NOPSEMA
Australia's offshore energy regulator

INFORMATION PAPER

Source control planning and procedures

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1. Purpose

A loss of well control (LOWC) incident is one of the biggest risks to the offshore petroleum industry, requiring thorough and detailed response planning so that impacts and risks can be reduced to as low as reasonably practical (ALARP).

The OPGGS (RMA) Regulations and OPGGS (Environment) Regulations contain provisions for LOWC response planning, control measures and arrangements. Interpretation of these provisions and methods, and information required to address the provisions within the permissioning documents, has been inconsistent.

The purpose of this Information Paper is to describe NOPSEMA expectations with regards to source control planning content of the Environmental Plan (EP), Well Operating Management Plan (WOMP) and the Source Control Emergency Response Plan (SCERP), and to describe the regulatory assessment focus of the EP and WOMP and the compliance monitoring inspection process and focus of the SCERP.

Additionally, in the event that a source control response is activated, vessel and drilling rig operators undertaking the response will require regulatory assessment and approval of the relevant Safety Cases. This Information Paper identifies the source control activities that would require a Safety Case to demonstrate the activity can be undertaken safely, and provides context regarding regulatory expectations of the Safety Case inclusions.

2. Source control planning documents

The OPGGS (RMA) Regulations and OPGGS (Environment) Regulations work together to ensure effective arrangements and planning for timely source control in the case of a loss of well integrity.

The WOMP requires demonstration of the ***engineering and technical suitability*** of the well design and integrity to enable source control measures for regaining well control.

As per Part 5 of the Commonwealth OPGGS (RMA) Regulations, a WOMP is required for each well. The WOMP must be a stand-alone document that is sufficient to meet the contents and level of detail requirements of the regulations without need for NOPSEMA to access other documents external to the WOMP. There may be descriptions of other documents in the WOMP, such as the SCERP, however the SCERP is not required to be submitted as part of the WOMP, and hence does not become part of the WOMP in force; only the descriptions of the SCERP become part of the WOMP in force.

- Reg. 5.09(1)(c) requires a description and explanation of the design, construction, operation and management of the well, showing how risks to the integrity of the well will be reduced to as low as reasonably practicable, including a description of the standards applied for planning the blowout contingency plan.
- Reg. 5.09(1)(k) requires a description of the measures and arrangements that will be used to regain control of the well if there is a loss of integrity. This includes a summary description of the blowout contingency plan and source control plan, demonstrating that the plan to regain control after a loss of well integrity is fit for purpose, based on a realistically modelled case, and will be available prior to commencing the well activity.

The EP requires demonstration of the ***effectiveness and timeliness*** of the control measures and arrangements to minimise the volume of hydrocarbon released to ALARP. It must demonstrate appropriate planning and preparedness arrangements to provide for effective and timely source control measures, and provide environmental performance standards for the timely deployment.

As per Part 4 of the OPGGS (Environment) Regulations 2023, the EP must demonstrate that the environmental impacts and risks of the activity will be reduced to as low as reasonably practical (ALARP) and include an appropriate implementation strategy, including an oil pollution emergency plan, to respond to an emergency and implement oil spill response control measures and arrangements.

- Reg. 21(5)(c): The environment plan must include … details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level;
- Reg. 22(3): The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to … emergencies and potential emergencies;
- Reg. 22(9)(a): The … emergency plan must include adequate arrangements for responding to … oil pollution, including … the control measures necessary for timely response to an emergency that results or may result in oil pollution;
- Reg. 22(12): The implementation strategy must include arrangements for testing response arrangements in the … emergency plan.

The SCERP is the ***response procedure*** used to plan and respond to a LOWC event.

The SCERP is not required to be submitted for assessment, but some of the content of the source control emergency response plan and arrangements must be presented in the WOMP and EP in sufficient detail to address the acceptance criteria of the WOMP and EP.

Under NOPSEMA's compliance monitoring program, the SCERP will be inspected immediately following WOMP acceptance and ideally a minimum of 30 days prior to spudding the primary well.

The SCERP should address:

- Arrangements for the provision of the Source Control IMT personnel (numbers, competency, capability for the duration of the response)
- Arrangements for the provision of equipment and supplies
- Arrangements for equipment and personnel monitoring and tracking
- Activation and mobilisation plans, including activation and expenditure authority and regulatory approval processes
- Logistics plans and providers
- SIMOPS planning process
- Deployment and installation plans
- Well kill and shut-in plans.

The deployment activities described in the SCERP will require an approved **Safety Case** to ***demonstrate how the safety risks will be managed***.

The Safety Case is to be developed by operators of vessels and drilling rigs undertaking source control response activities. The Safety Case should address all risks associated with the activities operating in abnormal marine conditions, such as within potential hydrocarbon plume locations.

The SCERP content expectations presented in this Information Paper are consistent with **IOGP Report 594** and **IOGP Report 592**.

Reference material for developing a SCERP, complete with source control information requirements of the EP and WOMP, can be found in the **APPEA Australian Offshore Titleholders Source Control Guideline**.

3. EP and WOMP content and assessment

The following section provides the expected content of source control planning and response to be included in the Environmental Plan (EP) and Well Operations Management Plan (WOMP), including SCERP content required in the WOMP and EP in sufficient detail to address the content requirements and acceptance criteria.

Context is provided for the content required to meet regulatory requirements, including the type and level of detail, and information is provided on the focus of the regulatory assessment.

