APPENDIX P

Well Intervention Response Strategies

equinor

1.0 WELL INTERVENTION RESPONSE STRATEGIES

This section describes the activities associated with stopping well flow in the event of an accidental discharge due to a subsea well blowout. Information regarding spill response measures, including recovery of spilled oil, are provided in Section 16.1.2.3 and Appendix O. It is generally recognized that a subsea well source control response strategy consists of these operational objectives:

- Blowout Preventer (BOP) Intervention
- Well Capping
- Well Containment
- Relief Well(s) Drilling

Equinor is a member of the Subsea Well Response Project (SWRP) and has access to the emergency response equipment available under the Subsea Well Intervention Services (SWIS) agreement with Oil Spill Response Limited (OSRL). This equipment is stored in various strategic locations throughout the world, it is maintained regularly and ready for deployment. This equipment is in addition to the well control equipment that is available on the drilling installation which is the first line of defence in a well control event.

1.1 BOP Intervention

Equinor's first response in a well control scenario is to attempt to control well flow by utilizing the drilling installation's BOP. The BOP is comprised of multiple rams capable of shearing the drill pipe and sealing the well. The BOP has additional backup activation systems which include an acoustic control system capable of being activated from elsewhere on the drilling installation, from a lifeboat or from a standby vessel, a remotely operated vehicle (ROV) intervention package and several other fail-safe systems that allow the BOP to close and shut in the well in the event of loss of communications and/or disconnection from the lower marine riser package (LMRP). BOP intervention is performed immediately upon indication that a well kick is occurring.

1.2 Capping, Containment and Relief Well Drilling

The viability of the capping and containment operations is contingent on many factors including the weather and sea state, the impact of the well flow since the incident occurred, possible reduced well integrity, vertical access to the well, jet-stream uplift forces, capping interfaces, and the remaining structural integrity related to fatigue and the well load capacity. Hence, review and revision of plans with consideration of possible alternative solutions for source control will be required after an actual incident occurs.

In the case of a subsea well incident, the primary focus of response would be to shut in and/or kill the well, stopping the source of all hydrocarbon flow to the environment. There are three major elements to source control – well capping, well containment and relief well drilling:

- **Well Capping** places an additional high-pressure shut-in device on top of a failed BOP, LMRP or wellhead to shut in well flow as an interim measure. If well flow isn't shut-in completely then restriction of flow helps reduce the environmental impact and the capping stack provides a mechanical interface to facilitate additional well containment if required.

- **Well Containment** systems divert hydrocarbon flow from the incident well to a surface system for processing and disposal as an interim measure. Well containment systems may be needed on rare occasions when well capping does not fully shut in the incident well.
- **Relief Wells** are drilled to intercept and kill the incident well, shutting off the source of flow to the environment.

A capping and containment response plan is prepared in addition to the normal relief well contingency plans and is tailored to the drilling operation and it's location (i.e. Eastern Newfoundland Offshore Area) to ensure compliance with local regulations, availability of specialised vessels, air freight and other logistical and commercial arrangements.

The engineering, equipment and analysis required for this source control planning will depend on the defined incident scenario, well and location specific details, and the various surveying and debris clearance operations to be completed during the overall source control emergency response. It is important to understand the tasks and processes, which make up the overall capping and containment response plan, and to utilize the documentation related to the emergency equipment available from OSRL.

For illustration purposes, a capping and containment concept overview schematic is illustrated in Figure 1-1.

