Safe by design – Good practice guidance for the offshore wind industry

G+ Global Offshore Wind Health & Safety Organisation

In partnership with energy institute

SAFE BY DESIGN—GOOD PRACTICE GUIDANCE FOR THE OFFSHORE WIND INDUSTRY

June 2024

Published by
Energy Institute, London
The Energy Institute is a professional membership body incorporated by Royal Charter 2003
Registered charity number 1097899

The Energy Institute (EI) is the chartered professional membership body for the energy industry, supporting over 23 000 individuals working in or studying energy and 200 energy companies worldwide. The EI provides learning and networking opportunities to support professional development, as well as professional recognition and technical and scientific knowledge resources on energy in all its forms and applications.

The EI's purpose is to develop and disseminate knowledge, skills and good practice towards a safe, secure and sustainable energy system. In fulfilling this mission, the EI addresses the depth and breadth of the energy sector, from fuels and fuels distribution to health and safety, sustainability and the environment. It also informs policy by providing a platform for debate and scientifically-sound information on energy issues.

The EI is licensed by:
– the Engineering Council to award Chartered, Incorporated and Engineering Technician status, and
– the Society for the Environment to award Chartered Environmentalist status.

It also offers its own Chartered Energy Engineer, Chartered Petroleum Engineer, and Chartered Energy Manager titles.

A registered charity, the EI serves society with independence, professionalism and a wealth of expertise in all energy matters.

This publication has been produced as a result of work carried out within the Technical Team of the EI, funded by the EI's Technical Partners. The EI's Technical Work Programme provides industry with cost-effective, value-adding knowledge on key current and future issues affecting those operating in the energy sector, both in the UK and internationally.

For further information, please visit **http://www.energyinst.org**

The EI gratefully acknowledges the financial contributions towards the development of this publication from members of the G+ Global Offshore Wind Health and Safety Organisation:

bp
Corio Generation
EDF Renouvables
Equinor
Iberdrola
Ocean Winds
Ørsted
RWE
Siemens Energy
SSE
Total Energies
Vattenfall

However, it should be noted that the above organisations have not all been directly involved in the development of this publication, nor do they necessarily endorse its content.

ISBN 978 1 78725 433 6

Published by the Energy Institute

Hard copy and electronic access to EI and IP publications is available via our website, **https://publishing.energyinst.org**.
Documents can be purchased online as downloadable pdfs or on an annual subscription for single users and companies.
For more information, contact the EI Publications Team.
e: **pubs@energyinst.org**

CONTENTS

Contents continued

LIST OF FIGURES AND TABLE

Page

Figures

Table

1 INTRODUCTION

This Good Practice Guideline (GPG) has been produced to support the offshore wind (OSW) industry in implementing the Safe by Design (SBD) philosophy through the lifecycle and ultimately lead to improved health and safety (H&S) outcomes.

Organisations who are relatively new to OSW and are seeking guidance regarding the implementation of SBD within their systems and processes represent the target audience for this GPG. It, however, may provide a useful framework for mature organisations to assess their current practices and identify areas for improvement. Each organisation is different, and the GPG is intended to set out requirements that should be implemented considering their specific context. It is intentionally non-prescriptive, and the principles should be applied in a manner that is suitable for the specific portfolio, project or asset. It essentially sets out 'what' organisations should have in place. It is for each organisation to review this and establish 'how', given relevant internal and external factors. To support this, a checklist has been provided in Appendix B, which is an extract from a G+ GPG SBD maturity assessment tool, which allows organisations to assess the extent wo which they satisfy the guidance and also to support the development and implementation of improvement plans.

This GPG does not replace regulatory requirements and local legislation which may specify additional obligations.

Many of the principles are taken from process safety and safety engineering but they are deliberately presented in more general language to make it more accessible to practitioners who are not from a safety engineering background. Furthermore, there is an array of standards describing the use of specific tools, such as failure mode and effects analysis (FMEA), hazard and operability study (HAZOP), etc. This GPG is not attempting to replace those; it is intended to set out a way the principles can be embedded within a project and asset lifecycle. Standards have intentionally not been referenced for three reasons: firstly, there may be different applicable standards in different regions and this GPG has been written as a global document; secondly, it is considered to be desirable to avoid suggesting that there is a preferred suite of standards; and thirdly, standards are not static and updates or the production of new standards may render this document out of date.

The aim of this GPG is to provide a method of minimising risks to people and the environment through design. However, implementing the principles outlined should also improve commercial and economic benefits due to improved risk management. It is specifically intended to support those involved in the development of new assets, management of operational assets or decommissioning activities to minimise (1) the risks related to people interacting with the asset (e.g. maintenance) and (2) the risk of a failure during normal operation causing harm to people or the environment.

The guidance is presented in two key parts. The first, in Section 4, includes generic principles and activities that apply at all stages of a project and operational life. The second part, in Section 5, provides the typical activities that should be applied during the different phases of the lifecycle.

1.1 BACKGROUND

It is widely acknowledged that the most effective way to manage safety risks is through elimination or management during design. An OSW asset will comprise many similar generating units which will magnify the impact of any design feature that introduces H&S hazards. There is also significant growth in the development and adoption of new technologies, which will have limited operational experience before deployment at commercial scale. It is therefore important to implement a robust approach to design that systematically identifies hazards and eliminates, or reduces to an acceptable level, the lifecycle risks.

Figure 1 shows conceptually the importance of managing H&S hazards as early as possible in the asset lifecycle.

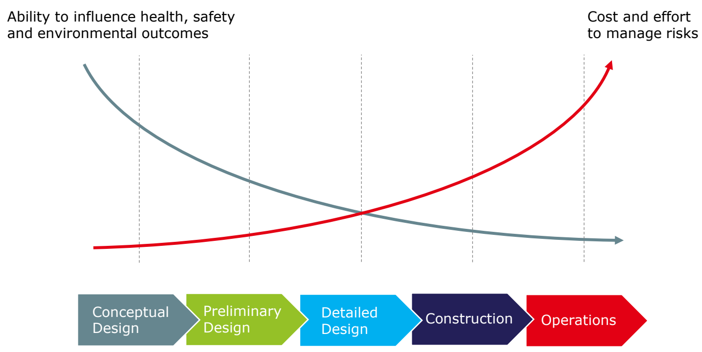


Figure 1 – Conceptual model

This GPG has been written with the project developer or asset owner in mind, as they are the party that has the primary responsibility for SBD and the greatest capacity to influence the H&S outcomes. H&S influence can be achieved by setting the overall direction with respect to objectives, establishing the strategy, and defining and communicating requirements, and then subsequently enforcing them. However, the principles should be applied by all organisations throughout the supply chain.

Although the general approach, principles and concepts are agnostic of the technology or sector, they have been written considering the inherent risks of OSW. For example, hydrogen, which may be developed alongside an OSW asset, presents an intrinsically higher hazard profile compared to OSW and would require a far more onerous application of process safety methodologies than is described in this GPG. Similarly, solar and battery energy storage systems have different hazards and this should be taken into account when OSW is part of an integrated energy system.

A broad definition of 'design' has deliberately been used to allow the decision-making process and management of residual risks to be described, as well as how safety is managed through the asset life cycle.

2 DEFINITIONS AND ABBREVIATIONS

Definitions

Asset	Generating asset; foundation; logistics and vessels; port and operations and maintenance (O&M) base; transmission system, including offshore substation and onshore substation, and metmasts. NOTE: The asset could be a demonstrator project.
Asset Owner	The organisation who has ultimate responsibility for the development, construction, O&M, and/or decommissioning of the asset.
Brownfield Project	Activities to modify, upgrade or improve the asset.
Competency	Combination of knowledge and experience in relation to a specific context.
Cost Benefit Analysis	A method of evaluating the cost and benefit of risk reduction measures (RRMs).
Construction	The stage of the project where physical activities directly associated with the build of the asset are carried out, up to the completion of commissioning and Asset energisation for commercial operation.
Cost Benefit Analysis	A method of evaluating the cost and benefit of RRMs.
Decision Support Tool (DST)	A bespoke tool or application that supports informed decision making by enabling analysis, optioneering, and potential outcomes to be assessed in a consistent and repeatable way.
Decommissioning	The phase in the asset lifecycle where the asset is beyond its useful life and is dismantled.
Design	Process of applying engineering principles to plan, create and manage resources, encompassing the complete lifecycle, and including the deliberate and systematic deployment of methodologies and procedures with the aim of delivering a specific outcome.
Design Assurance	Structured and systematic process to ensure the design complies with the relevant standards and guidelines.
Design Life	The life used during design to select materials, fatigue, corrosion allowances, and assess other time-dependent degradation mechanisms.
Design Verification	An activity to confirm that the design, or part of the design achieves the specified outcome, typically carried out by a third party.
Development	The phase from project origination through to construction and includes feasibility and front end engineering design (FEED) stages.
Failure Mode	A type of failure, e.g. corrosion, fatigue.

Definitions

Good Practice	Standards, practices, methods, guidance, and procedures conforming to the law and the degree of skill, care, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced person or body engaged in a similar type of undertaking under the same or similar circumstances.
Harm	Harm to personnel including injuries, illness, or strain.
Hazard	Anything with the potential to cause harm to people or damage to the environment.
Hazard review	A structured and systematic approach to hazard identification (HAZID), prevention, and mitigation.
Hierarchy of Controls (HOC)	A systematic framework that guides the selection of the most effective H&S control measures.
Hot Work	A process that involves fire or application of heat, including welding, soldering, cutting, drilling, or burning.
Isolation	The process of disconnecting part of a system to prevent the release of hazardous energy during a work activity.
Obsolescence	Loss of supply chain options for replacement prior to the end of the useful life of the asset.
Operations	The phase in the asset lifecycle where the asset delivers the planned value.
Project	The activities to create the asset.
Project H&S Plan	A documented plan that implements the SBD principles into a specific project management framework to ensure a satisfactory H&S standard.
Risk	A combination of severity and likelihood that may result in incidents causing harm to personnel.
Risk Reduction Measure (RRM)	Any measure that removes a hazard or prevents harm to people, reduces its likelihood, or mitigates the consequences.
SBD	A structured approach to design that, as far as is possible, implements inherently safe features and where necessary implements the appropriate RRM. Also called prevention through design in some regions.
Safety Critical	Any component, function, activity, process, or procedure whose omission, failure or incorrect operation could increase risks associated with the system.
Temporary Works	Temporary arrangements that are required to enable construction or maintenance. For example, this could include scaffold or temporary platforms.
Useful Life	Period over which the asset is expected to provide value.
Working at Height	A situation where, if precautions were not taken, a person could fall a distance liable to cause injury.