3.1. Environmental Plan (EP)

3.1.1. Worst Case Discharge (WCD) Analysis

Provide a summary of the parameters and assumptions used to estimate the WCD, and demonstrate the WCD has been applied to define the worst case potential consequences of an oil pollution incident.

The EP must demonstrate the control measures and response arrangements for source control and well kill that are appropriate for up to and including the WCD.

Context

WCD analysis evaluates the range of possible blowout scenarios of the activity to identify the worst case hydrocarbon discharge characteristics that could occur. WCD is defined by the maximum rate a well will flow based on reservoir characteristics, open hole of the well, no obstructions in the well, and zero mechanical skin factor.

It's noted that the WCD value calculated for the EP may be refined through the ongoing well engineering process, and the WCD presented in the WOMP and SCERP may be different to the WCD presented in the EP.

WCD information is used in the EP to:

- Establish the environment that may be affected (EMBA) in the event of a LOWC incident
- Define and scale oil spill response control measures and arrangements that will contribute to reducing oil pollution risk to ALARP
- Evaluate feasibility of source control options through the range of possible discharge rates and hydrocarbon characteristics up to and including WCD.

Regulatory assessment

Assess the worst-case well flow characteristics is based on reservoir characteristics, open hole of the well, no obstructions in the well, and zero mechanical skin factor.

Assess the calculated WCD is applied to EMBA identification and spill response control measures and arrangements.

Assess that all potentially feasible response options have been evaluated for up to and including the WCD.

3.1.2. Capping stack mobilisation, preparation, load-out, logistics, and deployment plan

Demonstrate the arrangements for timely activation and mobilisation of source control equipment (capping stack, ancillary equipment, etc.).

Provide ALARP assessment of alternative and improvement options to achieve shortest reasonably practicable timeframes.

It is noted that a LOWC may discharge with different hydrocarbon characteristics and/or different discharge rates than the estimated WCD, therefore it is expected that planning is undertaken for capping stack mobilisation to well location for all drilling activities, regardless of the feasibility at the WCD characteristics and rate. This is to enable appropriate planning in the event that the actual incident characteristics allow for a Capping Stack installation.

Provide a project plan for capping the well in the form of a response time model detailing the tasks, resources and estimated timeframes required to complete the project.

Provide environmental performance standards defining the key timeframes of the capping stack mobilisation and deployment project plan.

Context

Evaluate and define the capping stack mobilisation and logistics plan, and vessel specification requirements for deployment, including:

- Mode and timing of mobilisation
- If mobilising via air freight, define the types of planes to be used, define the tracking and contracting systems that will be used, and check that the planes can land at the designated airport (Runway length, width, load capacity)
- Ground handling equipment and trained personnel e.g. cranes, main deck loader availability and capacity (required for B747F), trucks, and trailers to support operations at the airport
- Transportation from the airport to the dock site. Review the road transport route between the airport and the port of operations to identify and resolve any potential transport and load restrictions (height, width, and load restrictions)
- If equipment requires assembly, provide for the range of spare parts required for re-assembly. Function and pressure testing are also necessary, and the plan needs to identify availability of necessary handling equipment such as cranes, power supplies and scaffolding
- Plan and prepare for any permitting requirements (import/export/duties/road transportation)
- Plan and prepare for Safety Case requirements of the capping stack deployment vessel
- Define marine vessel tracking and sourcing systems and evaluation of offloading capabilities at the port of operations
- Quayside maximum vessel draft and drawing(s) showing quayside load rating for use during crane outrigger rig up and lifting operations.

Define all tasks, resources, and estimated times to complete the project in a project plan in the form of a response-time-model to enable clear communication of the project with all stakeholders. Provide commitments to timeframes of project arrangements in the form of Environmental Performance Standards.

Regulatory assessment

Assess the arrangements for capping stack activation and mobilisation provide for the timely implementation and deployment of the capping stack.

Assess the ALARP arguments provided in the EP to assess alternative and improvement options to provide a timely response.

Assess the project plan and environmental performance standards define the ALARP timelines of the capping stack mobilisation to the well location and prepared for deployment.

3.1.3. Subsea Dispersant Operations Analysis

Provide evaluation of subsea dispersants viability as a response strategy that considers the effect of increasing entrained & dissolved oil in the water column to receptors verses the need to reduce surface plume and vapour to enable the source control response.

Context

Subsea dispersant delivery reduces concentrations of volatile organic compounds (VOC) that reach surface, thereby reduce human exposure and concentrations to be within safe low explosive limits (LEL's) of hydrocarbons, and allowing more effective surface operations.

Regulatory assessment

Assess the arguments and reasoning for selecting or not selecting subsea dispersants as a response strategy take into account the implications of increased hydrocarbon concentrations in the water column.

Assess the arguments and reasoning provided in the EP that selects the type of dispersant proposed for subsea use.

Assess the identification and management of environmental impacts from subsea dispersant operations.

3.1.4. Subsea Dispersant Supply Analysis

Provide evaluation of the worst-case dispersant consumption rate verses supply rate, and provide demonstration supply can meet WCD demand.

