Anatomy of a disaster

The tce team takes a closer look at BP’s efforts to stop the oil spill in the Gulf of Mexico

Containment

In a bid to wrestle control of BP’s 60,000 bbl/d gusher, the Gulf of Mexico has become a frontier-land for on-the-hoof engineering filled with top hats, and robots wielding diamond-tipped saws.

In late May, BP decided to abandon efforts to plug its damaged well. Prior to that, the company had tried about every measure in the book to stop the oil – and a few that weren’t. All to no avail. So what went wrong?

**top kill**

The so-called ‘top kill’ operation failed to stop the upwell of oil and gas despite BP pumping in 30,000 bbl of mud at pressures in excess of 10,000 psi and at rates as high as 80 bbl/minute. ‘Mud’ is industry parlance for a cocktail of heavy-density fluids, in this case made of barite and viscosifiers.

To complement efforts to clog the 445 t blowout preventer (BOP), the failed series of multi-redundant high-pressure valves atop the well, BP also fired in a series of ‘junk shots’ containing shredded tyres and dense rubber balls.

But the oil kept leaking from the well – along with the mud BP had pumped in; so BP’s engineers refocused their attention on containing the spill.

**domes and top hats**

Previously, BP had built a 12 m tall dome made from steel and concrete and lowered it on top of the leak. Unfortunately, on contact with cold seawater the leaking gas chilled into hydrate crystals, blocking the dome. Worse still, because the crystals were less dense than the surrounding water the dome became buoyant and began floating away from the well. According to a senior process engineer working in the oil industry, this sequence of events was entirely predictable: “Methane gas and cold water... didn’t hydrates cross their minds before they started to construct and implement the dome?”

A much smaller 4 m tall steel containment dome (the ‘top hat’) was more successful. While technical troubles prevented a snug fit and there is still some oil leaking into the sea, the injection of methanol antifreeze prevented further
Need to measure bulk transfers without compromising on accuracy?

The OPTIMASS 2300 Coriolis mass flowmeter from KROHNE is the answer.

Based on straight tube technology from the world leader in straight tube designs, KROHNE has developed the OPTIMASS 2300, an excellent solution for bulk product transfer where the highest accuracy is required.

 Offering outstanding performance for mass and volume flow measurement, the OPTIMASS 2300 is ideal for fiscal measurement and offers flow rates from 1,560 kg/h to 2,300,000 kg/h with a measuring accuracy of 0.1 %.

The OPTIMASS 2300 is also capable of high turndown ratios, keeping flow velocities low, preventing the build-up of static in hydrocarbons and presenting a real benefit for custody transfer applications, especially in the oil and gas industry.

With high pressure rating and excellent safety features the OPTIMASS 2300 is a first class solution for bulk measurement.

OPTIMASS 2300 – The new generation of Coriolis mass flowmeters.

KROHNE – The oil & gas industry is our world.

For further information please visit our website: www.krohne.com/coriolis
or email coriolis@krohne.co.uk
Clean-up

So the oil is in the water, what next?
The movement of oil is affected by tides, currents, and wind direction, and the first line of defence is to try to prevent the oil from washing ashore. There are several methods of doing this: skimming, controlled burns, containment with booms, and chemical dispersion.

Skim and burn
Skimming and burning are fairly self-explanatory. Skimmers may be deployed to the scene of a spill. These boats are fitted with equipment to separate oil, which can then be burned off. Almost 300 controlled burns have been carried out on oil from the Deepwater Horizon leak, removing an estimated 38b l of oil from the ocean so far. Both methods are only truly effective in calm seas.

Booms
There are two types of boom; containment booms and sorbent booms. Containment booms float on the surface of the ocean and are made of impermeable material such as plastic. They can be used to ‘corral’ oil in areas of the sea to facilitate skimming or to prevent oil reaching a certain place. In the Deepwater Horizon spill, booms have been used to try to protect the sensitive Louisiana shoreline, with limited success. Booms will only work in relatively calm seas – waves can cause the oil to wash over the top.

Sorbent booms soak up the oil with an absorbent or adsorbent core, which is usually synthetic but may be natural. Booms made of hair were trialled in the ocean so far. Both methods are only truly effective in calm seas.

Dispersants
The use of dispersants is somewhat controversial. They reduce the quantity of oil reaching the coast by dispersing it throughout the water column but this presents its own problems.

While much has been made of the fact that Corexit, the most-commonly applied pre-approved dispersant, is toxic to marine animals, Carys Mitchelmore, aquatic toxicologist at the University of Maryland’s Center for Environmental Science says it is less harmful than the dispersed oil itself.