Abbreviations

AFC	approved for construction
DDL	design decision log
DST	decision support tool
FEED	front-end engineering design
FMEA	failure mode and effects analysis
GIP	Good Industry Practice
GPG	Good Practice Guideline
HOC	hierarchy of controls
HAZCON	hazards in construction study
HAZID	hazard identification
HAZOP	hazard and operability study
HIRA	hazard identification and risk assessment
H&S	health and safety
KPI	key performance indicator
OEM	original equipment manufacturer
OSW	offshore wind
O&M	operations and maintenance
RRM	risk reduction measure
SBD	Safe by Design
TDD	technical due diligence

3 IMPLEMENTATION AND ADOPTION

Effective SBD requires an integrated approach across several teams, disciplines, and organisations. It also needs to be embedded within organisational structures and processes. Therefore, the requirements set out in this guidance should be converted into specific project or asset plans. The checklist in Appendix B, and associated maturity tool, are provided to support organisations in assessing their current status and develop actionable improvement plans.

Ownership for the implementation of SBD throughout an organisation should reside with someone senior enough to influence process and direct resources across the lifecycle. Commitment to SBD should be demonstrated by senior leadership.

Implementation and adoption requires:

– The requirements of this GPG to be converted into project or asset-specific plans.
– Implementing the requirements into appropriate organisational charts.
– Defining SBD responsibilities within role profiles.
– Ensuring sufficient and competent resource to fulfil the objectives.
– Implementing appropriate reporting processes to inform senior management of the performance against the SBD requirements.
– Implementing appropriate quality and assurance activities.

Appendix A provides some practical steps to deliver any organisational change required to implement this guidance.

G+ does not have legal authority to mandate requirements, so this document does not use ‘must’ or ‘shall’ terms. ‘Should’ is used as the default term for presenting good practices. This allows for flexibility in the means of achieving the H&S aims but does not mean that the practice is merely optional. Rather, G+ recommends that organisations should:

– follow the guidelines, going beyond them where reasonably practicable, or
– do something else that demonstrably satisfies the intent, and
– risk assess, justify, and document any deviations.

4 SBD FRAMEWORK

The GPG is based on a framework that contains two main components: key SBD principles that apply continuously, and requirements for the main phases of a generic asset lifecycle.

This is shown in Figure 2.

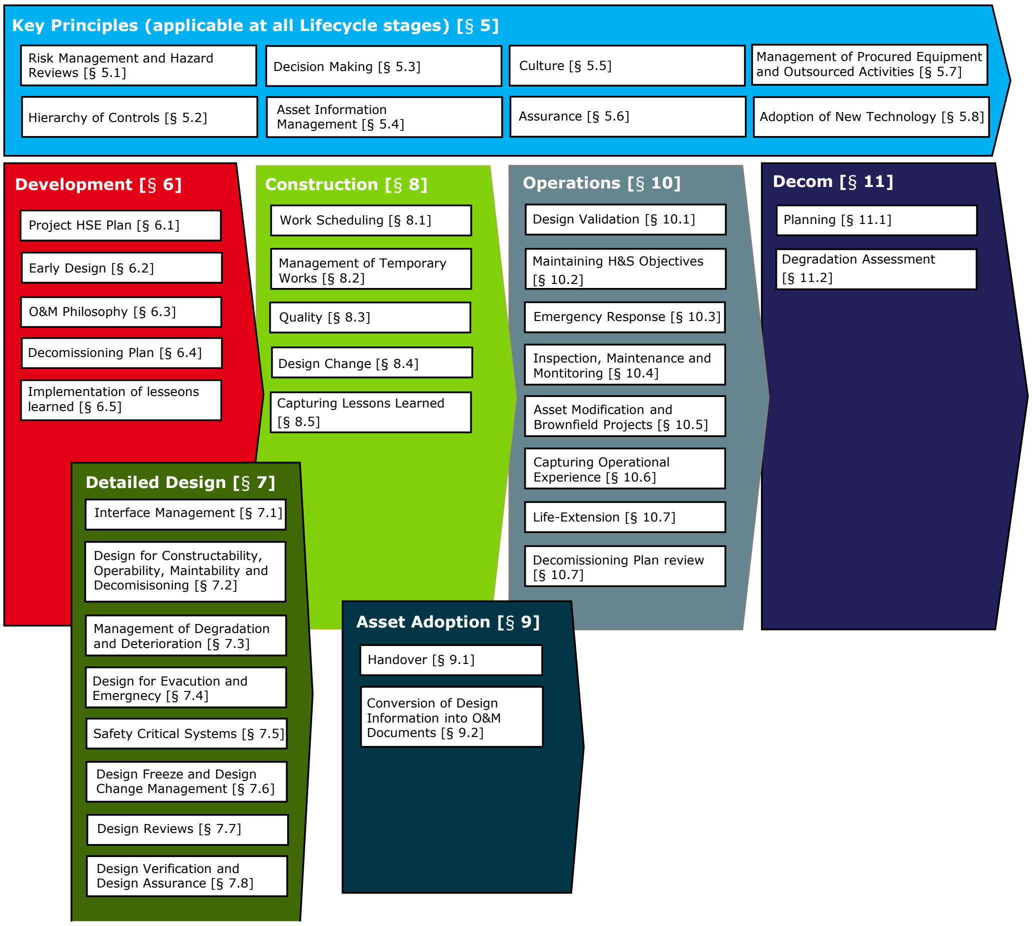


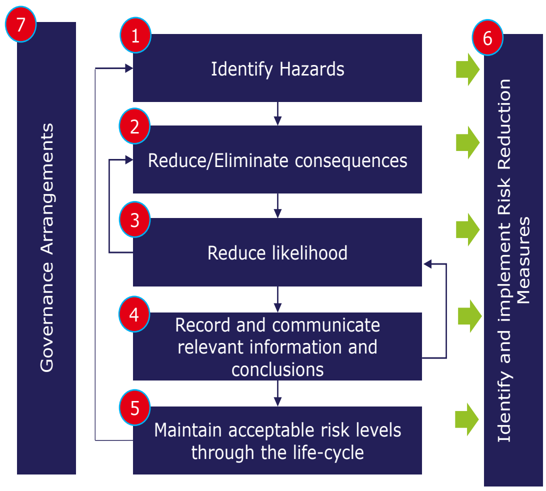
Figure 2 – SBD Framework

5 KEY PRINCIPLES

5.1 RISK MANAGEMENT AND HAZARD REVIEWS

5.1.1 Generic risk management framework

A generic framework for risk management is shown in Figure 3. This outlines the activities that should be implemented within an overarching safety management process. An organisation may implement a variation of this generic framework, but it should include the same elements.



1. Identification requires the structured, systematic and regular review of reasonably foreseeable Hazards and their consequences.
2. Reducing/eliminating consequences may be the effective way of managing the risks, especially if the consequences can be reduced significantly.
3. There are many methods of identifying likelihood and reducing through the implementation of controls.
4. It is important to document how adequate risk reduction is being achieved as this will need to be converted into actions and monitored.
5. The requirement to manage risks through the lifecycle is a key element of Safe by Design so needs to be updated following feedback from the asset condition, when assessing Brownfield modifications and following changes in GIP.
6. RRMs can be identified and implemented throughout the process, and is the main purpose a risk management.
7. The governance arrangements should include roles and responsibilities / ownership, quality assurance and processes.

Figure 3 – Generic risk management framework

5.1.2 Hazard reviews

Organisations should implement a systematic approach to HAZID, prevention, and mitigation. This should be a continuous process with specific planned hazard reviews at appropriate times in the lifecycle. The reviews should include input from a suitable range of stakeholders, including operational personnel and H&S specialists, with sufficient competence to assess the full range of hazards.

It is likely that several hazard reviews will be necessary to cover the different asset areas. Organisations should therefore ensure they collectively cover all hazards, and the interrelationship between RRMs are understood and managed. Organisations should fully plan hazards reviews and consider them to be a key part of the project schedule. Organisations should consider requiring hazard reviews to be carried out by equipment suppliers or entities delivering outsourced activities (see 5.7).

The hazard reviews should ensure that:

- All foreseeable hazards have been identified.
- Where appropriate, proportionate, and suitable, additional analysis has been identified.
- There is a record of the activity for audit purposes.
- Proportionate and suitable RRMs and good industry practive (GIP(has been applied.
- Any further RRMs requiring implementation are planned and allocated sufficient resource.
- Decisions to not implement RRMs that are considered to be grossly disproportionate are justified and documented.

A key outcome of the hazard review and associated risk assessment is the justification why any additional further RRMs are not planned to be implemented. It may be that the cost or effort is grossly disproportionate to the level of risk reduction for a given RRM, or the implementation introduces new hazards or increases other risks. This may require the use of a cost benefit analysis to support the judgement. The output should be documented and recorded as part of the hazard review. The actions from the hazard review should be recorded with owners and due dates.

As a minimum, the following hazard reviews should be carried out:

Table 1 – Minimum hazard reviews through the project and asset lifecycle

Stage	Requirements
Development	Identification of constraints, uncertainties, and Hazards due to design concept such as site location, local security issues, planned technology, weather, environmental conditions, terrain, and cable routes.
Detailed Design	Several hazard reviews will be required to cover the overall asset adequately encompassing the risks that manifest in construction, operations and decommissioning.
Construction	Review of hazards in construction including transportation, fabrication, installation, and commissioning.
Operations	Shortly after commencement of operations to assess any deviations from the design assumption. Prior to any significant changes in the management of the site (e.g. at the end of the WTG warranty period). At any key lifecycle milestones such as midlife and towards the end of the design life.
Decommissioning	During the planning of the decommissioning activity. Prior to the commencement of decommissioning execution.

Although hazard reviews are discrete activities, they should be considered as part of the overall lifecycle SBD approach and should consider any previous hazard reviews.

The success of a hazard review depends on quality of the planning and contribution of the review group. Organisations should ensure that the reviews are facilitated by a suitably competent and qualified individual who can ensure suitable collaboration and communication between the group. Organisations should consider the benefits for them to be independent from the project. Organisations should ensure that all relevant stakeholder groups are represented with suitable competent personnel.

The hazard review should clearly identify the hazards that will be influenced by equipment suppliers or via outsourced activities. Organisations should determine where it is suitable for the evaluation of appropriate RRMs to be delegated to suppliers, and where it is necessary to directly control the decisions relating to risk reduction and acceptance of residual risk. The hazard review should also clearly identify the hazards that are at the interface between contracts or teams, or where RRMs need contributions from more than one party. Organisations should apply specific controls and assurance through their supply chain activities to oversee risk reduction decisions and assessments.

