has been followed, including any update of assurance and verification activities.	Design	100%	Initial suitability and on modification
			Firepump starting, maintenance and flow curve procedures: PMRs FP-1-9	F1.2 Witness performance test of fire water pumps.	Ops	1 Firewater pump	12 m
				F1.3 Review firewater pump safety critical maintenance for previous 12 months	Ops	100%	12 m
F2	Firewater pumps to be capable of being started by the local control panel and: • Automatically via the DCS with cause and effects. • If firewater ringmain falls below xxx barg.	NFPA 20 Centrifugal Fire Pumps	Weekly firepump starting tests PMRs 1, 4 and 7	F2.1 Witness starting of firewater pump	Ops	100%	12 m
				F2.2 Review maintenance records to confirm PM have been successfully completed	Ops	10%	12 m
ID	Performance Criteria	Basis for Performance	Assurance of	Verification			

		Criteria	Performance Criteria	Activity	Phase	Sample	Frequency
F3	Standby firewater pump automatically starts on failure of the duty pump.	NFPA 20 Centrifugal Fire Pumps	Yearly failure test PMR FP-10	F2.1 Witness automatic starting of stand-by firewater pump	Ops	One pump	48 m
				F2.2 Review maintenance records to confirm tests have been successfully completed	Ops	100%	24 m
F4	Each firewater pump provided with xx hours diesel fuel at full load	Fire Protection Philosophy	Left blank in example				
F5	Firepump status monitored and indicated in CCR	Control Philosophy	Left blank in example				
AVAILABILITY							
A1	At least 2 Firewater pump to be available at all times	n/a	PMRs as F1-F5 above Audit of Operational risk assessments (ORAs)	A1.1 Review ORAs of firewater pump unavailability	Ops	100%	12 m
RELIABILITY							
R1	Reliability to start on demand of at least xx %	Firewater system reliability study	Review maintenance records to determine pump reliability PMR FP-99	R1.1 Review the pump reliability assessment	Ops	100%	24 m
SURVIVABILITY							
S1	Location of firewater pumps to minimise the potential for damage due to impacts, dropped objects, explosion and environmental conditions	Passive Fire Protection Layout Drawings. Fire and Explosion Risk Analysis Dropped Objects Study	Assurance by design	S1.1 Review design documents to ensure each firewater pump and day tank are protected by location	Design	100%	Initial suitability and on modification