Context

Establish and define continued access to dispersant. Different concentrations and quantities of dispersant will be required for different types of hydrocarbons and blowout flow rate. Though dispersant concentration rules-of-thumb exist, sensitivity modelling and/or laboratory testing on representative oil samples may also be performed to optimise injection quantities. In addition to identifying consumption rate, an assessment of total volume should be made. In doing so, the assessment should consider when dispersant can be applied and for how long it would be needed before the well is capped, or if capping is unsuccessful, when a relief well would kill the incident well. Suitable dispersant stock piles and, if required, ongoing dispersant manufacturing plans are to be identified along with supporting logistics plans.

Regulatory assessment

Assess subsea dispersant supply arrangements to meet the WCD demand as estimated in the EP.

3.1.5. Water Column Monitoring

Provide details of water column monitoring capability matched to monitoring requirements.

Describe arrangements for undertaking monitoring, including descriptions of the process for developing the sampling plan, relevant sampling procedures, transport procedures and analytical procedures.

Context

Water column monitoring is required to:

- Assess the efficacy of dispersant and refine the delivery rate (Dispersant Monitoring).
- Characterise the nature and extent of subsea or near surface dispersed oil and aid in the validation and accuracy of plume trajectory models.
- Support health and safety goals for VOC levels at the surface operational area.

Planning, sourcing and tracking of equipment, supplies, vessels and personnel to perform water column monitoring, including mobilisation of a field laboratory, for the sampling of the water column at different depths up-current and inside the hydrocarbon plume.

Access to specialist scientific support and science vessel should be identified, including identification of required sampling equipment, analysis equipment, and procedures for sample transport and handling.

Regulatory assessment

Assess the description of plans and arrangements for water column monitoring, including the proposed capability, to check the arrangements are appropriate and provide for implementation within the timeframes required to support subsea dispersant injection.

3.1.6. Relief Well Arrangements

Provide the arrangements for implementing a timely relief well, include an overview of relief well drilling rig specification requirements and tracking, monitoring and contracting systems, supported by environmental performance standards defining the time to spud and time to kill the well.

Provide an overview of relief well design and an inventory of equipment with the arrangements for supply.

Define all tasks, resources, and estimated times to complete the project in a project plan in the form of a response-time-model to enable clear communication of the project with all stakeholders. Provide commitments to timeframes of project arrangements in the form of Environmental Performance Standards.

Context

While capping solutions offer the fastest method to regain control of a well, the source control operation is not complete until the well is killed, which will most likely occur through a relief well. The relief well operation will occur simultaneously with the capping operation.

The EP must demonstrate sufficient planning for relief well operations and demonstrate all reasonably practicable arrangements for a timely response will be implemented.

Regulatory assessment

Assess the arrangements for relief well and well kill implementation provide for a timely response.

Assess the project plan and environmental performance standards define the ALARP timelines of the relief well drilling rig deployment plan and the well kill plan.

3.1.7. Source Control IMT

Provide details of the Source Control IMT capability and personnel supply arrangements to enable a timely response.

Context

Define the Source Control IMT Organisation structure, positions, roles and responsibilities, and competency requirements of personnel to fill positions.

Provide analysis of the arrangements for personnel sourcing, call-out and on-boarding systems to ensure all reasonably practicable control measures are implemented for timely and effective response to the LOWC incident, and procedure and systems for maintenance of the personnel roster and call-out system are maintained for the duration of the activity.

Regulatory assessment

Assess the capability and arrangements to provide a Source Control IMT are appropriate for the implementation of an effective and timely source control response.

3.1.8. Training, Exercising and Validation of the SCERP

Define the SCERP test and exercise plan.

Demonstrate the components of the plan to be tested and proposed schedule of tests.

State the test objectives.

Define how test and exercise outcomes are evaluated and incorporated into lessons learned.

Context

The SCERP should be in place and maintained response ready for immediate implementation. The SCERP is an integrated and systematic approach to source control incident management that provides the procedures designed to guide well operations personnel in the event of source control incident. The SCERP should contain written action plans that assign authority to appropriate personnel, address emergency reporting and response, and comply with applicable government regulations. They should also contain the process and procedures for establishing the Incident Command Centres and associated Operational Bases.

Plans within the SCERP must be validated by scheduled drills and exercises that test and assess the readiness of personnel and equipment. Training, drills and exercises must be conducted at appropriate frequency and based on realistic scenarios for the activity.

The testing and validation method should be fit for purpose and scalable, depending on the organisation size, complexity, location and risk factors. They can be in the form of:

- Drills and tabletop exercises
- Training
- Audits
- Review and updating of documents and plans with lessons learned
- Inspections and testing of equipment

- Market assessments for vessels and equipment to track and ensure availability.

Regulatory assessment

Assess the test and exercise plan for the SCERP meets the requirements of the incident response.

Assess the test frequency of the SCERP and test objectives meet the requirements of the regulations.

Assess the process to evaluate tests and capture the outputs of the SCERP test and exercises to manage actions that provide for continuous improvement.

3.2. Well Operations Management Plan (WOMP)

3.2.1. Worst Case Discharge (WCD)

Provide technical information on how the worst-case flowrate was derived. Demonstrate the method of calculating WCD applies credible pipe, casing and open-hole configurations, expected reservoir parameters and productivity, with zero mechanical skin factors or flow path restrictions.

It's noted that the WCD value calculated for the EP may be refined through the ongoing well engineering process, and the WCD presented in the WOMP and SCERP may be different to the WCD presented in the EP.

Context

WCD analysis evaluates the range of possible blowout scenarios of the activity to identify the worst case hydrocarbon discharge characteristics that could occur. WCD is defined as the maximum rate a well will flow with zero mechanical skin factors or flow path restrictions.

