Cap & Contain (Flow) – Defining Success!

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Introduction

The new Oil Spill Response Limited (OSRL) Subsea Well Intervention Service (SWIS) Containment toolkit was delivered in the second quarter of 2015. The toolkit was designed for use with standard industry well test hardware and utilizes long-lead time equipment not readily available in the industry that minimizes response times by allowing a well operator to use existing resources, see Figure 1.

For Shell to have a better understanding of this complex response strategy, a large-scale Tier 3 well source control exercise was designed for select members of the Shell Global Response Support Network (GRSN) and Shell Well Control Virtual Emergency Response Team (VERT) based on Incident Command System (ICS). During the exercise planning and execution, Shell further enhanced its level of preparedness by developing response plans for activating and implementing the OSRL SWIS Containment toolkit.

The key objectives of the Tier 3 exercise were to:

1. Exercise wells source control [capping, dispersant, relief well, containment (cap and flow)] response to include the activation, mobilization, and deployment planning for the SWIS toolkits and primary and backup capping stacks.
    a. Test the ability to mobilize the Source Control Branch within the Incident Management Team (IMT) quickly and take effective early actions to respond appropriately to well control / oil spill scenario
    b. Test logistics allocation and planning between offshore and onshore activities.

Main Results

Respond to a deep water Cap & Contain Source Control incident with a maximum flow rate of 16,000 barrels per day (BPD) - 1 leg

There are four major elements to well source control – dispersant, well capping, well containment and relief well drilling. Each of these elements has multiple missions, demanding pre-investment in planning, manpower, equipment, tooling and materials, as well as major logistical efforts to deploy to a wellsite.

The Tier 3 exercise scenario was based on a previous exploration well in the Turkish Black Sea. The incident flow rate of 16,000 BPD was chosen so that only 1 leg, of the 3 OSRL containment legs, was required. The first 60 hours of the exercise were scripted and the exercise play began with an incident briefing package (ICS 201) on day 3 of the incident.

Primary and secondary capping stacks were deployed during the exercise. The primary stack was from the OSRL base in Stavanger, Norway and the secondary stack from Angra dos Reis, Brazil.

Exercise wells source control response to include the activation and deployment planning for all mission related equipment including SWIS toolkits and capping stacks

Well capping and well containment are complex, cross-functional activities with significant logistics and SIMOPS considerations. They are also likely to require the deployment of equipment not normally under contract to the Well Owner (WO), requiring additional contracts and assistance agreements to be put in place.

The WO must plan the steps they will take to implement a source control solution for each well or group of wells in the event of a blowout. To minimize response time, the WO conducts pre-planning to define the well capping and well containment systems that are appropriate to each region or well should be conducted. Pre-planning for this exercise included the following:

- Region specific well capping and containment plans defining:
    - Incident response organization, including roles and responsibilities
    - Well configuration(s) & locations
    - Regional availability of vessels and equipment
    - Cap and containment equipment descriptions and mobilization task lists
    - Logistics planning
- Generic mission plans for:
    - Capping stack deployment
    - Subsea Structures
    - Flowline & Jumper
    - Surface Capture Vessel
    - Offloading & Tanker Operations
    - Chemical Delivery
    - Start-up & Commissioning
    - Operations
    - Decontamination & Decommissioning
- Generic Level 4 project schedule for mobilization, integration, testing and deployment of the OSRL dispersant, capping and containment equipment
- Generic vessel allocation spreadsheet defining requirements and high-level schedule all marine vessels required for dispersant, capping and containment activities
- Region specific logistics plan of mobilization of capping stacks and OSRL containment leg(s)

The scope of the exercise was limited to planning for equipment mobilization and installation up to but not including start-up and commissioning. Start-up and commissioning, operations and decontaminating & decommissioning is scheduled for a later exercise.