The hazard review should consider how factors external to the project or asset impacts the hazards, for example third-party interference or the presence of external structure, installations, and infrastructure.

There should be a demonstrable link between the output of the hazard reviews and the risk management activities in the design process, and the DDL.

5.1.3 Offshore wind hazard considerations

In OSW there are some common hazards each project should consider. These are outlined in Figure 4.

Figure 4 – Common hazards

Organisations should understand relevant GIP and endeavor to adhere to it unless there is clear justification to deviate. Care should be taken to identify relevant GIP particularly where advancements in technology or increases in scale are being implemented. It should not be assumed that proven methodologies will continue to provide similar risk management results when applied in different situations. GIP may not be constant across all regions, however any deviations from what is considered to be ‘best’ practice should be assessed and justified. GIP is also not static and will change over time and with the introduction of new technologies and improved industry methodologies. Organisations should regularly monitor GIP and where necessary review previous decisions.

Organisations should assess the effectiveness of the RRMs and where appropriate, consider implementing further measures. For example, the RRM (1) may not be effective for all Hazard characteristics, (2) it may not perform for all system configurations, (3) it may be unreliable, and (4) it may not be evident if the RRM is inoperable. Any procedural RRM, or one that can be overridden, will have a lower level of reliability and therefore care should be taken if these are the only RRMs for a given hazard. Furthermore, inspection and monitoring may only be able to detect a subset of all possible failure modes, or may not provide information of the failure mode early enough to intervene. Organisations should therefore evaluate the effectiveness of inspection and monitoring to manage health, safety, and environmental risks.

Where emergency response/emergency evacuation is a stated RRM, the hazard review should include an assessment of the rate of escalation to understand how quickly it would need to be completed. This should then be compared with an assessment of the practical duration for response and evacuation. This comparison should be used to assess the real effectiveness and adequacy of the RRM.

5.1.4 Residual risk management

Residual risks (i.e., those that are considered to be acceptable) should be clearly recorded in a risk register, which clearly states which phase(s) they may manifest. It is likely that these residual risks will have associated RRMs that reduce the consequence, likelihood, or both. Adequate assurance activities should be implemented to monitor their continued application and effectiveness. Organisations should monitor the continued application of the RRMs to ensure their ongoing effectiveness, identify whether the risk level has increased, and the basis for the prior evaluation has not changed. Residual risk information and RRMs should be transferred to relevant stakeholders through the lifecycle.

5.2 HOC

Organisations should use the HOC concept at all stages when making decisions regarding risk management and the selection of suitable RRMs. There are different versions of the model, one is shown in Figure 5, and it may also be part of legal requirements in some jurisdictions.

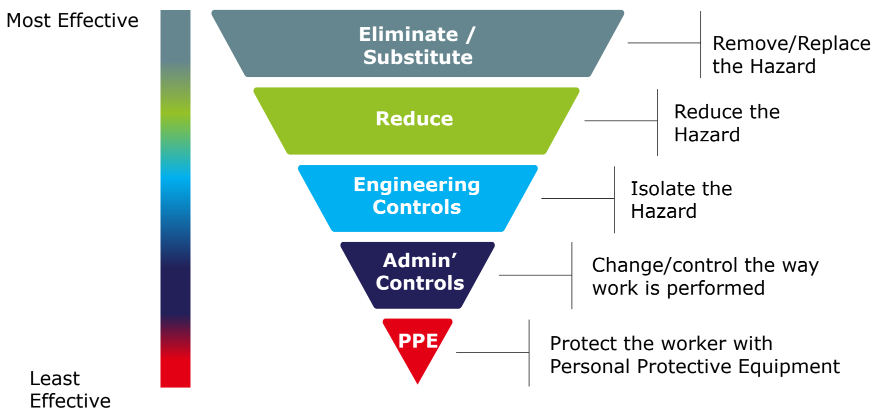


Figure 5 – HOCs

5.3 DECISION MAKING

Effective decision making is an essential element of the SBD principle. However, there are often conflicting objectives requiring tradeoffs. They are often made with incomplete information and there are interdependencies within systems. The complexity inherent in a given decision should be acknowledged and this should determine how the decision is approached. For decisions that could have a H&S consequence, the level of effort, rigour, resource allocated, and time allowed in the process should be proportionate to the most plausible worst-case consequence.

5.3.1 Generic decision-making process

Figure 6 outlines a generic decision-making framework. The requirements in each step should be based on the complexity of the decision and potential consequences in the event of an error in decision making, however all decisions will follow the same basic steps. The level of resource and time allowed should be appropriate for the complexity of the decision and consequences if an error is made. The decision-making process should be framed appropriately to ensure that the activities in the process are considered and executed within the desired context.

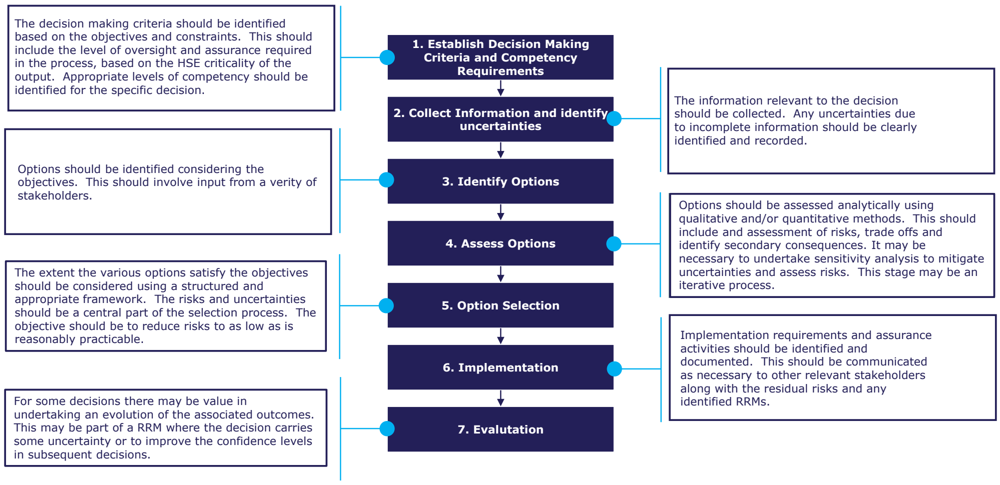


Figure 6 – Generic decision-making framework

For critical decisions, the level of oversight should be reviewed and considered. Influencing factors include:

- complexity of the decision;
- uniqueness of the decision;
- worst-case consequence if there is an error in decision making;
- extent GIP can be used to support the decision;
- level of uncertainty in the input information and analysis, and
- number of stakeholders affected.

Human factors can be a source of error in decision making processes and steps should be taken to minimise the risk that leads to adverse outcomes, and where possible fact-based and data driven decisions are made. Organisations should implement a structured approach that is deliberately designed and tailored to the specific decision. Where appropriate, DSTs should be developed and decisions codified in management systems and technical specifications.

5.3.2 Decision support tools

DSTs can be used to simplify complex decisions and improve efficiency when repeatable decisions are required. Key benefits of a well-conceived and implemented DST are improved transparency, and a reduction in variability. This improves accuracy, reliability, and it provides a basis for optimisation. Conversely, DSTs can embed systematic error so each DST should be subject to appropriate validation and assurance. Organisations should ensure that each DST has an owner who is responsible for ensuring that it is suitable, the outputs are valid and consistent, there is appropriate quality control, it is used consistently, implemented effectively, changes are appropriately managed, and there is a feedback loop that includes an assessment of the outcomes. In line with the general principles of decision making, the level of assurance should be proportionate to the H&S risks.

5.3.3 Codifying decisions

It may be appropriate for decisions to be codified into an organisation's management system and technical specifications. Where this approach is taken, organisations should ensure that there is a clear scope that describes the applicability and any limitations and constraints. It may be helpful to provide supporting data to provide necessary context. When developing the requirements, there should be appropriate rigour and assurance including peer reviews, an impact assessment and implementation plan.

Organisations should ensure that the artifact that implements the requirements is subject to appropriate version control and change management following updates.

5.4 ASSET INFORMATION MANAGEMENT

Organisations should implement an asset information strategy that provides a 'single source of truth' and contains the information necessary to safely manage the asset. A philosophy of 'right information, to the right people, at right time' should be adopted. The value of effective asset information management should be leveraged to avoid repeated mistakes by recording, communicating, and implementing lessons learned. This requires people to understand the information that may be required later in the asset lifecycle.

The asset information should be maintained and updated where necessary (e.g. following asset modifications) and will typically include:

- hazard and risk registers with assumptions and RRMs;
- DDL;
- design information;
- as-built records;
- O&M manuals;
- modification register;
- asset register,
- asset history;
- documents;
- images and multimedia;
- lessons learned from own experience, and
- relevant industry experience (e.g, OEM alerts and failures on other sites).

This should ensure that all stakeholders have access to the necessary information, managed through a document management system.

5.5 TEAM CULTURE

The success of a SBD philosophy relies on the actions and behaviours of a wide range of people. Organisations should therefore put effort into establishing the right culture for effective SBD, including:

- Establishing shared values by communicating the safety and environmental objectives.
- Ensuring engagement and involvement from all levels.

- Including contracting organisations within initiatives and reviews.
- Transparency in process and decisions.
- Enabling freedom to challenge and provide alternative viewpoints.
- Promoting continuous improvement.

Design is the product of the effort of multiple people (including operations teams and contractors). Organisations should consider how to provide an environment to support effective teamwork, collaboration, and challenge.

5.6 ASSURANCE

Quality plans should be implemented that are risk-based considering the hazards and H&S risks. There should be demonstrable alignment between the hazards and RRMs, and the activities on an inspection and surveillance plan. For critical activities, the calibration of work equipment and measuring equipment should be reviewed. Any safety systems that have been identified should be subject to appropriate review and test. The project should adopt a gateway process that aligns the output from the hazard reviews into the approvals to move to the next phase. Organisations should implement a design assurance programme and this should be included in the project reporting process. This should include leading and lagging indicators that are appropriate for each phase.

5.7 MANAGEMENT OF PROCURED EQUIPMENT AND OUTSOURCED ACTIVITIES

The development of OSW assets involves different teams and complex global supply chains. It is therefore inevitable that decision making, and risk evaluation will reside in various areas of the supply chain. Organisations should clearly record the hazards that will be influenced by equipment suppliers, and entities delivering outsourced activities. This can be recorded through contracts and ensuring appropriate controls are implemented that are proportionate to the risk. Project H&S objectives should be cascaded through the specification and contract requirements.

