



Review of Joint Industry Projects

Delivering Subsea Well Intervention Capability

Paper Authors – Emma Smillie & Matt Clements (OSRL)

Presenter - James Burroughs, Subsea Well Intervention Services – Operations Manager (OSRL)

The Macondo Incident in 2010 catalysed the trend towards ever tighter safety standards. The industry needed to examine and determine what could be done on a global scale to reduce the likelihood and impact of well incidents, as well as identify how to respond more effectively to such incidents. The International Association of Oil and Gas producers (OGP) very quickly established a committee called the Global Industry Response Group (GIRG) to consider these challenges. GIRG brought together more than 100 technical experts and managers from some 20 companies around the world. They worked together to identify, learn from and apply the lessons of Macondo and Montara in Australia. GIRG worked closely with national and international regulators and industry associations to develop recommendations that would enhance the industry's capabilities in three core areas:

- Prevention: developing better capabilities and practice in well engineering design and well operations management in order to reduce the likelihood of future incidents.
- Intervention: improving well capping response readiness (in the event of an incident) and studying further the need for, and feasibility of, global containment solutions.
- Response: delivering effective and fit-for-purpose oil spill response preparedness and capability.

The Subsea Well Response Project (SWRP), a consortium of nine leading upstream companies, was established to take forward GIRG's recommendations in the intervention field, working alongside newly established OGP bodies on prevention and response. SWRP had four core tasks:

- Designing a capping toolbox to allow subsea wells to be shut in.
- Designing hardware for the subsea injection of dispersant.
- Assessing the need for, and feasibility of, a containment system.
- Evaluating potential approaches for deployment of equipment.

Emerging solutions

SWRP's technical experts spent two years undertaking collaborative studies into subsea well incident intervention requirements. This covered a variety of potential incident scenarios and geographic variations in weather, ocean and oil conditions. They identified a set of intervention equipment that can enhance the industry's capabilities to respond to a subsea well incident in a variety of conditions around the world.

OSRL was identified to make this new equipment available to the industry. The collaboration between OSRL and SWRP resulted in the design and building of four comprehensive capping stack systems for use in waters as

deep as 3000 m. This global intervention equipment is now available for industry use through subscription to OSRL's Subsea Well Intervention Services (SWIS). The company owns, stores and maintains the equipment on behalf of its members. Members remain responsible for the mobilization and deployment of the equipment.

Advanced well intervention equipment

The intervention system is designed to be flexible, to allow for a number of subsea incident scenarios. It includes four capping stack systems, two 18 ¾ in. bore capping stacks developed to handle pressure up to 15 kpsi and two 7 1/16 in. bore capping stacks designed for pressure up to 10 kpsi. All of the capping stacks were designed to share a standard configuration, with common pipework, valves, chokes and spools rated to 15 kpsi. Interchangeable gate valves and rams provide added flexibility.

The intervention system also includes two subsea incident response toolkits, containing equipment for manual blowout preventer intervention, debris clearance and the subsea application of dispersant. The inclusion of this equipment further extends the system's suitability for a range of response options across the globe. The subsea application of dispersant can be an essential part of well response operations, where circumstances allow. Dispersant helps to limit the appearance of hydrocarbons at the surface and creates safer working conditions for responders on the surface through reduction in volatile organic compounds (VOC). The toolkit's debris clearance materials and spacer spools help responders to gain access to the existing BOP if a piece of equipment, such as a pipe, is protruding.

Continued collaboration: Containment

OSRL and SWRP continue to collaborate and are currently refining a containment toolkit and guidelines, which will be made available to industry mid 2015. In the rare event that capping is not possible or not sufficient to shut in a well, the containment system will enable oil to be flowed from a capping stack to a tanker while a relief well is drilled. While capping will always be the primary response approach, the containment system provides another level of contingency. The containment system maximises the use of standard industry vessels and hardware. This means an operator can call for assistance from nearby vessels and equipment, minimising response times and reducing the need for dedicated containment hardware. To form the containment system, a responding well operator will need access to mobile offshore drilling units, drilling risers, subsea test tree landing strings and surface well tests spreads as well as offloading tankers.