Map out Cap & Contain (flow) response capability and the associated interactions between multiple organizations (Shell/Contractors)

The Shell organizations that support the containment function is provided by specific business Emergency Response personnel that is supplemented by the Shell GRSN and VERT (Figure 2). Under the ICS Operations Section, there is a Source Control Branch containing a Contain Group with the following Task Forces:

- Subsea Equipment
- SSIT & Riser
- Well Test Facilities
- Crude Offloading
- Rig Interfaces

To effectively utilize the SWIS Containment Toolkit, multiple contactors would be required to support the response as follows:

- OSRL – Mobilization and Logistics / Freight Forwarder – Logistics
- Well Test Contractor / Subsea well test contractor

Understand pre-engineering requirements for system prior to drilling a well

Advance planning is critical for effective emergency response as well intervention operations are immensely challenging and are made even more so by the acute time pressures, integration of cross-functional activities and complex logistics/Simultaneous Operations (SIMOPS) considerations that arise following a loss of well control. This takes time and investment as thorough preparation is essential to significantly reduce the release of hydrocarbons and the environmental consequences of an incident.

The SWIS Containment Toolkit, managed and provided by OSRL, significantly reduces the response time by providing a pre-engineered well containment system. Integration of the toolkit into vessels of opportunity and industry well test systems requires planning and engineering, which can be done at the time of the incident. However, significant reduction in response time can be achieved through pre-planning. The WO must pre-define the well capping and well containment systems that are appropriate to each well and region, which will determine how much pre-planning is necessary to achieve an acceptable response time.

Pre-planning activities for well capping and well containment requires the integration of the following into an engineered solution for a specific well or region:

- Data collection and evaluation
    - Provides the basis for defining the level of pre-planning and engineering required. This includes specific information on well location, weather/metocean conditions and subservice data, water depth, anticipated shut-in and flowing pressures, and potential discharge rates. General data for support vessels, shore base infrastructure, and availability or resources to commit to the pre-planning.
- Regional availability of vessels and equipment
    - Required vessels and key requirements for installation and start-up of the capping and containment system subsea equipment. These vessels are generally available on the spot market.
        - Flexible pipe installation vessel
        - Capping Stack and Subsea hardware installation vessel
            - Heave compensated crane to deploy 130 tons to mudline
            - Minimum DP2 with 1 work class ROV
        - Coiled tubing vessel / Platform supply vessel / Site survey vessel
- Logistics Planning
    - A coordinated response to any incident will only be possible with careful pre-planning of the necessary logistics activities to include:
        - Existing infrastructure / Available logistics resources
        - Equipment and services / Operational conditions
        - Country customs and import laws
    - It is necessary to integrate the OSRL mobilisation activities with the WOs' activities of deployment, installation and operation. The objective of the logistics and infrastructure pre-planning is to identify:
        - Infrastructure and logistics services available to support logistics activities at the final destination by conducting site visits at:
            - Airports / Seaports
            - Port Agents / Customs brokers / Freight forwarding agents
            - Trucking companies / Crane companies / Warehousing
            - Other Exploration and Production (EP) operators or subscribers
        - Documented constraints and boundaries for logistics activities related to local regulations, laws, climate, operating area, politics, etc
        - Documented lessons learned and opportunities for synergies from other WO logistics operations and activities in the region
        - Potential Health, Safety, Security and Environment (HSSE) risks

        - Potential development needs and upgrades of existing WO infrastructure
- Generic capping and containment mission planning
    - Well capping and containment activities are organized into a series of missions plans that provide detailed guidance on the engineering required to execute the mission, vessel and infrastructure requirements, and interfaces with other missions. The generic mission plans can be used to estimate the amount of time and resources required for pre-engineering and evaluate what pre-engineering activities are required to reduce response times to an acceptable level.

A clear understanding of the roles and responsibilities of those involved in the response while working within the Incident Command System (ICS)

The Shell Incident Management System (IMS) is based principally on the internationally recognized and used "Incident Command System" outlined in the IPIECA/OGP "Incident Management System for the Oil and Gas Industry" Good Practice Guidelines and the United States Federal Emergency Management Agency (FEMA) Incident Command System. The Shell IMS is not a new system or a separate system, but rather the Company's customization to fit our emergency environment; and is used to organize emergency response operations for small to complex emergency response incidents, lasting from hours to months. The Shell IMS includes a set of proven organizational and management principles, which are essential to the success of emergency response management and premises under which it will be used in Shell.