WCD information is used within the WOMP to:

- Develop a pressure and temperature profile along the wellbore which is used for determining the casing design reliability.
- Creating an input for computational fluid dynamics (CFD) models that are used for modelling the land out of a capping stack and plume analysis.
- Establish relief well kill requirements.

Regulatory assessment

Assess the parameters used in calculating the WCD applies credible pipe, casing and open-hole configurations, expected reservoir parameters and productivity, with zero mechanical skin factors or flow path restrictions.

3.2.2. Casing Design for Blowout loads (During WCD & during well killing)

Define how the casing has been designed for normal loads as well as worst case MAE loads (WCD, Axial Load for capping stack, etc.).

Context

Analysis of the casing design and well integrity in the event of blowout, involving identification and consideration of the worst case load lines for the different phases of the LOWC event, and should include modelling of thermal effects if required.

Changes to the internal and external pressure profiles caused by blowout may include:

- Collapse loads:
  - Elevated External Pressure Profile (EPP) from heating of the annulus pressure as well fluids from the reservoir are produced at high rates.
  - Loss of Internal Pressure Profile and risk of collapse due to high flowrate / low pressure gas in the wellbore. Identification of areas of collapse risk is beneficial as it may have a bearing on relief well design and targeting.
- Burst loads:
  - Static Burst – Wellbore shut in on BOPs/Capping Stacks with wellbore full of well fluids.
  - Top kill case – Bullheading cold kill mud into well in static burst condition above after capping stack in place.

Consider erosion and/or corrosion of casing due to well fluids and flow.

Ensure the axial and bending loads on Casing and Wellhead from Capping Stack installation are acceptable.

Regulatory assessment

Assess that the casing design includes both normal operation and MAE cases (WCD, Axial Load for Capping Stack, etc.).

3.2.3. Well Integrity during Shut-in Pressure Analysis

Demonstrate the assessment of well barrier integrity under maximum anticipated loads (pressure, temperature, fluids).

Context

Well design screening that assesses whether the well can be safely shut-in after capping. A shut-in well should have full mechanical and geologic integrity; well barrier elements can withstand the maximum anticipated loads (pressure, temperature, fluids) it may be exposed to for the time the barrier element is in use. All information regarding formation strength and any decisions that may affect formation strength should be addressed in the relief well planning process.

Regulatory assessment

Assess the engineering and rationale for acceptance of well integrity under shut-in pressure.

3.2.4. Structural Integrity Analysis

Provide engineering to demonstrate the subsea components are able to carry the additional weight of a Capping Stack, taking into account the fatigue loading (if applicable) and bending stresses on the wellhead under blowout conditions.

Context

Assessment of the blowout WCD loads do not exceed the wellhead's ability to cope e.g. temperature, fatigue loading, bending loads, exposure to well fluids, etc. Provides engineering that ensures the subsea components are able to carry the additional weight of a Capping Stack. The ability to land out a Capping Stack on the incident well should be considered during the conductor design phase, and include assessment of fatigue loading, bending moment on the conductor and the wellhead with the BOP, LMRP and Capping Stack installed, and soil strength analysis to ensure sufficient axial pile capacity to avoid settling or slumping. If required, consider mitigation options e.g. conductor deepening, thicker wall heavier grade conductor, a higher capacity bending load wellhead, guy wires, holding weight until surface casing cement is set, etc.

Regulatory assessment

Assess the conductor / wellhead analysis to ensure subsea components can cope with the extra loads imposed by a Capping Stack.

3.2.5. Relief Well Locations, Design, and Dynamic Kill Plan

Provide a summary of the blowout contingency plan, including:

- modelling assumptions and scenarios
- primary kill strategy
- 2x relief well locations (or possible relief well quadrant)
- relief well design
- proposed relief well trajectory and intersect drawings
- relief well rig mud pumps specifications and ancillary equipment requirements to perform dynamic kill

Context

Identify and nominate at least two possible relief well locations, or a possible relief well quadrant at a safe distance from the well (blowout) that considers seabed and sub-bottom/shallow hazards, and seasonal dominant wind conditions and currents to avoid volatile gases and accumulations of oil on the surface.

Plan and define relief well trajectories considering proximity ranging tools, approach and intersect method. Perform Dynamic Kill analysis to determine volumes, density, and pump rates for well kill fluids. Define pump and ancillary equipment needs for well kill including redundancy during critical well kill operations. The description should define the number of relief wells required to kill the blowout well, identification of possible relief well locations, shallow gas assessment, well paths, and equipment logistics and specialist service provider arrangements.

Provide casing and wellhead design for relief wells, and provide drawings of the relief well(s).

Regulatory assessment

Assess relief well locations, design, Dynamic Kill analysis, and relief well drilling rig specification requirements to ensure fit-for-purpose.

4. SCERP content and compliance monitoring

As the SCERP is not required to be included in the regulatory assessment process for the EP and WOMP, it shall be inspected under NOPSEMA's compliance monitoring program to ensure it includes the following content and detail to demonstrate an acceptable level of planning for a source control response.

4.1. Source Control Emergency Response Plan (SCERP)

4.1.1. Plume Study

Describe the possible plume forces expected and define the surface operational area and Capping Stack access routes for the source control response, taking into account the plume to surface results.