Dispersed from the surface, oil droplets could badly affect creatures living in the top 10 m of the water column. Here live the larval stages of many marine creatures so a generation is at risk, as are the zoo- and phytoplankton, which form the bottom of the marine food chain.

As this is the first time dispersants have been applied below the surface the potential effects are as yet uncertain. “This is one big experiment,” says Mitchelmore. “We really don’t know what will happen. It’s a learning curve for everybody.”

Shoreline clean-up
Once the oil is on the shore there are various options but Denise Reed, a professor of earth and environmental sciences at the University of New Orleans warns that there isn’t a ‘one-size-fits-all’ solution, as superficially similar coastlines may actually be quite different.

Removing oil from sandy and rocky shores is relatively simple, it can be shovelled up and taken away from sand or pressure-washed off rocks.

On marshes the operation is more complex. If the leaves of marsh plants become coated with oil, they cannot breathe and will die. Trying to remove the oil can force it into the soil where the conditions are anaerobic, preventing microbial breakdown.

Microbial breakdown can be encouraged by one of two methods, biostimulation and bioaugmentation.

With biostimulation, nutrients are added to the environment to encourage microbial growth. With bioaugmentation, additional microbes are added to the environment. Reed says that in places like Louisiana, where growth is already high due to a warm climate and abundant nutrients, this is likely to do more harm than good because it disrupts the existing balance.

Sometimes the best option can be ‘do nothing’ – though BP may find it hard to convince politicians and the media of the wisdom in this. But once the area is clean, animals will recolonise from other areas, so lasting impacts should be minimal.

Regulation

When a disaster such as this hits the headlines, the question is asked: “How could this be allowed to happen?”, usually followed by “We must learn the lessons and prevent it from ever happening again.”

Some, including representatives of the Government Accountability Office and the Interior’s Inspector General have testified that there was too little critical oversight, that the rules weren’t tight enough, and that companies have enjoyed too much freedom to set their own rules and procedures when it comes to health and safety.

On the other hand, a kneejerk reaction resulting in an avalanche of prescriptive safety regulations could do more harm than good, warns Donald Dobson, principal inspector of well engineering at the UK’s Health and Safety Executive.

Dobson suggests that the US could learn a thing or two from the UK, which operates a goal-setting regulatory regime rather
than the more prescriptive approach used in the US. This gives the UK a measure of flexibility, while keeping operators on their toes, which he says is a key safety advantage.

Anyone wanting to drill offshore has to submit a safety case, follow the goals set by the Offshore Installations and Wells – Design and Construction regulation, and have their design and construction checked by an independent competent expert. The regulations typically require operators to ensure equipment specified (such as the BOP) is suitable to the task. Operators may get suggestions for what constitutes “suitable” from the available guidance, but ultimately, UK regulators do not demand specific solutions.

“A weakness of the regime anywhere is that there aren’t any international standards for the design of a well,” says Dobson. This means that most of the industry works to its own corporate standards. Part of the problem is that company engineers are have far more experience and competence than regulators ever will, Dobson says. “Any regulator can only spot the fairly major blunders,” he admits, though the independent expert adds another pair of eyes in the UK.

The US requirement for regulatory consent adds its own problems, particularly when requests for a new drill site are often not made till the last minute, putting regulators under pressure to consent with insufficient time for a meaningful review. Dobson believes that while this apparently tighter regime may look good to outsiders, in practice it can give the operator a false sense of security, the warm fuzzy feeling of “regulator-approved”.

It may come as a surprise to some, given the huge effects of an accident, that there is no independent requirement or check to ensure that the safety, design and building standards used by firms are up to scratch – the industry is largely self-regulating.

The closest they come to independent scrutiny is the UK requirement of an independent expert – however this is a scheme set up and paid for by the oil companies. This person might be third party, but can also be from the operator’s own company, provided they have no direct responsibility for work they are examining.

“There is a trade-off between competence and independence,” Dobson admits. It works, he says, because “company insiders have a better understanding on how that particular company does things and is better able to spot errors that a complete outsider would not.”

Sandvik worldwide locally...

...your reliable local source for stainless steels and special alloys in all product forms from stock

Sandvik is a worldwide producer of an extensive range of stainless steels and special alloys developed to meet the most demanding of applications. What’s more, they’re all available locally, off-the-shelf and in all the product forms you are likely to need.

There’s also our package building service to help you with your specific projects.

Find out more about Sandvik materials that matter - ask for your copy of our latest brochure.

Sandvik Materials Technology UK
Manor Way, Halesowen, West Midlands B62 8QZ, UK.
Tel: +44(0)121 504 5111 Fax: +44(0)121 504 5151
E-mail: sales.smtuk@sandvik.com
Website: www.smt.sandvik.com/uk