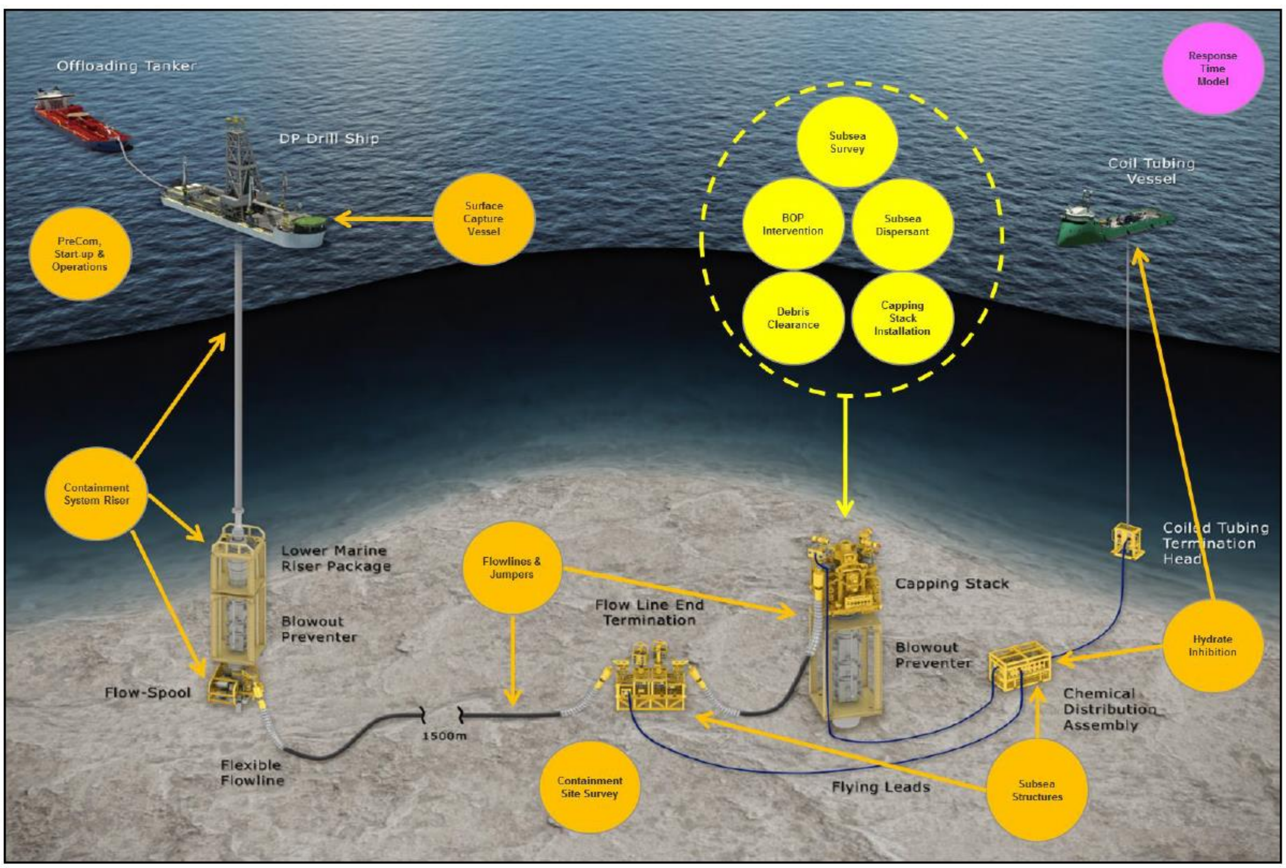

Figure 1-1 Capping and Containment Concept Overview

2.0 OSRL SUBSEA WELL INTERVENTION SERVICES

OSRL's SWIS is a non-profit joint initiative providing the industry with the capability to better respond to subsea well control incidents. OSRL owns, maintains and stores in a response ready state the equipment required for well-intervention operations, as designed and procured by the SWRP with input from the end-users.

As part of the OSRL SWIS membership, access is provided to an OSRL Electronic Document Management System (EDMS) with technical documentation on the equipment available. These documents range from mobilization procedures, operation manuals, technical drawings, lifting certificates, etc., and provide the information required for the OSRL SWIS members to plan and prepare for subsea capping and containment operations. Equinor utilizes the various OSRL documents along with local area knowledge to develop a robust and effective response plan taking into account the local infrastructure, remoteness, environmental conditions, and availability of various resources including specialized vessels, land transportation requirements, craneage and port availability.

2.1 Notification and Activation

2.1.1 Equinor Notification and Activation

In case of a subsea blowout which requires the mobilization of the Subsea Incident Response Toolkit (SIRT), the Capping Stack System (CSS) and the Containment Toolkit, the activation of the Equinor Blowout Task Force and the OSRL SWIS is performed according to Equinor's governing documents and OSRL's Notification and Activation Procedure. Equinor's Notification and Activation chart is shown in Figure 2-1 below.

The activation of OSRL with the handling of well capping and well containment emergency response activities is complex and demands the engagement of multiple resources and skills. Equinor's Line 3 emergency response team (in Norway) has the authorization to call off support from OSRL and will facilitate the contact between OSRL and Equinor representatives. Extensive support is required from the Equinor Line 2 Incident Command System (ICS) emergency response team located in the local office in St. John's, Newfoundland and Labrador (NL) and who are intimately familiar with the local area, drilling installation details and interfaces, specific well incident information and local regulations.