Context

Perform a subsea plume dispersion study that considers water depth, flowrate and phase of escape fluids, or use a suitable offset study if relevant (nearby, similar water depth, temperature and metocean conditions). Evaluate where hydrocarbons in the water column interfere with surface operations to cap or kill the well (vertical access assessment). Determine extent and likelihood of a flammable cloud, VOCs and surface boils to establish a safe operational zone for surface operations and establish Capping Stack access routes.

Note that although the WCD modelling may indicate that vertical access to the incident well is not feasible, it is still important to ensure equipment, resources and plans for a vertical capping operation are in place as the actual incident may have lower flow rates than modelled.

Compliance monitoring: Inspection

Inspect the subsea plume dispersion modelling is documented in the SCERP to establish a safe surface operational zone and Capping Stack access routes.

Inspect the SCERP considers both horizontal and vertical access where appropriate.

4.1.2. Capping Stack Landing

Provide demonstration of feasibility of capping a blowout scenario at the given water depth with threshold values for flow rate and GOR.

Provide a description of the expected uplift forces, up to and including WCD. Define the Capping Stack equipment and installation procedures that overcome the plume uplift forces to enable the landing of the Capping Stack complete with their operational thresholds to enable an adaptive response based on the experienced uplift forces.

The actual angle of the wellhead or interface point will not be known until the post incident site survey has been completed, so the SCERP may include preparedness measures for:

- Mechanical shims.
- Hydraulically operated tool to mate with the Capping Stack and aligned to the angle of the well.
- Installation of a subsea pile with either an on-bottom hydraulically actuated straighten tool or a sheave with a line connected to a surface vessel to pull the wellhead straight again.

Context

If required due to shallow water, high gas flow, or high GOR, undertake Computational Fluid Dynamics (CFD) analysis that provides a plume-force Capping Stack landing analysis to establish the thresholds that enable a Capping Stack to be landed on the well. Offset studies are acceptable where it can be demonstrated they are appropriate for the target well.

Uplift forces will influence the selection of installation methods and procedures, and may even prevent the installation of the Capping Stack at defined discharge values or dictate the use of a stack of different dimensions and/or design.

CFD requires accurate Capping Stack information and engineering drawings, and also considers a range of wellhead inclination sensitivities as these may impact Capping Stack landing assumptions.

The stack can be misaligned, rotated, or pushed off balance as a result of fluids flowing both vertically and horizontally. Output from the CFD model may guide the landing solution to be on drill pipe or require additional vessels to stabilise the cap while another lowers the stack.

CFD also involves performing erosional analysis on the Capping Stack bore and across the rams or valves when closing. Usually this work is undertaken during the Capping Stack design and is part of the API RP 17W specification, however, if anticipated solids content exceeds those assumed limits, additional analysis may be required.

Compliance monitoring: Inspection

Inspect the CFD analysis and Capping Stack landing analysis in the SCERP provides feasibility assessment of capping a blowout scenario at the given water depth, and defined flow rates and GOR (may be suitable offset study if deemed appropriate).

Inspect the parameters considered for CFD analysis (or offset study) and the output conclusions provide for Capping Stack design and specification of equipment, installation procedures, and supply arrangements.

4.1.3. Selection of Capping Stack and Ancillary Equipment

Describe the parameters used to select the appropriate Capping Stack and ancillary equipment

Context

Evaluate and select the required Capping Stack specification and ancillary equipment.

Consider methodologies for landing Capping Stack where weights (stack + wire) begin to exceed vessel capabilities i.e. Installation by MODU on drill pipe or heave compensated landing system. Consider results from plume study to determine if vertical or horizontal access is feasible. Where required, ancillary equipment should consider offset landing scenarios.

Provide confirmation of the applicability and compatibility of the Capping Stack specifications with activity specific requirements:

- Conformance with API RP 17W
- Wellhead, BOP top, and LMRP top interface points
- Through bore size
- Water depth rating
- Flowing temperature, pressure rating, flow rate, and fluid type rating
- Re-entry considerations
- Chemical injection functionality for hydrate mitigation
- Pump-in capability for well kill operations (if applicable)
- Pressure and temperature monitoring sensors
- Ability to mobilise expediently from point of location (air versus sea freight)
- Choke size and specification for cap and contain contingency c/w flowback system interface design
- Overall shape and weight of the selected Capping Stack related to installation methodology when considering water depths, subsea currents, plume force uplift, etc.

Compliance monitoring: Inspection

Inspect the parameters used to select the Capping Stack and ancillary equipment compatibility with activity-specific requirements.

4.1.4. Well or BOP to Capping Stack interface analysis and Clash Checks

Provide drawings of Capping Stack and interface connections, and provide a list of equipment requirements to enable connection.

Provide identification of all connections and possible interfaces from wellhead to flexible joint, or identification of all connections and possible interfaces from XT to interface to workover equipment.

Provide an overview of equipment availability to allow installation of a Capping Stack, including an adapter to enable connection of the Capping Stack.

Context

A detailed stack-up diagram should be produced to demonstrate the key connection interface points and ensure all are available and there are no clashes / interferences. This would usually include details of the wellhead connector, Xmas Tree, or BOP connector. The top LMRP connector is often prohibitive for connection due to riser connectors and the additional load placed on the wellhead, so ensure there are lift points for recovery options to remove the LMRP.

A detailed interface study is required, including a 'clash check' to confirm there is no interference when landing the Capping Stack on any of the landing points, noting that BOP stack frame designs are not all standard.