In situations where the risk level, risk analysis, selection, and/or execution of RRMs are influenced by the actions and decisions of multiple parties, organisations should ensure sufficient assurance and oversight are in place. Where an RRM is applied at interfaces between contracts, the benefits of specifying prescriptive requirements should be assessed.

Organisations should assess the compatibility between different suppliers' equipment and design to ensure no unacceptable risks emerge at the interfaces.

Organisations should consider where it is appropriate to have approval and sign-off gateways and ensure that this is outlined within contracts.

5.7.1 Procured equipment

Organisations should ensure that procured equipment has been designed and evaluated using appropriate and structured design risk assessment processes, and there are mechanisms in the specifications to ensure suitable RRMs are implemented. This should be supplemented with appropriate assurance activities.

Organisations should evaluate procured equipment to include an appropriate technical due diligence (TDD) activity. This should include:

- ability to adequately isolate any stored energy from the system;
- guarding;
- hazards and associated RRMs relating to routine maintenance;
- hazards and associated RRMs relating to non-routine maintenance;
- health, safety and environmental Hazards during manufacturing processes;
- H&S hazards during build/installation;
- recyclability of the asset components;
- lessons learned;
- performance guarantees;
- decommissioning implications, and
- sustainability of equipment.

An effective TDD requires appropriate planning, suitable competence from the review team, engagements from the equipment supplier and for it to be completed early enough to allow time for the implementation of any changes that are considered necessary. It may not be practical to complete a TDD on all procured equipment. Therefore a risk-based approach should be taken. The TDD should identify any specialist tooling needed and any specific competency requirements.

The TDD should be documented, the outputs entered into the DRR, and actions tracked.

5.7.2 Outsourced activities

Outsourced activities such as substructure design, transfers risk management decisions to the supply chain, however, the asset owner/developer still retains overarching H&S responsibility. The contract should clearly articulate the H&S objectives and the key design criteria necessary to achieve it. Where possible, prescriptive requirements with regards to safety justification and RRMs should be included in contracts. Where this is not possible, an appropriate approval process should be developed and specified. This should ensure that the design decisions that have a significant impact on the hazards are documented with a design risk assessment and are subject to client review and approval.

Production of specifications and contractual requirements

Organisations should ensure that specifications are produced with an objective of achieving good SBD outcomes. Specifications should clearly outline the safety goals and requirements and cascade those set out at the project level into the supply chain.

Organisations should ensure the specification and contract requires the supplier to:

- Provide an explanation of how they will deliver the scope in way that complies with the SBD principles, and their SBD plan.
- Provide all data necessary for effective management of the asset through its lifecycle (see 7.2).
- Participate in project-level risk reviews.
- Maintain a DDL and risk register and this should be regularly reported to the asset owner/developer for review and approval.

- Demonstrate consideration of risks through the lifecycle.
- Demonstrate that they have considered available RRMs, and those not incorporated are grossly disproportionate.
- Consider and assess operability and maintainability (see 7.3).
- Consider and assess escape and evacuation should be demonstrable (see 7.4).
- Undertake specific studies and assessments of interfaces.
- Communicate residual risks to the asset owner/developer, including justification and the asset phase in which the risk may manifest.
- Include appropriate review points with the asset owner/developer in their schedule.

5.8 ADOPTION OF NEW TECHNOLOGIES

The adoption of new technology or concepts will invariably change or introduce new hazards. Organisations should implement a process for assessing the maturity of the technology alongside the associated H&S risks. When assessing new technology, the extent of the conditions for testing the prototypes should be compared with the expected operational criteria.

New technology is at a greater risk of significant unplanned non-routine modifications in the operational phase than proven technology. These non-routine activities could introduce significant hazards therefore consideration should be given to how any issue would need to be resolved.

New technology also introduces specific risks when applied within a system as new hazards can emerge at the interfaces. There should be specific activities to identify any systemization risks and appropriate controls implemented.

New technology may also require changes to existing operational processes and competency requirements. It should therefore be considered a change management topic.

6 DEVELOPMENT

6.1 PROJECT H&S PLAN

During the development phase, organisations should identify H&S objectives for the project and asset. These should be documented in a project H&S plan which should outline how they will be achieved.

During development, site selection and conceptual design, decisions will embed key constraints therefore even at this early stage a hazard review should be carried out. This should identify any key features that will influence risks during the project (including construction), asset operations and decommissioning. This could include the expected deployment of new technology, weather or environmental factors or issues relating to the site location.

The H&S and SBD plans should set out how safety engineering will be implemented. This should include how SBD will be integrated into the engineering design and project management frameworks. Specifically, this should describe how:

- Hazard reviews will be used to support design decision making.
- Residual risks will be made visible and considered during design reviews and project approval gateways.
- SBD will be part of the project monitoring and reporting processes with appropriate leading and lagging indicators.
- There will be suitable competency levels with respect to SBD.
- The H&S plan should outline the initial assumptions for logistics, access and egress, and emergency response.
- The H&S plans may have a specific name and requirements in some regions.

6.2 EARLY DESIGN

Design in development should be a process where a wide number of options are appropriately narrowed to a sufficiently mature design that can be crystalised in the detailed design phase. This is shown conceptually in Figure 7, and this could apply to the overall design or part of it. A structured approach should be implemented that de-risks the design as far as practicable and avoids ‘locking in’ H&S risk.

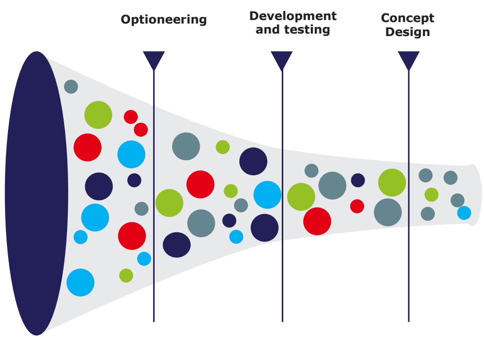


Figure 7 – Generic design development process

It is likely that some risk reduction decisions cannot be made without carrying out some scenario analysis. This could include technical analysis, modelling and reviewing options against H&S criteria. The project should consider where scenario analysis is needed to support its decision-making process and allocate sufficient resources to adequately complete it.

6.3 OPERATIONS AND MAINTENANCE PHILOSOPHY

Organisations should ensure that an O&M philosophy is produced to establish, record, and communicate the long-term vision for the operational phase of the asset. This is to help the project adopt a long-term, holistic approach, and to develop and establish expectations.

The O&M philosophy should include:

- Objectives and goals.
- Anticipated maintenance strategies.
- Logistics plan covering how material will be transported to the asset and then to the point of work.
- Strategy for the management of fire risks.
- Emergency response plan.
- A description of how safety procedures and safe system of works will be applied.

Where the asset will be implemented into an operational portfolio of assets, then the O&M philosophy should also describe how the asset will be integrated into an existing asset management structure.

The O&M philosophy should be used during the detailed design stage as a key part of the design specification. Organisations should develop the O&M philosophy at an early stage to support early HAZID and ensure that the appropriate site-specific context is established when undertaking hazard reviews and risk assessments.

The development of the O&M philosophy should include an appropriate range of stakeholders with suitable understanding of O&M.

6.4 DECOMMISSIONING PLAN

Organisations should ensure that an initial decommissioning plan is developed to ensure there is a clear plan for the decommissioning phase of the asset.

The purpose of this is to:

- Ensure the approach to decommissioning is considered during detailed design.
- Record the decommissioning hazards associated with the concept.
- Document expected permitting requirements in relation to decommissioning.
- Describe how asset material will be recycled.
- Identify any components that can't be recycled using contemporary technology.

The decommissioning plan should be reviewed regularly through the project and asset's useful life.

6.5 IMPLEMENTATION OF LESSONS LEARNED

Organisations should ensure that the relevant lessons learned from previous projects, operational sites, and the industry are considered, and where appropriate, steps are taken to mitigate the likelihood of reoccurrence.

7 DETAILED DESIGN

Prior to detailed design, organisations should identify and record the design basis standards that are required to ensure integrity and meet applicable legal, regulatory, and statutory requirements. Where approved good practices, and established design practices exist, they should be implemented, or the deviations justified.

7.1 INTERFACE MANAGEMENT

Organisations should plan specific activities to effectively manage interfaces. These could be interfaces within the asset, interfaces with the external energy system, contractual responsibilities, or areas of project responsibility. Resource should be provided to manage and coordinate interfaces with a specific responsibility to consider H&S issues. The contractual interfaces where there is the potential for an emergent hazard should be identified and management arrangements put in place.

7.2 MANAGEMENT OF DEGRADATION AND DETERIORATION

During design the potential for major degradation giving rise to hazards should be avoided or managed. This should include activities to understand the likelihood and rate of degradation, and its impact on risk levels.

This should include:

- Identifying deterioration and failure modes that may impact the primary functional requirement.
- Understanding the drivers for the deterioration and failure modes and the impacts that deterioration and failures might have on value and cost outcomes.
- Evaluating options for the mitigation of deterioration and failures (e.g. as an input to the design of the major asset in terms of resilience, redundancy and maintainability and evaluating prediction and detection methods).
- Evaluating RRMs (e.g. to reduce the consequences of failure) and recovery methods (e.g. to restore functionality, performance, reliability and availability).
- Identifying, and minimising, where degradation is expected and there are difficulties carrying out inspections in operations.
- Assessing the time between detectable degradation and loss of function/catastrophic failure.

7.3 DESIGN FOR CONSTRUCTABILITY, OPERABILITY, MAINTAINABILITY AND DECOMMISSIONING

Organisations should ensure that the design adopts a holistic and ‘whole life’ perspective. This is a key objective of the SBD philosophy. The design should explicitly and demonstrably consider constructability (including transportation), operability, maintainability, and requirements for decommissioning.

Specific considerations include:

– management of stored energy and safety from the system;
– isolation requirements, ensuring they can be easily and effectively implemented;
– remote operation of switches and points of isolations;
– position of anchor points;
– manual and materials handling (from good inwards, through to point of work including lifting arrangements);
– logistics including personnel access;
– complex and non-routine activities;
– security requirements;
– lifting requirements;
– access for maintainability/repairability;
– ability to inspect for the degradation mechanisms;
– location of any non-inspectable areas;
– cyber security;
– lighting;
– site communications;
– bunding;
– chemicals, gasses, and fuels;
– prevention of falls from height and dropped objects;
– prevention of slips, trips and falls;
– access and egress routes;
– fire prevention;
– confined spaces;
– subsea work and diving, and
– environmental discharge.

Effective design for constructability, operability, maintainability and decommissioning will require the input from a wide range of stakeholders.