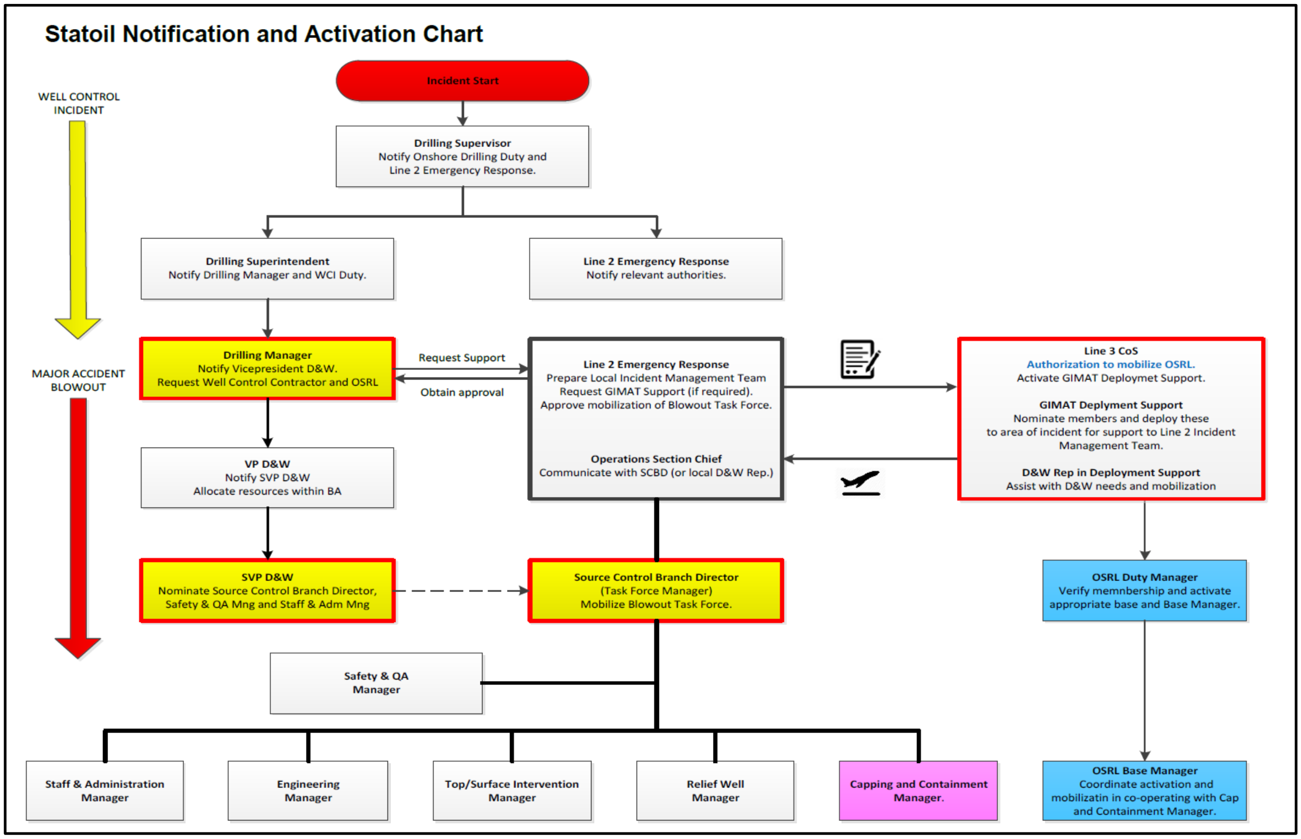

Figure 2-1 Equinor Notification and Activation Chart

Activation of OSRL is via a 24-hour emergency phone number in the United Kingdom (UK) or Singapore where a discussion with the OSRL Duty Manager will be initiated. The OSRL Duty Manager has extensive response experience and will discuss the emergency scenario and explain the current status of all response resources. The OSRL Duty Manager acts as the primary point of contact for Equinor and the initial discussion with Equinor will include:

- Scenario of spill
- Assets required
- Location assets to be mobilized from
- Transportation mode (air/sea/land)
- Special logistical/permits required for the country of disembarkation
- Additional technical support required (from Oceaneering/Trendsetter)
- Additional oil spill response equipment required

In addition to verbal activation several activation forms are required to be completed by Equinor which includes technical details of the incident which will allow for successful mobilization of the SWIS package. Upon confirmation by the OSRL Duty Manager that the initial response requirements have been met, the OSRL Duty Manager then activates the OSRL Base Manager at the required storage location(s). The OSRL Base Manager is responsible for:

- Co-ordinating in country response team
- Liaising with manufacturers and technical support teams

- Overall responsibility for preparation, pre-testing, loading and handover of equipment to Equinor
- Managing the logistics chain
- Ensure that exportation procedures and customs clearance are completed

Equinor, as a member of the SWRP, has access to the full suite of response equipment and can mobilize a maximum of two CSS and one subsea dispersant toolbox in the event of a response.

The Equinor Capping and Containment Manager is responsible for planning and execution of all operations related to the attempts to regain control of the blowing well by well capping and well containment. Furthermore, the Capping and Containment Manager is responsible for coordinating the well capping and well containment activities with other ongoing activities in the overall blowout situation (e.g. relief well drilling). The emergency response operational requirements will depend on the severity of the incident, location specific details and missions to be completed related to the overall source control activities. In order to handle the various operations, the response organization will need support with personnel and resources from Equinor Line 2 Incident Command System.

3.0 WELL CAPPING

3.1 Well Capping Overview

The capping stack is the contingency well isolation device used to ‘cap’ a blowout and stop the flow of hydrocarbons from the well. It is designed to interface primarily with the BOP stack by connecting to the top profile of the BOP after the removal of the LMRP, using a compatible connector. Once mated, the stack’s rams are deployed to isolate flow from the well. The capping stack is also capable of connecting directly to the LMRP or to the wellhead using special interface adapters if required.

The viability of well capping operations is contingent on many factors including the impact of the well flow since the incident occurred (i.e. casing washout and reduced well integrity), vertical access to well, jet-stream forces, BOP interfaces and design, and remaining structural integrity related to fatigue and the well load capacity.

In the unlikely event that shut-in of the well is not attainable due to wellbore integrity issues, the capping stack may serve as the mechanical interface for contingency flow-back (well containment) and/or restricting the well flow before and during the relief well dynamic kill operations.

Before the capping stack can be installed and used to shut in the well, a number of separate operations take place depending on the incident scenario. These are:

1. **Subsea Survey**: To determine the appropriate response and conduct necessary planning relative to the incident, information on the current state of the well is required.
2. **BOP Intervention**: Based on initial subsea survey results, BOP intervention may be considered as a means to isolate the well flow or reduce the hydrocarbon outflow by attempting to operate the incident rig BOP pipe and shear rams to the closed position.
3. **Debris Clearance**: Based on initial subsea survey results, debris clearance may be required in order to provide access to the BOP Intervention panel, capping stack interface points or on the seafloor to facilitate the installation of ancillary response equipment.