Prepare 3D and 2D drawings of Capping Stack connectors interfacing with the BOP/XT mandrel. Check for clashes with inner diameter of guide funnel. Provide for BOP Adapter or spare connector for cases where Capping Stack connector clashes with the mandrel or is different to the hub profile i.e. Cross-over adapter or locate connector with smaller OD.

Compliance monitoring: Inspection

Inspect the completeness of the interface study and clash checks in the SCERP.

Inspect the SCERP contains Capping Stack and interface drawings.

Inspect appropriate adaptors and/or connectors have been specified with supply plans.

4.1.5. Capping Stack actuation and ROV interface points verification

Provide a procedure for the closing method of the Capping Stack.

Provide a description of the ROV tooling required to interface with the Capping Stack, and the supply plan to obtain the tooling.

Context

Analyse the closing method of the Capping Stack, which may be closed mechanically, hydraulically, or both. Define equipment needed to enable alternate or contingent actuation possibilities without having to recover the stack. Suitable equipment needs to be contained in the Capping Stack system to facilitate the activation method.

Assess ROV interface points and the type of ROV functions that are on the Capping Stack and how the ROV will interface. Some interface equipment may be supplied by the Capping Stack provider while others may require sourcing. Necessary ROV tooling will be dependent on the selected Capping Stack.

Compliance monitoring: Inspection

Inspect the SCERP contains the procedures for closing the Capping Stack and provides a description of the ROV tooling and the supply plan to obtain the tooling.

4.1.6. BOP ROV Panel

Provide a procedure for BOP intervention and ROV interface.

Context

Ensure the correct ROV hot stabs to mate with the BOP panel. Assess the possible need for subsea hydraulic intervention skid. Define suitable grab handles for stabilisation on the BOP intervention panel.

Compliance monitoring: Inspection

Inspect the SCERP contains the procedure for BOP intervention and ROV interface.

4.1.7. Capping Stack mobilisation, preparation, load-out, logistics and deployment

Define the arrangements for Capping Stack activation and mobilisation from storage through to well head.

Provide a project plan for capping the well in the form of a response time model detailing the tasks, resources, and estimated timeframes required to complete the project.

Context

Define the Capping Stack mobilisation and logistics plan, and vessel specification requirements for deployment, including:

- Mode and timing of mobilisation.
- If mobilising via air freight, define the planes to be used, the identification and contracting system to obtain the planes, and confirmation of planes landing ability at the designated airport (Runway length, width, load capacity).
- Define the ground handling equipment and trained personnel e.g. cranes, main deck loader availability and capacity (required for B747F), trucks, and trailers to support operations at the airport.
- Transportation from the airport to the dock site. Document the road route between the airport and the port of operations and address transport and load restrictions (height, width, and load restrictions).
- If equipment requires assembly, provide for a list of spare parts required for re-assembly complete with the supply plan. Function and pressure testing are also necessary, and the plan needs to identify availability of necessary handling equipment such as cranes, power supplies and scaffolding.
- Plan and prepare for any permitting requirements (import/export/duties/road transportation).
- Plan and prepare for the Safety Case approval of the capping stack deployment vessel.
- Provide the marine vessel sourcing plan and analysis of offloading capabilities at the port of operations.
- Provide the quayside maximum vessel draft and drawing(s) showing quayside load rating for use during crane outrigger rig up and lifting operations.

Define all tasks, resources, and estimated times to complete the project in a project plan in a response-time-model to enable clear communication of the project with all stakeholders.

Compliance monitoring: Inspection

Inspect the Capping Stack mobilisation and logistics plans contained in the SCERP are consistent with the arrangements presented in the EP and provide for a timely response.

Inspect the project plan for tasks and estimated times to complete the project is consistent with the project timelines presented in the EP.

4.1.8. Relief Well locations, design, and Dynamic Kill Plan

Provide a description and drawings of the proposed relief well locations or quadrants.

Provide relief well trajectories considering proximity ranging tools, approach and intersect method.

Specify the rig capability requirements for relief well drilling and the tracking and sourcing arrangements.

Provide a summary of the expected Dynamic Kill Plan.

Context

Define at least two possible relief well locations or suitable quadrant at a safe distance from the well (blowout). Consider seabed and sub-bottom/shallow hazards, and seasonal dominant wind conditions and currents to avoid volatile gases and accumulations of oil on the surface.

Define relief well trajectories including proximity ranging tools, approach and intersect method. Provide Dynamic Kill analysis to define volumes, density, and pump rates for well kill fluids. Define pump and ancillary equipment needs for well kill including redundancy during critical well kill operations. The description should provide for shallow gas assessment, well paths, and equipment logistics and specialist service provider arrangements.

Provide casing and wellhead design for relief wells and drawings of the relief well(s).

Compliance monitoring: Inspection

Inspect relief well locations are defined in the SCERP.

Inspect relief well trajectories, proximity ranging tools, approach and intersect method are in the SCERP.

Inspect relief well rig specifications and sourcing arrangements are contained in the SCERP.

Inspect the relief well drilling rig sourcing and tracking arrangements are consistent with the EP and ensure a timely response.

4.1.9. Back-up equipment, drill strings and casing for relief well drilling

Provide a description of the procurement and mobilisation process for back-up equipment, drill strings (if required) and casing for relief well drilling. Required in the emergency response plan as part of the relief well procedures and equipment supply arrangements.