The VERT is made up specifically of personnel trained to serve in the Source Control Branch for well control response. The exercise ensured the VERT could work in IMS allowing personnel to better understand key communications, resource ordering, tactics, and incident action planning.

Understand process for securing required resources directly or using mutual aid such as construction vessels, MODUs, offshore support vessels, and DP tankers

During the planning of the exercise, it was critical as part of pre-planning to understand what additional resources may be in the region of the well operations that could assist with a response. Once potential resources were identified to meet the needs of the various missions, it would be advantageous for the WO to enter into mutual aid agreements with other operators or companies that would help expedite the use of such resources.

During the exercise play, the source control branch personnel verified the availability of necessary resources and identified the potential steps that would be required in order to secure those assets for use during an incident.

Exercise logistics for a viable Incident Command Post (ICP) to meet needs of more than 200 responders

The sourcing a suitable ICP venue to accommodate an exercise of this size is integral to ensuring the IMT can operate seamlessly and effectively. For approximately 200 responders, a large ICP (approx. $500m^2$) is required to accommodate the IMS structure:

- Operations, Planning, Logistics, Finance Sections
- Five additional breakout rooms (each approx. $100\text{-}150m^2$) to accommodate the Command, Joint Information Centre and Liaison Sections,
- A meeting room, the simulation cell (SimCell), and a room to accommodate VIPs and exercise observers was required.

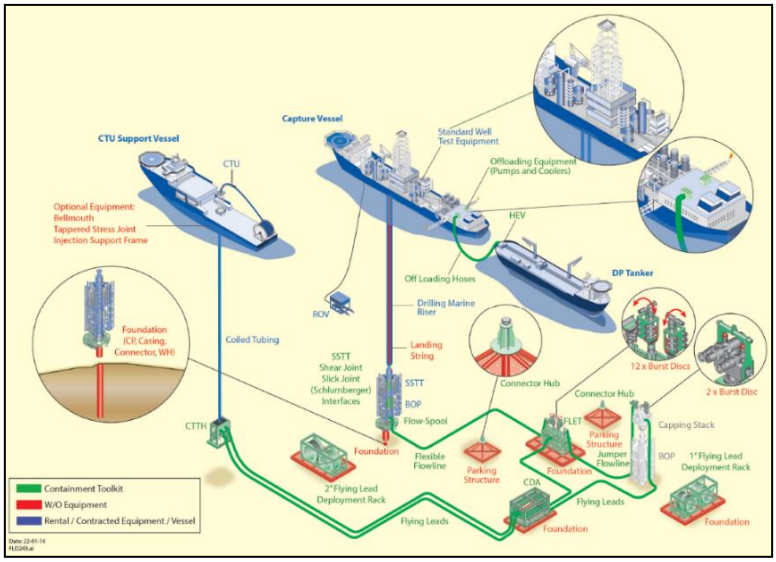
Ideally the rooms all need to be on the same floor and in close proximity to each other so that walking between them is quick and easy to fascinate collaboration. This exercise was held at the NH Den Haag Hotel in The Hague, see Figure 3.