4. **Subsea Dispersant Operations**: The application of subsea dispersant at the source point may be desired to reduce environmental impact of flowing hydrocarbons and/or required to reduce Volatile Organic Compounds (VOC) and Lower Explosive Limits (LEL) at surface, so that response vessels and personnel can work within the defined safety zone. Approval from the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) is required to use subsea dispersants.
5. **Capping Operations**: The capping stack is the contingency well isolation device used to 'cap' a blowout. The capping stack is configured according to Equinor requirements and installed by positioning over the flowing well and latching it to the BOP, LMRP or wellhead. If shut-in of the well is not attainable due to wellbore integrity or other issues, the capping stack may serve as the mechanical interface for contingency flow-back (containment) and/or assist in metering and/or restricting well flow during the relief well dynamic kill operations.

When evaluating a specific well capping response it is necessary to have detailed information of the emergency equipment available and the specifications and limitations of the incident well. It is also important to identify Equinor provided equipment and resources in order to prepare a mobilization and deployment response. Furthermore, well intervention response strategies must be engineered to avoid additional and potentially irreversible wellbore damage which could result in prolonged environmental impacts. These evaluations are performed prior to initial spudding of the well such that major gaps related to logistics, equipment or methods for capping are identified and addressed.

The objectives for well capping operations are as outlined below:

- Eliminate environmental impacts by preventing hydrocarbons from exiting the wellbore.
- Minimize environmental impacts by reducing the amount of hydrocarbons exiting the wellbore through the use of capping stack chokes.
- Minimize or eliminate environmental impacts by providing interface for well containment operations.
- Work with debris clearance team to ensure that the proper interface is accessible for capping stack installation.
- Conduct engineering assessment of the well / BOP to determine proper capping stack configuration.
- Mobilize appropriate response equipment to incident well AS SOON AS SAFELY POSSIBLE.
- Conduct engineering and assessment of the well loads to determine capping feasibility.
- Install capping stack onto the blowing well.
- Conduct assessment of the well to determine proper shut-in procedures.
- Perform shut-in of the well using the capping stack.
- Support the relief well and/or well containment operations as required.

3.2 OSRL Equipment and Support

The SWIS capping toolbox suite of equipment includes the SIRT and the CSS with 10,000 psi or 15,000 psi pressure rating. In addition, OSRL provides access to the global dispersant stockpile with 5000 m3 of dispersant chemicals to be used with the subsea dispersant equipment included in the SIRT.

3.2.1 Subsea Incident Response Toolkit

The OSRL SIRT is divided into four sub-categories with equipment available for subsea survey, BOP intervention, debris clearance and subsea dispersant injection. The subsea toolkit is stored in ready-for-shipment mode and consists of five 20 ft containers, two 10 ft containers, four subsea hose racks, four accumulator modules and once accumulator suspension beam. The entire toolkit is suitable for road and air transport.

Although OSRL is a provider of key critical emergency response equipment, Equinor provides significant resources and ancillary services in order to effectively deploy and use the OSRL provided kits. OSRL provide technical support throughout the emergency response planning phase and work with industry to continuously develop technology improvements and enhancements that increase the overall effectiveness and chance of success of a capping and containment operation.

3.2.2 Capping Stack System

OSRL has a total of four CSS stored at various bases around the world. The 7 1/16”, 10,000 psi CSS are stored in Singapore and South Africa. The 18 3/4”, 15,000 psi, CSS are stored in Stavanger, Norway and Angra dos Reis, Brazil (Figure 3-1). All four capping stacks are designed into a standard configuration, with common pipework, valves, chokes and spools, which are rated to 15,000 psi and a water depth of 3000 m. The common framework gives flexibility by utilizing interchangeable gate valves and rams. The CSS is designed to the same international standards as offshore blowout preventers.

The CSS comes with subsea accumulators, hydraulic flying lead (HFL) skids and required tools for installation with an 18 ¾” connector. The CSS also includes spacer spools, an inclination tool and the secondary containment cap which all may be required depending on the actual incident scenario.

The intended installation method for the CSS is based on vertical access to the incident well. The CSS is designed for installation with up to 10-degree inclination when utilizing the CSS inclination tool. In the situation where the wellhead and/or BOP has been subject to loading and inclination differs from the original, additional engineering and analysis is conducted to confirm that the well / BOP is able to support the additional weight of the CSS.

OSRL also have access to the Wild Well Control capping stack located in Aberdeen, Scotland. This stack can also be used if the main OSRL stacks aren’t available. OSRL, Equinor and other SWRP members continue to evaluate other technologies as they become available to complement and further enhance the suite of tools available in a response situation. At the current time however, the OSRL capping stacks are the preferred option for use in this area due to their robust fabrication, engineering and design that offers greater operational flexibility, adherence to industry recognized international standards and access to OSRL’s Global Technical Department that focuses on improving oil spill response on a global basis.