OSRL is providing a containment toolkit of longer lead items, which supplement this standard hardware to create a containment system. Industry access to the containment toolkit is available on a subscription basis through OSRL.

The toolkit includes flexible jumpers and flowlines, which will be stored in three regional locations – Brazil, UK and Singapore - and shipped to an incident site if required. The toolkit also includes flowline end terminations with flow spools, hydrate inhibitor delivery system, transfer pumps and coolers, hose end valves and marine off loading hoses. This latter equipment is air-freightable and will be stored with its manufacturers, ready for global use.

In essence, the subsea well containment toolkit involves a standard readily-available well test riser and well test surface spread, deployed offshore from a drilling rig/capture vessel at a safe distance off set from an incident well. This is possible because of a side-entry flow spool with subsea test tree latch, which has been developed by the SWRP team. This newly engineered technology allows the aforementioned equipment to be deployed safely in most weather conditions several hundred meters away from the incident site. This set up establishes an expandable off set well test concept capable of collecting hydrocarbons at a safe distance from the incident well. While one containment leg will be suitable for the majority of anticipated scenarios the system can be assembled with up to three legs, depending on the discharge volume and gas-oil ratio of the well.

Containment guidelines

Subsea well containment is a very complex operation and the proposed concept relies on well operators having access to a wide range of standard vessels and equipment. SWRP has therefore developed a suite of documents, which describe the containment concept to SWIS subscribers. The containment guidelines include advice on the advance contingency preparations that should be in place before well operations commence, equipment specifications, how to deploy the toolkit equipment alongside standard industry vessels and hardware and information about operating a containment system and its role in a wider response scenario. The guidelines also include information on simultaneous operations, the management of which is essential for a safe and efficient response.

Future developments

The collaboration between SWRP and OSRL has enabled the development of advanced capping and containment equipment. In turn, this equipment has enhanced the industry's capability to respond to subsea well incidents around the world. This has been a huge achievement by the industry, for the industry, but the work does not stop here.

To supplement these well capping and containment capabilities, SWRP is now procuring off set installation equipment (OIE) following feasibility studies. OIE would enable the removal and installation of equipment in scenarios where there is no direct vertical access above the incident well.

The SWRP OIE is based on buoyancy tanks, stabilised with mooring and pennant lines. The system includes four buoyancy tanks configured to minimise interaction with the hydrocarbon plume. Electrical power and communications are provided via a remotely operated vehicle (ROV) through an ROV docking point. There is a winch system with pay-out and tension sensors that help with positional control and to monitor the tension in the cables attached to the seabed/BOP. Additionally, a cardan joint provides both the capability to align the capping stack to a tilted BOP and to lower the capping stack onto the BOP. The full system is due to be delivered early 2016. The availability of OIE should further enhance the industry's intervention capabilities, allowing operators to respond effectively in the event of a subsea well incident – with or without direct vertical access.

For the benefit of international industry

The collaboration has given the global oil and gas industry access to state-of-the-art subsea well intervention equipment. There are 19 long term SWIS capping subscribers to date, covering in excess of 350 global subsea wells per annum. The subscription basis means the cost of the equipment is shared, making it available to a broad range of operators. It also provides a more comprehensive solution than any individual company could have achieved alone. The message to well operators is always that access to equipment alone is not sufficient. Robust response planning is critical for a successful response. With a variety of equipment stored at locations throughout the world, the well operator/owner needs to be familiar with this equipment. Specific configurations for the various components of the SWIS equipment need to be planned, established and requested by the well operator/owner to provide for a smooth mobilisation, deployment and execution. A subsea well capping and containment contingency plan, prepared prior to a drilling campaign, will greatly enhance a well owner's ability to contain the well flow as expediently and efficiently as possible, if a well incident occurs. The only way to achieve such preparedness is to proactively plan for it.

The establishment of this new international intervention capability, available to all operators via global storage bases, is a huge step forward for industry.