Context

Supply plans are required for back-up subsea wellheads, float equipment, full casing strings and other ancillary well equipment and services to demonstrate timely availability for the relief well drilling operations.

Compliance monitoring: Inspection

Inspect relief well drilling equipment and supply arrangements defined in SCERP are consistent with the EP and ensure a timely response.

4.1.10. SIMOPS: Relief Well and Capping Stack operations interfacing

Provide an overview of proposed SIMOPS control processes/ procedure and on overview of the elements that will need to be included in the SIMOPS Plan.

Context

Source control planning has a close but independent relationship with relief well planning. Undertake analysis to capture elements of SIMOPS planning that will be required in a response to ensure the two emergency response plans are compatible with one another. Areas of potential clashes could be, but are not limited to:

- Relief well locations and how they may be affected by hydrocarbon plume.
- Use of supply bases and support vessels.
- Positioning of surface vessels and consequences if station keeping is lost.
- Sourcing of equipment like conductors that may be used for relief wells as well as to support capping or cap and contain subsea infrastructure.
- Pressure limitations on the source well during proposed intersection and kill operations.

Compliance monitoring: Inspection

Inspect the SCERP contains the process of SIMOPS control and elements that will need to be addressed in the response SIMOPS Plan.

4.1.11. Debris Clearance

Provide a debris clearing activation and mobilisation procedure, complete with contracts and logistics plans for SSFRT supply. Debris clearing implementation will be subject to specific requirements of the incident.

Context

Planning, sourcing and tracking of equipment, supplies, vessels and personnel to perform subsea debris clearing at the wellhead/discharge point. Establish contracts with Subsea First Response Toolkit suppliers. Create SSFRT Logistics Plan.

Compliance monitoring: Inspection

Inspect the Debris Clearing Activation and Mobilisation Procedure, SSFRT supply contract and logistics plan are contained in the SCERP.

4.1.12. Subsea Dispersant Operations

Define the subsea dispersant components, vessel requirements, logistics plans, personnel requirements, and arrangements for dispersant supply.

Context

Subsea dispersant delivery reduces concentrations of volatile organic compounds (VOC) that reach surface, thereby reducing human exposure and concentrations to within safe low explosive limits (LEL's) of hydrocarbons, and allowing more effective surface operations.

Provide the supply plan for subsea dispersant operations, including containers, pumps, pipes, ancillary equipment, vessels and personnel to perform subsea dispersant injection at the wellhead/discharge point.

A dispersant delivery system involves installing a subsea manifold on the seabed, providing a supply vessel with high pressure pumping equipment and dispersant stockpile above the manifold, installing coil tubing or suitable conduit to connect the vessel to the subsea manifold and a jumper hose to connect between the manifold and an ROV with an injection nozzle inserted in the well flow.

Compliance monitoring: Inspection

Inspect the SCERP contains the arrangements for supply of subsea dispersant equipment, vessels, logistics plans, and personnel requirements and arrangements. Ensure the arrangements are consistent with the EP and provide for a timely response.

4.1.13. Subsea Dispersant Supply

Define the dispersant supply plan, including contracts, activation plan, mobilisation plan, and logistics plans.

Define the initial dispersant application rate, monitoring method, and procedure for adjusting injection rates to match performance requirements.

Context

Establish continued access to dispersant as part of the SCERP. Establish the worst case dispersant consumption rate and total volume. In doing so, consider when dispersant can be applied and for how long it would be needed before the well is capped, or if capping is unsuccessful, when a relief well would kill the incident well. Suitable dispersant stock piles are to be identified along with supporting logistics plans.

Compliance monitoring: Inspection

Inspect the dispersant supply plans and logistics plans are provided in the SCERP and are consistent with the EP.

4.1.14. Source Control IMT arrangements

- Define the Source Control IMT Organisation Team Structure.
- Define positions, roles and responsibilities.
- Define competency requirements of personnel to fill positions.
- Define the personnel sourcing, call-out and on-boarding processes.
- Define the procedure and systems required for maintenance of the personnel roster and call-out system.

Context

The SCERP must define the arrangements to provide sufficient Source Control IMT personnel with appropriate competency are available for timely activation and mobilisation in the event of a LOWC incident.

Source Control IMT personnel may be provided by the titleholder, through contracts, or through other companies under mutual aid agreements.

Mutual aid is a multi-lateral support network that provides a pre-agreed framework for the sharing of equipment and expertise. The objective is to enable rapid response to control the source as efficiently as possible. To define and resource a sufficient Source Control IMT, the SCERP may give consideration towards mutual aid between Operators. Once identified, a mutual aid agreement can be implemented with the relevant parties. Mutual aid agreements generally feature:

- Legal liability control
- Secondee arrangements
- Commercial considerations
- Notification and communication protocols

Compliance monitoring: Inspection

Inspect the Source Control IMT Organisation structure is defined in the SCERP, is consistent with the EP, and is capable to meet the requirements of the incident response.

Inspect the competency requirements of personnel to fill positions meets the required duties of the position.

Inspect the SCERP defines the personnel sourcing, call-out and on-boarding processes to enable a timely response, and is consistent with the EP.

Inspect the SCERP defines the procedure and systems required for maintenance of the personnel roster and call-out system.

5. Safety case and validation considerations

The deployment activities described in the SCERP must be addressed in one or more Safety Cases to demonstrate how risks to the health and safety of persons at or near the facility will be reduced to a level that is as low as reasonably practicable.