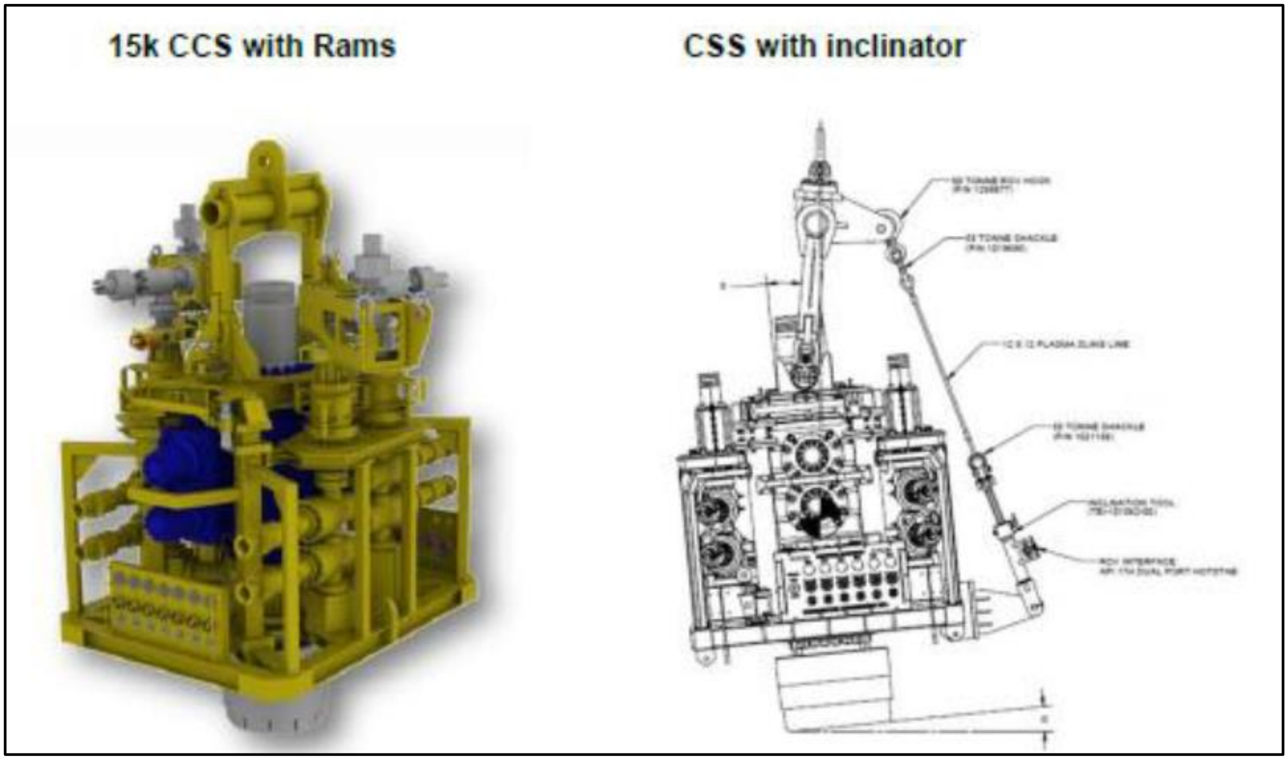

Figure 3-1 OSRL 15,000 psi CSS

OSRL's CSS has a design life of six months (flowing) and two years (shut in). This design basis is sufficient to enable subsequent plug and abandonment (P&A) of the capped well, which would likely be done by drilling a relief well to intersect the wellbore to complete P&A activities. At the appropriate time during / after P&A operations, the CSS would be removed and any final decommissioning (i.e., wellhead removal) would be completed. Removal of equipment and any subsequent monitoring required would be undertaken in accordance with the requirements set out in the Newfoundland Offshore Petroleum Drilling and Production Regulations.

3.2.3 Global Dispersant Stockpile

OSRL provide members with access to a range of dispersant chemicals with the most worldwide approval via the OSRL Supplementary Agreement. The dispersant chemicals are held in 1 m3 transport tanks at their location and OSRL arranges and coordinates air or sea freight to an airport or sea port as requested by Equinor.

The use of dispersants will not be contemplated unless approved by the C-NLOPB. The C-NLOPB consults with other federal departments such as the Department of Fisheries and Oceans and Environment and Climate Change Canada. A Spill Impact Mitigation Analysis (SIMA) is a detailed environmental risk analyses regarding the application of dispersants to various spill scenarios. Equinor will prepare and submit a SIMA for review by the C-NLOPB as part of the Operations Authorization (OA) application process.

Actual chemicals to be mobilized from the global dispersant stockpile will depend upon the SIMA performed based on oil samples from the incident well. The injection volumes required will be determined by the amount of hydrocarbon leaking subsea and type of dispersant selected. The details on quantities and location of the dispersant chemicals are presented in the OSRL Global Dispersant Stockpile Fact Sheet which can be found on the OSRL website at web address https://www.oilspillresponse.com/globalassets/services/member-response-services/global-dispersant-stockpile/tis-gds-2017-oct-27.pdf

3.3 Mobilization and Duration

The response plan includes a listing of key locations for the equipment required for capping operations with information on storage locations, response vessel(s) and planned Port of Mobilization (POM). Also included are details on transit requirements from storage location to POM, POM activities and vessel requirements from POM to the incident well.

The mobilization of the SWIS equipment starts from the OSRL storage location, this is done in coordination with Trendsetter and Oceaneering to configure, test and prepare the system according to Equinor's requirements. Once mobilized, the equipment is now the responsibility of Equinor as owner of the well and is transported to the port of mobilization, for operations in the Eastern Newfoundland Offshore Area the equipment will be mobilized from Stavanger, Norway and/or Angros doe Reis, Brazil. Both locations have a 15,000 psi capping stack system and complete Subsea Incident Response Toolkits (SIRT) on stand-by at all times and ready for deployment. OSRL is responsible for selecting locations for CSS based on their own internal requirements and processes, and proximity to global offshore drilling activities. OSRL does not have CSS in eastern Canada. It is unlikely that having a CSS available in eastern Canada would reduce the overall time to install on a well as a number of activities are required prior to installation from a safety perspective such as site assessments / preparation and debris removal.