Human factors and ergonomics should be considered throughout the design process to ensure that the asset is designed around the foreseeable tasks. This should include a consideration of how people can potentially impact the safe operation of the asset. For example, the design should include error-proofing principles and interlocks where appropriate. The application of these should be based on a human factors assessment. It should be ensured that safety devices are selected and designed in way to prevent a possibility that they can be defeated when in use.

Where practicable, enclosed and restricted spaces should be avoided and where this is not possible, the design should include appropriate access and egress arrangements. Consideration should be given to the type of work that may take place in the enclosed space and the possibility that normal access, emergency rescue, parts and equipment, ventilation hoses and/or power cables may be required. The design of the asset should include multiple points of access and egress and where this is not considered to be practicable, a specific documented risk assessment that provides justification produced.

During the design process, the reasonably foreseeable maintenance activities should be identified (including unplanned activities). Where there is an expectation that a replacement of a particular part of the asset will be required, consideration should be given to the inclusion of specific permanent features to reduce the risks of the activity. The materials handling requirements, such as size and weight of components and the expected frequency, should be identified. Task-based analysis should be completed to assess how the required equipment could be transported to the point of work and the proposed methodology should be reviewed and if acceptable recorded. This should be an iterative process through the design phase, and it should become more detailed as the design matures and becomes more defined. This requires the project developer to have sufficient knowledge and awareness to provide adequate reviews of the proposed methodologies. The design process should ensure that the end-to-end logistics activity is optimised, and equipment such as lifting bags are considered as part of the design. A lighting study should be carried out to ensure appropriate lighting throughout all stages of the logistics process.

Organisations should ensure that the project proactively seeks learnings from operational assets and construction from similar projects and where appropriate, incorporate it into the design.

The O&M philosophy [6.3] and decommissioning plan [6.4] should be updated with additional information as the design matures and further detail can be included. Any deviations to the requirements outlined should be subject to formal change control and approval.

7.4 DESIGN FOR ESCAPE AND EVACUATION

Regardless of the efforts put into reducing the likelihood of hazards occurring during design, organisations should consider emergency situations. Specifically, an assessment of the emergency response arrangements that should be carried out including the realistic time for enactment. This should consider (1) evacuation situations where personnel can leave the asset in a planned, managed, and controlled way, without being directly exposed to hazards, and (2) escapes where there isn't sufficient time to execute an orderly evacuation.

This should include as a minimum:

- Access and egress arrangements including safe routes of escape and alternative routes, routes in dark or smoke, markings on floors and emergency lighting.
- Consideration of position and type of detectors, their sensitivity, how much warning before a situation could escalate.
- Consideration of segregation of people from hazards and safe havens.
- Type and positioning of life saving kit, escape chutes, life rafts, etc.
- Design of safety equipment for ease of use including in the dark or in smoke.
- Method of communications in emergency such as automatic systems for communication of positions of the emergency and people.
- Consideration of the placement of manual alarm raising points.
- Use of low flammability materials, low smoke, low toxicity smoke materials.

This should be recorded in an initial emergency response and fire management plan.

7.5 SAFETY CRITICAL SYSTEMS

Organisations should identify safety critical systems, establish performance standards in terms of functionality, reliability, availability, survivability alongside interactions and dependencies, and inspection, and define maintenance strategies. This should include the setting for alarms and trips and identify where limits are close to failure point. Performance standards should be measurable and auditable.

7.6 DESIGN FREEZE AND DESIGN CHANGE MANAGEMENT

Organisations should ensure that the project has a clear design freeze stage where the design is documented, and design change management is introduced. It may be necessary to apply design freeze to the elements of the project at different times, and if so, an overarching configuration management plan should be implemented. For example, design freeze could be an assumption in the approved project basis of design, an entry in the project design log, an approved technical specification, a drawing issued to a contractor as approved for construction (AFC). Organisations should therefore ensure that there is appropriate control and coordination across the project. The timing of design freeze will be dependent on each project, and it is generally convenient to align it with overall project gateways, however the design should be sufficiently mature and well developed.

At the time of design freeze the following should be recorded:

- hazards and implemented RRMs;
- design drawings and design documentation;
- residual risks, and
- 'open' design decisions.

Following the design freeze, formal design change management processes should be implemented. This should include a process for assessing and approving changes to the design and the use of a design change log to record the change and the justification. Specific attention should be paid to:

- change in isolations points;
- change of hazards and previous risk assessments;
- changes to design assumptions;
- changes impacting O&M;
- changes impacting emergency plan;
- changes impacting material handling;
- changes impacting decommissioning, and
- design reviews.

Organisations should ensure that there is a programme of meaningful design reviews. These should include operational and H&S specialists. These shall be formal project gateways and include the satisfactory completion of the activities set out in this GPG.

7.7 DESIGN VERIFICATION AND DESIGN ASSURANCE

Organisations should ensure that there are appropriate design verification and assurance activities.

This should include verification that the design is compliant with standards and codes, and assurance that:

- design satisfies the H&S objectives;
- design appropriately considers constructability, operability, maintainability and decommissioning;
- residual risks are acceptable, and
- RRMs have been effectively implemented.

It may be necessary for the design, or part of the design, to be subjected to an independent verification by an external organisation. As a minimum the design verification should include individuals who are independent from the project.

8 CONSTRUCTION

8.1 WORK SCHEDULING

Organisations should consider the sequencing and scheduling of the work to minimise the risks associated with simultaneous activities. This should include a plan for the application of safety rules through the build and commissioning including when different safety rules will be applied and the authorisation process.

Organisations should ensure that asset energisation is appropriately managed with a process that includes appropriate assurance and authorisation.

8.2 MANAGEMENT OF TEMPORARY WORKS

The design of temporary works should be subject to the same principles set out of the permanent asset.

Where temporary works interact with the permanent asset, organisations should consider the additional loads that are applied and how these relate to the design load cases and impact on the short and long-term life.

Where there is a non-negligible impact, sufficient analysis should be conducted to assess the impact on the asset followed by suitable approvals before commencement.

8.3 QUALITY

Organisations should implement a risk-based quality plan that considers the identified hazards and complexity and risks of managing issues in the construction, operation and/or decommissioning. The surveillance schedule should consider the time needed to implement any critical items without impacting the overall construction schedule. When assessing concessions and non-conformities the impact on the assessed hazards and likelihood of future non-routine and complex rectification work should be considered. The justification of accepting deviations should be documented and form part of the asset information.

During construction, specific quality checks should be undertaken on critical areas exposed to degradation that cannot be inspected during operational life. There should be quality checks of the measurements of any H&S critical parameters.

The quality plan should specifically and demonstrably cover activities to ensure any safety related system is installed and commissioned as intended and it complies with the performance requirements.

8.4 DESIGN CHANGE

During construction the design change management process should continue with the same approval process for justifying change.

Capturing Lessons Learned

Through construction there should be a lessons learned register that records where the hazards during construction could have been reduced with alternative design decisions.

9 ASSET ADOPTION

9.1 HANDOVER

The handover from construction to operations is a critical phase in the asset lifecycle and organisations should ensure that it is appropriately managed through a specific handover plan.

This should include:

- recording and transfer of asset information;
- communication of key risks (and where they may manifest);
- provision of design information;
- information regarding degradation mechanisms and drivers;
- design assumptions;
- unresolved non-conformities;
- establishment of safe system of work processes;
- emergency response plan;
- competency requirements;
- any snags/punch list items with a plan for rectification;
- alarm management plan identifying which alarms can be reset, those that need further investigation and protocols;
- asset register, and
- residual risks following risk assessment and actions during design.

The handover plan should be produced and agreed between senior representatives from the construction and operations departments. It is likely that the handover will be a phased transition over several months. The timeline of transfer of responsibilities should be clearly described and there should be regular reviews between relevant stakeholders.

9.2 CONVERSION OF DESIGN INFORMATION INTO OPERATIONS DOCUMENTS

Organisations should ensure that documentation necessary to manage the asset in accordance with the H&S objectives is produced and accessible. This should include:

- maintenance manuals;
- maintenance scope and frequencies;
- inspection criteria (i.e. acceptance levels);
- inspection scope and frequencies;
- expected degradation rates, and
- isolation procedures.

10 OPERATIONS

10.1 DESIGN VALIDATION

Organisations should plan and implement activities to validate the design assumptions. This should include:

- Degradation rates and performance of any parts of the design intended to control degradation.
- Magnitude and frequency of the applied loads.
- Environmental conditions.

Any deviations should be reviewed and assessed to understand the significance and where appropriate, mitigation actions implemented.

10.2 MAINTAINING THE H&S OBJECTIVES

GIP is not static, and over the operating life of an asset there will be a change in the way the industry manages particular risks, and new technology will be available. Organisations should assess this and where appropriate, adopt increases in GIP. Risk assessments should be reviewed regularly, and procedures updated accordingly.

Organisations should review changes to external factors, assess their impact on hazards and risk profile and where appropriate update the RRMs.

10.3 EMERGENCY RESPONSE

Where an emergency response is a RRM, organisations should carry out trials to assess the effectiveness and determine if it is adequate. This should also consider the time taken to enact compared to the speed a hazard may escalate. There should be an ongoing programme of drills, to test the effectiveness of the emergency response plan and help drive safety culture.

10.4 INSPECTION, MAINTENANCE AND MONITORING

Organisations should implement processes for planning, executing, and recording appropriate inspection and maintenance. The asset care requirements will change as the asset ages therefore the original regime should be periodically reviewed and updated. This should include quality checks and audits of the activities that influence key H&S risks.

The O&M activities will inevitably use technicians that work on a number of sites with different technology. The site induction should clearly describe any features of the asset that may be unique or require special attention in relation to safety.

Any temporary works should be designed in accordance with 8.2.

10.4.1 Events outside design basis and significant damage

In the event of significant events that will put loads through the system that are outside the design basis, or where there is significant damage through heat damage, then organisations should complete an assessment to understand the risks prior to undertaking the repair and returning the asset to service.

10.4.2 Monitoring activation of safety systems

During operation, the activation of organisations safety systems should be monitored and specifically where they are the 'last line of defence'. Activation should be considered to be a 'near hit' with appropriate investigation and, where appropriate, remediation carried out. There should be a planned maintenance programme in place with test results recorded. There should also be a process for managing any deterioration in performance levels.

10.5 ASSET MODIFICATIONS AND BROWNFIELD PROJECTS

Organisations should implement a process for managing modifications to the asset. This should include the definition of authority to approve changes, the documentation requirements, risk assessment. The process should include a consideration of the points of isolation, existing practices, competency requirements. The design process should follow the principles outlined in Section 7, but a level to commensurate with the extent and risks associated with the modification. Software changes, changes to maintenance regimes, temporary changes, and alarm changes (particularly where critical) should also be subjected to an appropriate change management process.