Some SCERP related activities are required to be addressed in facility safety cases on the basis the activities are for drilling or servicing a well for petroleum or doing work associated with the drilling or servicing a well. These facility activities include:

- ROV monitoring only
- Subsea dispersant deployment and supply
- Debris clearance in preparation for capping stack that may have direct contact with wellhead
- Capping stack installation and/or operation
- Containment associated with capping stack (excluding offtake tankers)
- Drilling of relief wells

A scope of validation is required to be submitted and agreed by NOPSEMA prior to the submission of a new safety case or for a revision to an accepted safety case in circumstances where additional safety critical equipment (i.e., hardware major accident event (MAE) risk control measures) has been identified. Titleholders are encouraged to share scopes of validation and associated validation statements for items such as capping stacks and their control systems. NOPSEMA is amenable to consideration of validation scopes and associated statements for a capping stack system from one facility to be used on another facility where no material changes have been made to the equipment.

Operators of vessel facilities, MODUs, and drill ships are responsible for the development and submission of safety cases and revisions to accepted safety cases that address the hazards and risks associated with source control response activities they are intending, or foresee the potential, to undertake. In developing or revising safety cases for vessel facilities, operators should consider guidance provided by NOPSEMA in its Vessel facilities subject to external hydrocarbon hazards safety case guidance note (N-04300-GN1733) as a starting point.

Whilst the characteristics of a potential loss of well control incident will not be known until an incident occurs, this does not preclude operators of vessel facilities from submitting safety cases that generally address the hazards and risks associated with source control activities with an explicit commitment to revise the case on an activity-by-activity basis. This is already common practice for MODUS, drill ships, and vessel facilities undertaking activities with external hydrocarbon risks.

Titleholders should monitor the availability of vessels and drilling rigs with safety cases accepted by NOPSEMA that are suitable for the range of possible well discharge characteristics. There is a published register of operators available on the NOSPEMA website (Operator nomination and registration | NOPSEMA).

Titleholder should engage with such operators to incorporate generic source control activities and associated control measures into an existing facility safety case. While some information will not be known until an incident occurs, a facility base safety case can incorporate generic source control activities by clearly delineating the operational parameters for the activity. The validation process should also be considered as a preparatory activity where specific equipment can be identified in advance. This approach is likely to have a significant positive impact on assessment time frames for a specific safety case revision associated with an actual loss of well control event requiring source control activities.

Several response actions, such as BOP intervention, subsea dispersant injection, and debris clearance involve ROV activities that might not normally fall into the category of facility activities. However, in the context of source control emergency response, such activities will be conducted in the presence of an ongoing, uncontrolled hydrocarbon release that presents risks other than an ordinary marine risk. Therefore, the safety case for any facility undertaking such activities should consider control measures for:

- Worst case release scenarios for consideration in the facility fire and explosion analysis, e.g. is the safety case revision specific to a particular location where the worst case release has already been estimated or is the safety case generic with fewer defined limits on what a worst case release scenario might entail.
- Monitoring measures for releases, whether oil or gas, and flammable atmosphere concentrations.
- Release avoidance measures, including consideration for planned escape routes and collision avoidance.

The following sections describe other activities which require additional consideration in the facility safety case.

5.1. Capping Stack Deployment and Operation

There can be single or multiple vessels involved with Capping Stack deployment and operation. The Capping Stack is expected to be deployed by a crane vessel with crane specifications suitable for the lift weight, span and depth. As the Capping Stack is lowered to the interface location, it may be guided by ROVs provided by the crane vessel or provided by other vessels.

Capping Stack deployment vessel operators should consider the following safety aspects in the facility safety case:

- Capping stack design data and operational parameters, e.g. pressure rating, temperature rating, max water depth, choke size, max flow rates, etc.
- Command structure and interfaces between facility operator, client, and client provided capping stack specialist personnel.
- SIMOPS Plans to coordinate multiple response vessel activities and avoiding vessel collision.
- Possible integrity failure of the well bore casing when under blowout pressures following Capping Stack activation and well shut-in, which could result in subsurface plume migration and subsea discharge at unexpected locations.
- Capping stack control system requirements, e.g. ROV interface, additional hydraulic power supply skids, and umbilical connections to surface.
- Scope of vessel facility capping stack activities, for example will the activity be deployment only, will it also include operation including latching to wellhead/BOP and well shut in, or will it extend to well kill operations from the vessel.
- Well kill operations from the facility, including any conduits between the well bore and the deck of the facility and any additional temporary equipment required on the facility for well kill such pumps and fluids.

5.2. Relief well drilling rig(s)

The relief well can be drilled with one or more drilling rigs, each with accepted Safety cases for the drilling operation. Typically, the relief well drilling operation is similar to the primary well drilling operation, thereby providing a suitable template for the drilling rigs to follow in defining safety controls for the relief well drilling operation. A number of items identified above in section 3.2.5 Relief Well Location, Design, and Dynamic Kill Plan as relevant to the WOMP are also relevant to a safety case revision for a MODU facility involved in drilling a relief well. For example, pump and ancillary equipment needs for well kill operations, including equipment redundancies and contingency plans, should be considered in the rig safety case revision. MODU facility operators should also consider the following aspects in a relief well revision to a facility Safety Case:

- Location specific data: worst case discharge estimates, distance from incident location, mobilisation timings, etc.
- SIMOPS with additional surface mobile facilities.