Due to lack of the specialized local infrastructure including proper maintenance and storage facilities, transport and installation vessels with the capabilities required, and appropriate yard space, Equinor Canada maintains an international vessels of opportunity (VOO) database that identifies vessels that have the capabilities for transport and installation of the CSS.

The preferred way of mobilization of the CSS is by sea, but the CSS can also be transported by air using two options; (1) by breaking down and containerising the equipment, which would consist of fourteen 20 ft containers and thirteen shipping skids, or (2) air freighting the fully assembled stack.

Air transport has its limitations as tear down and rebuilding of the CSS introduces additional time and risk of damage to the equipment. The increased logistics associated with air travel and road transport increases the overall complexity of the logistical operation. The time savings realized are not significant and, in some cases, may actually increase overall mobilization time.

Recently, OSRL conducted trial operations to fly the CSS in its fully assembled state. This requires the use of an Antonov aircraft, shipping frame and multiple fastening arrangements. Large auxiliary cranes are also required to load and unload the stack from the aircraft. Utilizing this transportation method is another option that may be considered when mobilizing the equipment to an incident well. In the fully assembled state, crane availability, ground transportation and logistics, and installation vessel availability further reduce the likelihood of this mobilization option for the Newfoundland offshore area.

Technology development is ongoing related to air transportable capping stack options that may be suitable for the Project. There have been other recent developments in capping stack technology, name the Halliburton RapidCap™ system. This is a much smaller version of the OSRL capping stack that can be air freighted in its fully assembled stat. Developments in improved technology are under review by Equinor technical experts and if deemed the optimal solution will be added to Equinor's response technology options. It is important to note that offshore operators and spill responders continue to invest in research and technology with a focus on continuous improvement in spill response capability. As these technologies are developed and qualified for safe use, they are added to the response options available for incidents. As environmental assessments are required to take the precautionary principle, conservative estimates for completion of capping have been applied to this assessment and used for spill modelling purposes. The time frames provided for capping and containment in the EIS are conservative estimates based on existing and proven technology appropriate for the conditions at the BdN field and include contingency. In the extremely unlikely event of a blowout, the actual time frame for capping will be dependent on the condition of the well, wellsite and weather and may be shorter than the time frames modelled. All resources and technology required to safely cap the well as quickly as possible will be deployed.

In shallower water depths, typically less than 600 m, an offset installation tool may be required. This tool enables CSS installation in situations where extreme jet forces from the incident well does not allow for vertical access to the wellbore by vessel. The offset installation tool and associated hardware is mobilized separately from its location in Italy.

Certain vessel requirements must be met for CSS to be transported by vessel. Equinor maintains a VOO database where appropriate vessels are logged and their current location is recorded. This allows Equinor to quickly identify vessels that are equipped to handle the CSS when needed.

A typical capping operation can be executed within a 36-day (maximum) timeframe. This includes time for activation of OSRL, equipment preparation and mobilization, installation offshore and capping operations. Contingency time has been included for waiting on weather, slower than expected transit time due to sea state and ice presence and other delays due to non-productive time and other logistical constraints. As previously mentioned, increased logistics associated with air travel and subsequent road transport for vessel load out to port are also of significance. These incremental activities increase the overall complexity of a CSS mobilization and could result in longer mobilization times for the equipment to the well site.

4.0 WELL CONTAINMENT

4.1 Well Containment Overview

The subsea well containment concept is intended to serve as the basis for developing a temporary subsea production system for capture of hydrocarbons in case the well capping operation is not adequate to stop the uncontrolled flow of hydrocarbons to the environment. The well containment concept involves the use of the OSRL Containment Toolkit, which when combined with standard industry hardware can create a single or multiple leg containment system designed to flow hydrocarbons from a wellhead to the surface in a safe and controlled way and ready for storage or disposal.

Well Intervention Response Strategies

The system is based on a common subsea system and the use of standard well test equipment installed on VOO such as drill ships or semi-submersibles installations to process captured hydrocarbons. The riser system will be the capture vessel marine riser/landing string system, incorporating subsea test trees (SSTT) with a floating drilling installation. Disposal of produced liquids would likely be by direct offloading to tankers. Before the well containment system is ready for use a number of operations are required in order to install and commission this temporary subsea production system. These are:

1. **Containment Survey**: The scope of the containment survey is to conduct the over-arching survey which will facilitate the containment operations that follow. This includes the identification of seabed features and debris caused by the incident which may affect the previously planned locations for the subsea system to be installed.
2. **Subsea Structures Survey**: The scope of the subsea structures survey is to prepare and install the subsea structures as per overall field layout for the subsea system, prior to subsea lay of the flexible flowlines.
3. **Flowlines and Jumpers Survey**: The scope of the subsea flowlines and jumper survey is to prepare and lay the subsea flowlines and jumpers required for the subsea system, and hook-up to the capping stack and flowspool on each containment leg.
4. **Containment System Riser Survey**: The scope of the containment system riser (CSR) survey is to mobilize, deploy and install the CSR with foundation, flowspool, SSTT, landing string, surface flow tree and marine riser.
5. **Capture Vessel Surface System Deployment**: The scope of the capture vessel surface operation is to deploy a surface hydrocarbon processing and offloading system, for the safe capture and disposal of well fluids.
6. **Hydrate Inhibition**: The scope of hydrate inhibition is to prepare and deploy a chemical delivery system capable of providing the subsea system with hydrate inhibition chemical (e.g. glycol) on demand.
7. **Pre-commissioning, Start-up and Operations**: The scope is to provide guidance with regards to pre-commissioning of the containment system prior to start-up, ensure a controlled start-up of the system with the containment of the uncontrolled flow, and provide monitoring requirements during the containment operation for steady state and transient flow operations.
8. **Decommissioning and Decontamination**: In addition to the operations above, a plan should be prepared for decommissioning and decontamination of equipment and resources used. This plan should also include the procedure for decontamination of vessels supporting the ongoing well capping and well containment operations.

When evaluating a specific well capping response it is necessary to have detailed information of the emergency equipment available and the specifications and limitations of the incident well. It is also important to identify Equinor provided equipment and resources in order to prepare a mobilization and deployment response. Furthermore, well intervention response strategies must be engineered to avoid additional and potentially irreversible wellbore damage which could result in prolonged environmental impacts. These evaluations are performed prior to initial spudding of the well such that major gaps related to logistics, equipment or methods for capping are identified and addressed.

4.2 OSRL Equipment and Support

The SWIS Containment Toolkit is designed to supplement standard industry well test hardware in order to create a containment system. The toolkit comprises long-lead equipment not readily available in the current industry and minimises response times by allowing a responding well operator to draw on existing resources. To ensure a quick response, the toolkit is stored in strategic locations around the world. The flexible flowlines and jumpers are stored in three regional sets in Brazil, Singapore and the UK. All other containment toolkit components can be moved by air and is predominantly stored at the original equipment manufacturers' facilities in the United States, Norway and the UK.

4.2.1 The Containment Toolkit

The Containment Toolkit includes several elements which combined with Equinor equipment and resources can be deployed to enable the flow of hydrocarbons from the capping stack to an offloading tanker. The major components are shown in Figure 4-1 below.

Subsea well containment toolbox specification

Water depth	Up to 3,000m	Max temperature	130°C (operation)
H2S content	0 to 500ppmV	Design operating life	2 x 6 month deployments
Design temperature (operation)	-1°C to 130°C	Design temperature (storage)	-20°C to 40°C
CO2 content	0 to 10 mol %	Transportability	Air (Boeing 747-400 ERF; excluding flexible flowlines), land and sea
Containment toolkit storage life	20 years		

Flowline end termination (FLET)
Subsea hardware installed at the end of flexible flow lines to enable ROV operated functions, venting functionality and pressure control.
Size: 6.2m x 2.5m x 3m
Weight = 32 tonnes

Flow spool with subsea test tree latch
Assembly that connects the flexible flowline to a standard well testing riser and interfaces with standard wellhead foundation and MODU BOP equipment.
Size: 4.3m x 3.7m x 3.8m,
Weight = 43.5 tonnes

Diverless subsea connectors
Standard ROV operated subsea hardware used to connect flexible flowlines to a capping stack, FLET, flow spool assembly and burst disk trees.
Size: 1.6m x 1.2m x 1.9m
Weight = 3.3 tonnes

Coiled tubing termination head (CTTH)
A hydrate inhibitor distribution hardware suspended from the coiled tubing to de-couple the dynamic section of the coiled tubing riser from the static CDA.
Size: 1.5m x 1.1m x 1.8m
Weight = 3 tonnes

Chemical distribution assembly (CDA)
Hardware for distribution of hydrate inhibitor to the FLET and/or to the capping stack.
Size: 2.5m x 2m x 2.3m
Weight = 6 tonnes

Deployment reels for flying leads
The 1" and 2" flying leads are coiled on deployment reels for safe subsea installation of flying leads between the CTTH, CDA, capping stack and the FLET, for hydrate inhibitor supply to the cap or FLET(s).
Size: 6.2m x 2.4m x 2.6m
Weight = 12 tonnes

Hose end valves (HEV)
End valves on the marine offloading hoses for safe coupling to the offloading tanker.
Size = 1.5m x 1.8m x 1.1m
Weight = 2.5 tonnes

Flexible jumpers / flowlines
Connect pipe between the capping stack, FLET and the flow-spool assembly.
Inner diameter = 6"
Lengths = 250m, 850m, 1200m

Figure 4-1 Well containment toolkit

The containment system extends from the SWIS CSS to an offloading tanker. Hydrocarbons are directed from the capping stack through a Flow Line End Termination (FLET) via a flexible jumper. From the FLET, flow continues through a flexible flowline and flowspool assembly into a standard well testing riser, terminating at a drilling installation. Hydrocarbons are processed using standard surface well testing equipment, and then stabilised and offloaded to a tanker positioned at a safe distance from the incident well. The well containment system is illustrated in Figure 4-2.