Where it is necessary to carry out a brownfield project the complexity, interface with operational arrangements, capacity, and competency for the operations team should be considered. This should be used to assess the necessary management arrangements.

Any temporary works should be designed in accordance with 8.2.

10.6 CAPTURING OPERATIONAL EXPERIENCE

Organisations should ensure that operational experience relating to H&S is captured, suitably arranged, and made available to the team designing new projects.

Incidents that include design as a cause should be identified, investigated, and fed back into new projects.

10.7 LIFE EXTENSION

Organisations should ensure the transition into a life extension is subject to a change management plan. Any life-extension approval requires an understanding of time degradation mechanisms and operational experience.

A specific integrity management plan should be implemented to manage the increased risks presented by going beyond the design life.

10.8 DECOMMISSIONING PLAN REVIEW

At suitable times, organisations should review the decommissioning plan. Specific consideration should be given to any changes or improvements in relevant GIP since previous iterations. The implications of any relevant changes in asset condition and integrity should also be considered.

The decommissioning plan should consider the residual life (e.g. corrosion allowance) necessary to complete the project, including any contingency.

Organisations should review the expected decommissioning methodology and identify opportunities to reduce risks (for example, through the development of new technology) and allocate appropriate resource to realise the potential benefits.

11 DECOMMISSIONING

11.1 PLANNING

Organisations should ensure that decommissioning planning commences well in advance of the end of the Useful Life and be based on the decommissioning plan developed and maintained through the asset's life (see 6.4 and 10.8). The supply chain and other key stakeholders should be involved during decommissioning planning and the same HAZID and risk reduction principles outlined in Section 5 should be used and relevant asset information should be provided to the decommissioning team.

Any temporary works should be designed in accordance with 8.2.

11.2 DEGRADATION ASSESSMENT

Decommissioned assets provide an opportunity to assess its performance and degradation to help inform new designs. Organisations should develop a plan that identifies any specific areas of the asset that are considered suitable for investigation.

12 IMPLEMENTATION SUGGESTIONS

The SBD GPG sets out a comprehensive framework for managing safety through the lifecycle. The framework includes several elements, and it is recognised that it will take time for organisations to fully implement the associated requirements. However, each part will generate value and it is not necessary to implement all the parts of the GPG in their entirety to start yielding benefits.

Organisations should consider their specific context, including the nature of the development projects and operational assets, the organisational design and structure and prescriptive local regulations when producing their own plan to improving their approach to SBD. The GPG should therefore be reviewed and converted into organisational specific systems and processes.

A good starting point is to review what is already in place. The review could be in the form of a compliance matrix against the checklist in Appendix B. Existing frameworks may use different terminology, which is entirely acceptable, so it is important to focus on the requirements and assess where these are being implemented. Existing processes and 'ways of working' are a good platform as they can be supplemented and built upon without requiring radical change.

When this is complete, an organisation will have a clear understanding of the gaps and existing processes that act as the initial building blocks. This can then be used to develop an 'SBD improvement plan'. This should consider any quick-wins, resources and capability available, the benefit that can be derived based on the nature of the project and asset portfolio and interfaces with other frameworks and management systems.

It is important that the 'SBD improvement plan' includes a strong stakeholder engagement element as it will invariably require the introduction of new process. It is also important that there is demonstrable senior leadership support and the progress is reported upon.

It is important that leading and lagging SBD performance metrics are implemented to help prioritise elements within the 'SBD improvement plan' and provide a means of routinely communicating SBD to the organisation.

It is important that there is a single person who is responsible for overseeing the delivery of the 'SBD improvement plan'. They will need to coordinate activities across a number of functions, so they need sufficient seniority to influence and drive change.

It takes time for processes to become embedded and tested, so it is important that adoption and adherence levels are reviewed periodically.

In summary, the key to an organisation successfully implementing the SBD GPG is it digesting the requirements and developing a 'SBD improvement plan' that is suitable for them, providing it with sufficient resource and ensuring there is senior level support.

12.1 IMPLEMENTATION CHECKLIST

Please click here to download this checklist as an excel file.

1. Generic requirements				
Item	Question	No	Partial	Yes
1.1	Risk management and hazard reviews			
1.1.1	Is there a systematic approach to HAZID, prevention and mitigation throughout the organisation?			
1.1.2	Is there a continuous process of hazard reviews taking place at appropriate times in the project and asset lifecycle?			
1.1.3	Do hazard reviews include input from a suitable range of stakeholders, including operational personnel and H&S specialists, with sufficient competence to assess the full range of hazards?			
1.1.4	Where multiple hazard reviews are carried out, is there a process to ensure they collectively cover all hazards, and the interrelationships between RRMs are understood and managed?			
1.1.5	Are hazard reviews a key part of a project schedule and do they link to formal project gateways?			
1.1.6	Are equipment suppliers or entities delivering outsourced activities required to carry out hazard reviews?			
1.1.7	Where it is necessary to conduct further analysis to fully assess risk levels, can it be demonstrated that this is suitable and proportionate to the hazard?			
1.1.8	Are hazard reviews recorded, including output, scope and attendees?			
1.1.9	Can it be demonstrated that proportionate and suitable RRMs and GIP are applied?			
1.1.10	Is there a process to ensure that necessary further RRMs are planned, allocated sufficient resource and their implementation monitored?			
1.1.11	Is there a process to ensure that decisions to not implement available RRMs, because they are considered to be grossly disproportionate, justified and documented?			
1.1.12	Are hazards that will be influenced by equipment suppliers or via outsourced activities identified, recorded and used to develop an appropriate management plans?			

1. Generic requirements				
Item	Question	No	Partial	Yes
1.1.13	Is there a demonstrable link between the output of the hazard reviews and the risk management activities in the design process, and the DDL?			
1.1.14	Are there activities to understand relevant GIP, and is this adhered to unless there is clear justification to deviate?			
1.1.15	Is the effectiveness of RRMs assessed and, where appropriate, is consideration given to implementing further measures?			
1.1.16	When emergency response/emergency evacuation is a stated RRM, does the hazard review include an assessment of the rate of escalation to understand how quickly it would need to be enacted in real world situations?			
1.1.17	Are residual risks (i.e., those that are considered to be acceptable) clearly recorded in a risk register, which clearly states which phase(s) they may manifest and the assumptions the assessment is based upon?			
1.1.18	Are there activities to monitor the continued application of the RRMs to ensure their ongoing effectiveness, identify whether the risk level has increased, and the basis for the prior evaluation has not changed?			
1.1.19	Is residual risk information and RRMs transferred to relevant stakeholders through the lifecycle?			
1.2	HOC			
1.2.1	Is the HOC concept used when making decisions regarding risk management and the selection of suitable RRMs?			
1.3	Decision making			
1.3.1	Is there a structured process for decisions related to H&S?			
1.3.2	Is there oversight for critical H&S decisions that considers the complexity of the decision, uniqueness of the decision, worst-case consequence if there is an error in decision making, the extent to which GIP can be used to support the decision, level of uncertainty in the input information and analysis, and the number of stakeholders affected?			
1.3.3	Does the decision-making process relating to H&S account for human factors, which can be a source of error, and are steps taken to minimise the risk of adverse outcomes?			

1. Generic requirements				
Item	Question	No	Partial	Yes
1.3.4	Where possible are decisions relating to H&S fact-based and data driven?			
1.3.5	Do DSTs relating to H&S have an owner who is responsible for ensuring that they are suitable, the outputs are valid and consistent, there is appropriate quality control, they are used consistently, implemented effectively, changes are appropriately managed and there is a feedback loop that includes an assessment of the outcomes?			
1.3.6	Where appropriate, are decisions relating to H&S codified into an organisation's management system and technical specifications? Where this approach is taken is there a clear scope that describes the applicability and any limitations and constraints?			
1.3.7	Is there appropriate rigour and assurance including peer reviews, impact assessment and implementation plans for new specifications and processes relating to H&S?			
1.3.8	Are specifications and processes relating to H&S subject to version control and change management?			
1.4	Asset information management			
1.4.1	Is there an asset information strategy that provides a 'single source of truth' and includes the information requirements necessary to safely manage the asset?			
1.4.2	Is a philosophy of 'right information, to the right people, at right time' adopted and can this be demonstrated?			
1.4.3	Are there activities to identify and understand the information that may be required to effectively manage H&S risks throughout an asset's lifecycle?			
1.4.4	Is asset information maintained and updated where necessary including hazard and risk registers, assumptions DDL, design information, as built records, O&M manuals, modification register, and an asset register?			
1.4.5	Do relevant stakeholders have access to the necessary information and is this managed through a document management system?			
1.5	Safety culture			
1.5.1	Is there a programme or initiative to establish the right organisational culture for effective management of H&S?			

1. Generic requirements				
Item	**Question**	**No**	**Partial**	**Yes**
1.5.2	Are there activities to: – Establish shared values by communicating the safety and environmental objectives. – Ensure engagement and involvement from all organisational levels. – Include contracting organisations within initiatives and reviews. – Provide transparency in process and decisions. – Enable freedom to challenge and provide alternative viewpoints. – Promote continuous improvement.			
1.5.3	Is an environment that supports effective teamwork, collaboration, and challenge promoted?			
1.6	Assurance			
1.6.1	Are quality plans implemented that are risk-based considering the hazards and H&S risks?			
1.6.2	Is there a demonstrable alignment between the hazards and RRMs, and the activities included in the inspection and surveillance plan?			
1.6.3	Is there a design assurance programme that is included in the project reporting process, and does this include leading and lagging indicators that are appropriate for each phase of the project?			
1.7	Management of procured equipment and outsourced activities			
1.7.1	Are appropriate controls implemented for procured equipment and outsourced activities to ensure they conform to H&S objectives?			
1.7.2	Are there processes to ensure there is sufficient assurance and oversight in place for procured equipment and outsourced activities?			
1.7.3	Is consideration given to the extent prescriptive requirements can be applied at interfaces between contracts?			
1.7.4	Can it be demonstrated that the compatibility between different suppliers' equipment and design is assessed to ensure no unacceptable risks emerge at the interfaces?			
1.7.5	Can it be demonstrated that appropriate approval and sign-off gateways are identified to provide the necessary oversight and control, and that these are outlined within contracts?			