The IT requirements to support an exercise response of this size are demanding and require the following:

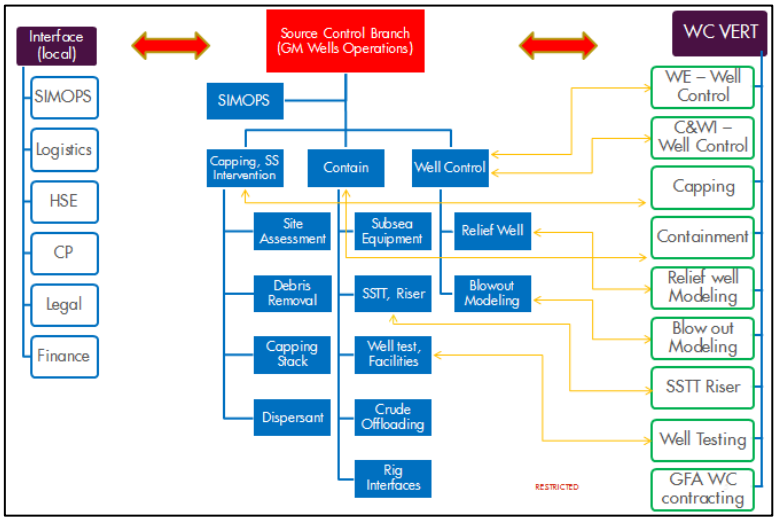
- Segregated dedicated internet (both hardwire and wireless) with capability of 50MB upload and download speeds (to support up to 400 devices)
- 26 telephone lines with capability of phoning internally and externally (local and international)
- 5 large multifunction printers/copiers/scanners
- 1 A0 plotter to print maps and posters
- 5-10 large screens to display incident information around the ICP
- Cabling to provide power point connections for 200 users

With regards to internet capability, few hotels/ venues can provide a dedicated, segregated internet line of this size, and it usually needs to be brought into the venue. The IT team works closely with the planning team to ensure the needs are met prior to the start of the exercise and these personnel are then integrated into the IMS response structure for seamless support.

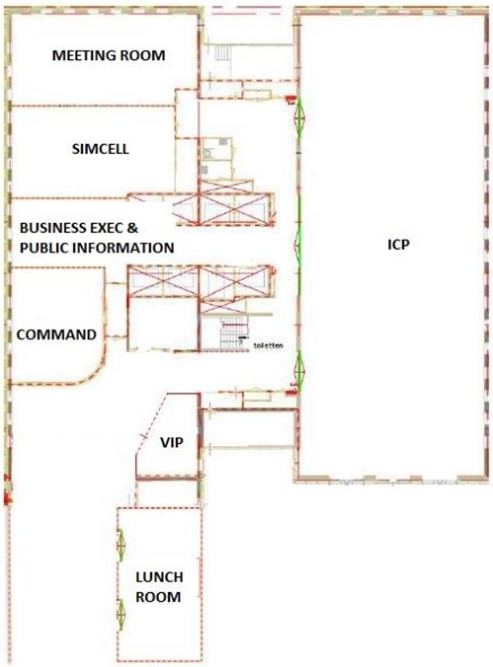
Supporting Images or Graphs



OSRL SWIS Containment – Figure 1



GRSN / VERT ICS Organigram – Figure 2



Incident Command Post Layout – Figure 3

Conclusion

The Tier 3 exercise was held during the week of June 5 – 9, 2017 in The Hague, Netherlands. The overall exercise objectives were met that included implementing the mission plans to ensure key aspects had been addressed in the exercise pre-planning. After the exercise, the appropriate mission plans were updated with additional information that was obtained during the exercise play.

To date, key aspects of the OSRL SWIS Containment system have been verified in workshops and the Tier 3 exercise, except for commencing flow operations. The next step in this preparedness journey is to conduct additional pre-planning for flow operations and further develop mission plans. After the pre-planning, a workshop/exercise will be held to evaluate the flow operations activities.

References

- Subsea Well Response Project – Containment Toolkit
  - http://subseawellresponse.com/2015/04/14/oil-industry-delivers-containment-toolkit-to-enhance-subsea-well-incident-response/
- OSRL SWIS Capping
  - https://www.oilspillresponse.com/services/subsea-well-intervention-services/capping/
- OSRL SWIS Containment
  - https://www.oilspillresponse.com/services/subsea-well-intervention-services/containment/
- IPIECA/OGP "Incident Management System for the Oil and Gas Industry"
  - http://www.ipieca.org/resources/good-practice/incident-management-system-ims/