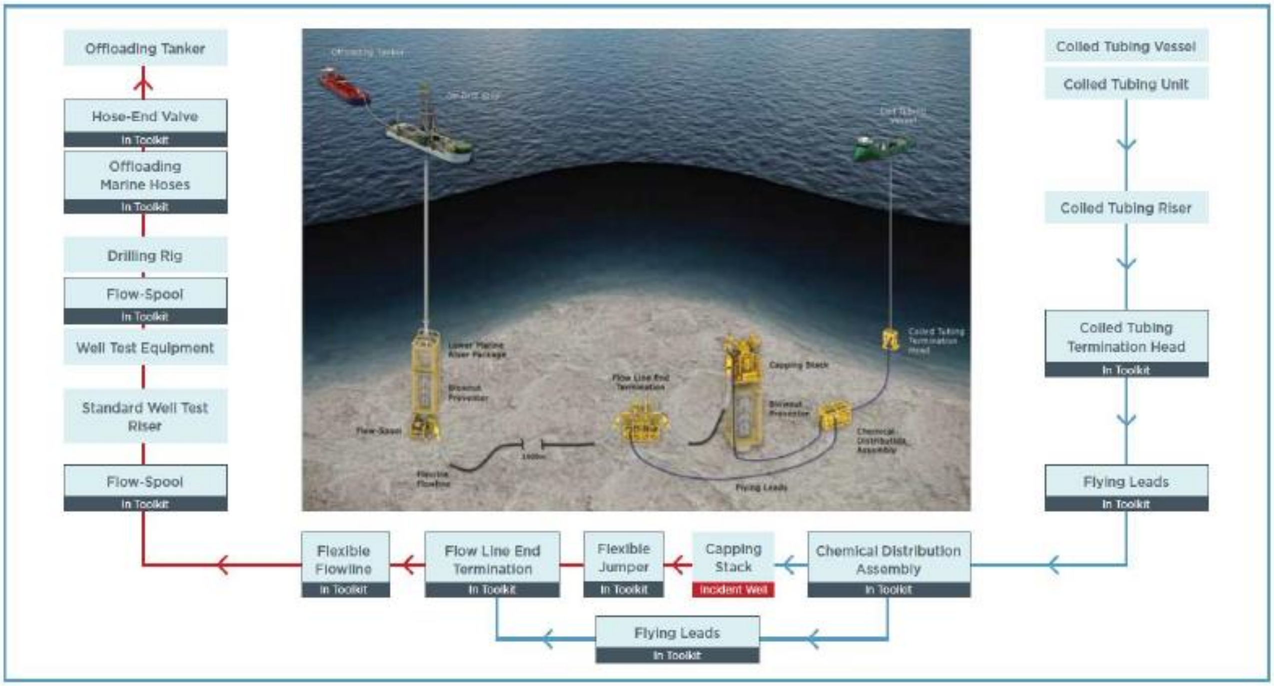

Figure 4-2 Well containment System

4.3 Mobilization and Duration

The Containment Toolkit elements have been designed to provide the most efficient way of deploying the equipment. Most of the equipment is packed in smaller units which allow for ease of transport by road, sea or air and require minimal assembly.

An agreement and procedures have been put in place between OSRL and the Original Equipment Manufacturers (OEMs) and storage location management to ensure a fluent mobilization of systems requiring OEM support. Upon notification from OSRL, the OEM's and other storage location managers will mobilize their own identified logistics enablers who will transport the cargo to the seaport or airport of embarkation as instructed to OSRL by Equinor.

Upon deployment of the CSS, Equinor will also mobilize the Containment Toolkit at the same time to ensure that is it is readily available if needed. Preparation of this equipment occurs concurrently with the CSS.

5.0 RELIEF WELL DRILLING

5.1 Relief Well Drilling Overview

The installation of well capping or well containment equipment will temporarily secure the subsea well and reduce the environmental impact from the incident. However, the killing of the well is still required for the permanent securing and abandonment of the well. This has traditionally been achieved by relief well drilling and is covered as part of the normal blowout contingency planning which is submitted to the C-NLOPB and approved under the existing OA process.

The killing of the well by relief well drilling is executed similarly to the standard well plan. A relief well is typically drilled as a vertical hole down to a planned deviation (“kick-off”) point, where it is turned toward the target well using directional drilling technology and tools. Once the target well is intersected, dynamic kill well control commences by pumping drilling fluid down the relief well and into the incident well to kill the flow. Concrete may follow to seal and abandon the original well bore. Specific details of the relief well drilling operations are submitted to the C-NLOPB as part of the OA application.

In developing the relief well drilling plan and well kill procedures, Equinor considers the potential operational impacts of other source control operations. The specific killing strategy is developed based on the actual incident well data taking account the well integrity modelling work and the capped and shut in or contained well system configuration.

The planned relief well locations are selected based on normal directional intersect and kill requirements, as well as any new constraints with regards to the planned capping and containment activities. The selected locations are integrated into the overall source control SIMOPS activities.

The relief well drilling installations are identified in advance of any drilling operations and meet the functional requirements needed for the specific well locations such as water depth restrictions, dynamic positioning capability etc. These drilling installations are commonly available within the operational area and are available through mutual aid agreements with other operators in the area. Drilling a relief well can be executed within approximately 100 to 115 days. Well construction equipment including wellheads, running tools, crossovers, casing and tubulars is readily available locally and sourced in advance of any relief well drilling operations. Transit and mobilization times for the drilling installation and any required equipment are evaluated and provided to the C-NLOPB in advance of their approval of drilling operations. Precise durations for capping and relief well execution will depend on a number of factors including local conditions (e.g. weather) and the condition of the well.