1. Generic requirements				
Item	Question	No	Partial	Yes
1.7.6	Are there processes to ensure that procured equipment has been designed and evaluated using appropriate and structured design risk assessment processes, and there are mechanisms in the specifications to ensure suitable RRMs are implemented?			
1.7.7	Are there TDD assessments to evaluate procured equipment against H&S requirements, including: – Ability to adequately isolate any stored energy from the system. – Guarding. – Hazards and associated RRMs relating to routine maintenance. – Hazards and associated RRMs relating to non-routine maintenance. – Health, safety and environmental hazards during manufacturing processes. – H&S hazards during build/installation. – Recyclability of the asset components. – Lessons learned. – Performance guarantees. – Decommissioning implications. – Sustainability of equipment.			
1.7.8	Is there a process to ensure that design decisions made by equipment suppliers and external designers that have an impact on H&S are subject to a design risk assessment and require review and approval?			
1.7.9	Is there are process to ensure that specifications are produced with an objective of achieving good SBD outcomes?			
1.7.10	Are the safety goals and requirements clearly defined at the project level and cascaded into the supply chain?			
1.8	Adoption of new technologies			
1.8.1	Is there a process for assessing the maturity of the technology alongside the associated H&S risks?			
1.8.2	When assessing new technology, are conditions for testing the prototypes compared with the expected operational criteria to assess applicability?			

1. Generic requirements				
Item	Question	No	Partial	Yes
1.8.3	Are non-routine activities that could result from unproven technology and introduce significant hazards considered and appropriate mitigations implemented?			
1.8.4	Are there specific activities to identify any systemisation risks and appropriate controls implemented?			
1.8.5	Are changes to existing operational processes and competency requirements due to new technology assessed and appropriate change management implemented?			

2. Development phase				
Item	Question	No	Partial	Yes
2.1	Project H&S plan			
2.1.1	Is a H&S plan produced in the development phase?			
2.1.2	Does the H&S plan identify key risks for the construction, operations and decommissioning phases? Does this include, for example, the expected deployment of new technology, weather or environmental factors, or issues relating to the site location?			
2.1.3	Does the H&S plan set out how hazard reviews will be used to support decision making?			
2.1.4	Does the H&S plan set out how residual risks will be made visible to relevant stakeholders and considered during design reviews and project approval gateways?			
2.1.5	Does the H&S plan set out how SBD will be part of the project monitoring and reporting processes with appropriate leading and lagging indicators?			
2.1.6	Does the H&S plan set out how there will be suitable competency levels with respect to SBD?			
2.1.7	Does the H&S plan set out how risk assessment tools will be adopted and the outputs used directly in the design process?			
2.1.8	Does the H&S plan outline initial assumptions for logistics, access and egress and emergency response?			
2.2	Structured approach to early design			
2.2.1	Is there are structured approach to early design?			

2. Development phase				
Item	Question	No	Partial	Yes
2.2.2	Are early design scenarios, analysis, modelling and options reviewed and compared against H&S criteria?			
2.3	O&M philosophy			
2.3.1	Is an O&M philosophy produced in the development phase?			
2.3.2	Does an O&M philosophy in the development phase establish, record and communicate the long-term vision of the operational phase of the project?			
2.3.4	Does an O&M philosophy in the development phase include anticipated maintenance strategies?			
2.3.5	Does an O&M philosophy in the development phase include a logistics plan covering how material will be transported to the point of work?			
2.3.6	Does an O&M philosophy in the development phase include a strategy for the management of fire risks?			
2.3.7	Does the O&M philosophy include an initial emergency response plan?			
2.3.8	Does the O&M philosophy in the development phase describe how safety procedures and safe system of works will be applied?			
2.3.9	Does an O&M philosophy in the development phase describe how the asset will be integrated into an existing asset management structure?			
2.3.10	Is the O&M philosophy produced during the development phase linked to design specifications?			
2.3.11	Is the O&M philosophy produced with stakeholders with suitable understanding of O&M?			
2.4	Decommissioning			
2.4.1	Is a decommissioning plan produced in the development phase?			
2.4.2	Does the decommissioning plan record the decommissioning hazards associated with the design concept?			

2. Development phase				
Item	Question	No	Partial	Yes
2.4.3	Does the decommissioning plan document expected permitting removal requirements in relation to decommissioning?			
2.4.4	Does the decommissioning plan describe how asset material and components will be recycled?			
2.4.5	Does the decommissioning plan identify components that can't be recycled using contemporary technology?			
2.5	Lessons learned			
2.5.1	Are lessons learned systematically implemented?			
2.5.2	Are relevant lessons learned from previous projects considered during the development phase?			
2.5.3	Are relevant lessons learned from operational sites considered during the development phase?			
2.5.4	Are relevant lessons learned from the industry considered during the development phase?			

3. Detailed design phase				
Item	Question	No	Partial	Yes
3.1	Design basis			
3.1.1	Is a design basis produced that sets out requirements for integrity and applicable legal, regulatory, and statutory requirements?			
3.1.1	Does the design basis implement approved good practices, and established design practices exist, and/or justify deviations?			
3.2	Interface management			
3.2.1	Are there interface management activities that cover the physical asset, the external energy system, contractual responsibilities and projects responsibilities?			
3.2.2	Is there sufficient resource to effectively manage interfaces?			
3.2.3	Is there a specific responsibility to manage H&S considerations in the design process?			
3.2.4	Are management arrangements put in place where there is the potential for an emergent hazard at contractual interfaces?			
3.3	Management of degradation and deterioration			
3.3.1	Are there activities to avoid or manage degradation that could give rise to hazards?			

3. Detailed design phase				
Item	Question	No	Partial	Yes
3.3.2	During detailed design, are there activities to understand the likelihood and rate of degradation, and its impact on risk levels?			
3.3.3	During detailed design, are there activities to identify deterioration and failure modes that may impact the primary functional requirement and require strategies for through-life management?			
3.3.5	During detailed design, are there activities to evaluate options for the mitigation of deterioration and failures (e.g. as an input to the design of the major asset in terms of resilience, redundancy and maintainability and evaluating prediction and detection methods)?			
3.3.6	During detailed design, are there activities to evaluate RRMs?			
3.3.7	Where potential degradation has been identified during detailed design, is the ability to carry out inspections during the asset life-cycle assessed?			
3.3.8	During detailed design, are there activities to assess the time between detectable degradation and loss of function/catastrophic failure?			
3.4	Design for constructability, operability, maintainability and decommissioning			
3.4.1	Is a holistic and whole life perspective taken during detailed design that considers constructability, operability, maintainability and decommissioning?			
3.4.2	Does the design process address the management of stored energy and safety from the system?			
3.4.3	Does the design process address isolation requirements, ensuring they can be easily and effectively implemented?			
3.4.4	Does the design process provide remote operation of switches and points of isolations?			
3.4.5	Does the design process consider position of anchor points in relation to foreseeable routine and non-routine use cases?			
3.4.6	Does the design process consider manual and materials handling (from good inwards at the O&M warehouse, through to the point of work including lifting arrangements)?			
3.4.7	Does the design process consider logistics including personnel access?			

3. Detailed design phase				
Item	Question	No	Partial	Yes
3.4.8	Does the design process consider complex and non-routine activities?			
3.4.9	Does the design process consider security requirements?			
3.4.10	Does the design process consider lifting requirements?			
3.4.11	Does the design process consider access for maintainability/repairability?			
3.4.12	Does the design process consider ability to inspect for the degradation of mechanisms?			
3.4.13	Does the design process consider location of any non-inspectable areas?			
3.4.14	Does the design process address cyber security?			
3.4.15	Does the design process consider lighting requirements?			
3.4.16	Does the design process consider site communications?			
3.4.17	Does the design process consider bunding?			
3.4.18	Does the design process consider chemicals, gasses, and fuels?			
3.4.19	Does the design process address the prevention of falls from height and dropped objects?			
3.4.20	Does the design process consider prevention of slips, trips and falls?			
3.4.21	Does the design process consider access and egress routes?			
3.4.22	Does the design process consider fire prevention?			
3.4.23	Does the design process consider confined spaces?			
3.4.24	Does the design process consider subsea work and diving?			
3.4.25	Does the design process consider environmental discharge?			
3.4.26	Does the design process involve input from a wide range of suitable stakeholders?			
3.4.27	Are human factors and ergonomics considered through the design process?			
3.4.28	Does the design process ensure the asset is designed in consideration of foreseeable tasks?			

3. Detailed design phase				
Item	Question	No	Partial	Yes
3.4.29	Does the design process consider how people can potentially mistakenly impact the safe operation of the asset and appropriate measures taken (e.g. through error-proofing principles and interlocks)?			
3.4.30	Does the design process consider how safety devices could be defeated and appropriate measures taken?			
3.4.31	Does the design process consider learnings from operational assets, similar projects and the industry?			
3.4.32	Is the O&M philosophy updated during detailed design and further definition added?			
3.4.33	Is the decommissioning plan updated during detailed design and further definition added?			
3.5	Design for escape and evacuation			
3.5.1	Does the design process consider emergency situations?			
3.5.2	Does the design process consider the realistic time to enact an emergency plan?			
3.5.3	Does the design process consider situations where personnel can leave the asset in a planned, managed, and controlled way, without being directly exposed to hazards?			
3.5.4	Does the design process consider escapes where there isn't sufficient time to execute an orderly evacuation?			
3.5.5	Does the design process consider access and egress arrangements including safe routes of escape and alternative routes, routes in dark or smoke-filled environment, use of markings on floors and emergency lighting?			
3.5.6	Does the design process consider the position and type of smoke and fire detectors, their sensitivity and how much warning before a situation could escalate?			
3.5.7	Does the design process consider segregation of people from hazards and safe havens?			
3.5.8	Does the design process consider the type and positioning of life saving kit, escape chutes, life rafts, etc.?			
3.5.9	Does the design process consider method of communications in emergency such as automatic systems for identifying the locations of people?			

3. Detailed design phase				
Item	Question	No	Partial	Yes
3.5.10	Does the design process consider the placement of manual alarm raising points?			
3.5.11	Does the design process consider use of low flammability materials, low smoke, and low toxicity smoke materials?			
3.5.12	During design, is an emergency response and detailed fire management plan produced?			
3.6	Safety critical systems			
3.6.1	Does the design process identify safety critical systems?			
3.6.2	Does the design process establish performance standards in terms of functionality, reliability, availability and survivability?			
3.6.3	Does the design process establish interactions and dependencies of safety critical systems?			
3.6.4	Does the design process define appropriate inspection and maintenance strategies for safety critical systems?			
3.6.5	Does the design process establish settings for alarms and trip setting, and identify how close these are to failure points?			
3.6.6	During design, are measurable and auditable performance standards established?			
3.7	Design freeze and design change management			
3.7.1	During design, is there a planned design freeze process where the design is documented and design change management is introduced?			
3.7.2	At the point of design freeze, are hazards and implemented RRMs, design drawings and documentation, residual risks and ‘open’ design decisions recorded?			
3.7.3	Following design freeze, is there a change management process that includes review and approval to change and the use of a design change log?			
3.7.4	Following design freeze, does the change management process specifically consider any changes to isolation points?			
3.7.5	Following design freeze, does the change management process specifically consider any changes to hazards and previous risk assessments?			

3. Detailed design phase				
Item	Question	No	Partial	Yes
3.7.6	Following design freeze, does the change management process specifically consider any changes to design assumptions?			
3.7.7	Following design freeze, does the change management process specifically consider how changes will impact the O&M philosophy?			
3.7.8	Following design freeze, does the change management process specifically consider how changes will impact the emergency plan?			
3.7.9	Following design freeze, does the change management process specifically consider how changes will impact the material handling plan?			
3.7.10	Following design freeze, does the change management process specifically consider how changes will impact the decommissioning plan?			
3.8	Design reviews			
3.8.1	Does the project plan include a programme of meaningful design reviews?			
3.8.2	Do design reviews include input from operational and H&S specialists?			
3.8.3	Is the satisfactory completion of the activities required to manage H&S risks part of formal design reviews?			
3.9	Design verification and design assurance			
3.9.1	Does the design process include appropriate design verification and design assurance activities?			
3.9.2	Does the design process check compliance with standards and codes?			
3.9.3	Does the design process ensure that the design satisfies the H&S objectives?			
3.9.4	Does the design process ensure that there is consideration of constructability, operability, maintainability and decommissioning?			
3.9.5	Does the design process ensure that residual risks are acceptable?			
3.9.6	Does the design process ensure that RRMs have been effectively implemented?			
3.9.7	Does the design verification include individuals who are independent from the project?			

4. Construction phase				
Item	Question	No	Partial	Yes
4.1	Work scheduling			
4.1.1	Is the sequencing and scheduling of work considered with the objective of minimising the risks associated with simultaneous activities?			
4.1.2	Is there a plan for the application of safety rules through the build and commissioning phases, including when different rules will be applied and the authorisation process?			
4.1.3	Is there a plan to manage the energisation process with appropriate assurance and authorisation?			
4.2	Management of temporary works			
4.2.1	Is the management of temporary works subject to the same principles set out for the permanent asset?			
4.2.2	Where temporary works interact with the permanent asset, are the additional loads considered and how these relate to the design load cases and their impact on the short and long-term life?			
4.2.3	Where there is a non-negligible impact, is analysis carried out with a suitable approval required before commencement?			
4.3	Quality management			
4.3.1	Is there a risk-based quality plan that considers the identified hazards and complexity and risks of managing issues in the construction, operation and/or decommissioning?			
4.3.3	When assessing concession proposals and non-conformities, is the impact on hazards, and likelihood of future non-routine and complex rectification work, considered?			
4.3.4	Is the justification of accepting deviations documented and does this form part of the asset information?			
4.3.5	During construction, are quality checks undertaken on critical areas that are exposed to degradation and cannot be inspected during operational life?			
4.3.6	During construction, do quality checks include the measurements of any H&S critical parameters?			
4.3.7	Does the quality plan specifically and demonstrably cover activities to ensure safety related systems are installed and commissioned as intended and they comply with the performance requirements?			
4.4	Design change			

4. Construction phase				
Item	Question	No	Partial	Yes
4.4.1	Does the design change management process continue during the construction phase with the same approval process for justifying change?			
4.5	Capturing lessons learned			
4.5.1	Is there a lessons learned register that records where the hazards during construction could have been reduced with alternative design decisions?			

5. Asset adoption				
Item	Question	No	Partial	Yes
5.1	Handover			
5.1.1	Is there a specific handover plan to adopt and transfer the asset into operations?			
5.1.2	Does the handover plan include recording and transfer of asset information?			
5.1.3	Does the handover plan include communication of key risks (and where they may manifest)?			
5.1.4	Does the handover plan include the provision of design information?			
5.1.5	Does the handover plan include information regarding degradation of mechanisms?			
5.1.6	Does the handover plan include design assumptions?			
5.1.7	Does the handover plan include unresolved non-conformities?			
5.1.8	Does the handover plan include establishment of safe system of work processes?			
5.1.9	Does the handover plan include emergency response plan?			
5.1.10	Does the handover plan include competency requirements?			
5.1.11	Does the handover plan include any snags/punch list items with a plan for rectification?			
5.1.12	Does the handover plan include an alarm management plan identifying which alarms can be reset, those that need further investigation and protocols?			
5.1.13	Does the handover plan include asset register?			
5.1.14	Does the handover plan include residual risks?			
5.1.15	Is the handover plan agreed between senior representatives from the construction and operations departments?			

5. Asset adoption				
Item	Question	No	Partial	Yes
5.1.16	Does the handover plan clearly describe the transfer of responsibilities and the timeline?			
5.1.17	Is the handover plan subject to regular reviews between the relevant stakeholders?			
5.2	Conversation of design information into operations documents			
5.2.1	Is the documentation necessary to manage the asset in accordance with the H&S objectives produced and accessible?			
5.2.2	Are maintenance manuals provided to the operations department?			
5.2.3	Is the maintenance scope and frequencies provided to the operations department?			
5.2.4	Are inspection criteria (i.e. acceptance levels) provided to the operations department?			
5.2.5	Is the inspection scope and frequencies provided to the operations department?			
5.2.6	Are expected degradation rates provided to the operations department?			
5.2.7	Are isolation procedures provided to the operations department?			

6. Operations				
Item	Question	No	Partial	Yes
6.1	Design validation			
6.1.1	Is there a plan that includes activities to validate the design assumptions?			
6.1.2	Are there activities to assess degradation rates and performance of any parts of the design intended to control degradation?			
6.1.3	Are there activities to assess the magnitude and frequency of the applied loads and compare with design assumptions?			
6.1.4	Are there activities to assess environmental conditions and compare these with design assumptions?			
6.1.5	Are any differences between design assumptions and observations reviewed and assessed to understand the significance and where appropriate, mitigation actions implemented?			
6.2	Maintaining H&S objectives			

6. Operations				
Item	Question	No	Partial	Yes
6.2.1	Is there a plan to maintain H&S objectives in the operational phase?			
6.2.2	Is GIP monitored and action taken when there are improvements in risk management practices?			
6.2.3	Are risk assessments regularly reviewed and where necessary updated?			
6.2.4	Are external factors reviewed and, where there is a change, their impact on hazards and risk profile assessed and where necessary RRMs updated?			
6.3	Emergency response			
6.3.1	Is there a process to regularly review the emergency response plan?			
6.3.2	Are emergency response trials carried out to assess their effectiveness?			
6.3.3	Is the time required to enact an emergency response plan assessed and compared with the speed a hazard may escalate?			
6.4	Inspection, maintenance and monitoring			
6.4.1	Are there processes for planning, executing, and recording appropriate inspection and maintenance?			
6.4.2	Are the asset care requirements reviewed and updated as the asset ages?			
6.4.3	Are the technicians provided with information of any asset features that may be unique to the site and require special attention in relation to safety?			
6.4.4	Is the management of temporary works subject to the same principles set out for the permanent asset?			
6.4.5	Where temporary works interact with the permanent asset, are the additional loads considered and how these relate to the design load cases and their impact on the short and long-term life?			
6.4.6	Where there is a non-negligible impact, is analysis carried out with a suitable approval required before commencement?			
6.4.7	Are events that put loads through the system that are outside the design basis, or cause significant damage assessed prior to returning the asset to service?			
6.4.8	Is the activation of safety related systems monitored and are investigations undertaken where the 'last line of defence' system is deployed?			
6.4.9	Is there a process for managing any deterioration in the performance levels of safety related systems?			

6. Operations				
Item	Question	No	Partial	Yes
6.5	Asset modifications and brownfield projects			
6.5.1	Is there a process for managing modifications to the asset?			
6.5.2	Does the process include authority levels required to approve changes, the documentation requirements, and the requirements for risk assessment?			
6.5.3	Does the process include a consideration of the points of isolation, existing practices and competency requirements?			
6.5.4	Are software changes, changes to maintenance regimes, temporary changes, and alarm changes (particularly where critical) subject to an appropriate change management process?			
6.5.5	When complex brownfield projects are required, is the competency of the operations team considered and suitable construction support provided?			
6.6	Capturing operational experience			
6.6.1	Is operational experience relating to H&S captured, suitably arranged, and made available to team designing new projects?			
6.6.2	Are incidents that include design as a cause identified, investigated, and fed back into new projects?			
6.7	Life extension			
6.7.1	Is transition into a life extension subject to a change management plan?			
6.7.2	Does a life-extension approval process require an understanding of time degradation mechanisms?			
6.7.3	Is there a specific integrity management plan developed and implemented to manage the increased risks presented by going beyond the design life?			
6.8	Decommissioning plan review			
6.8.1	Is the decommissioning plan regularly reviewed?			
6.8.2	Is specific consideration given to any changes or improvements in relevant GIP since previous iterations?			
6.8.3	Are the implications of changes in asset condition and integrity considered when planning decommissioning?			

6. Operations				
Item	Question	No	Partial	Yes
6.8.4	Are there activities to review the expected decommissioning methodology and identify opportunities to reduce risks (for example through the development of new technology) and resources put into realising the potential benefits?			

7. Decommissioning				
Item	Question	No	Partial	Yes
7.1	Planning			
7.1.1	Does planning for decommissioning start well in advance of the end of the useful life of the asset?			
7.1.2	Is the decommissioning plan regularly reviewed and updated?			
7.1.3	Are the supply chain and other stakeholders involved in decommissioning planning?			
7.1.4	Are HAZID and risk reduction principles used?			
7.1.5	Is the relevant asset information made available to the decommissioning team?			
7.1.6	Is the management of temporary works subject to the same principles set out for the permanent asset?			
7.2	Degradation assessment			
7.2.1	Is the level of asset degradation assessed and fed back into the new designs?			
7.2.2	Is a plan produced to identify any areas of the asset considered suitable for investigation to support new designs and the operational management of other assets?			

This publication has been produced as a result of work carried out within the Technical Team of the Energy Institute (EI), funded by the EI's Technical Partners and other stakeholders. The EI's Technical Work Programme provides industry with cost effective, value adding knowledge on key current and future issues affecting those operating in the energy industry.

Energy Institute
61 New Cavendish Street
London W1G 7AR, UK

t: +44 (0) 20 7467 7100
e: pubs@energyinst.org
www.energyinst.org

9781787254336
ISBN 978 1 78725 433 6
Registered Charity Number: 1097899