

2011 Lillehammer Energy Claims Conference

BP Macondo Well Incident
U.S. Gulf of Mexico

Pollution Containment and Remediation Efforts

Presented By:
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Pollution Containment



Pollution Containment

How do you contain pollution from a well out of control in 5,000 feet of water?

- Bring together the brightest minds to solve the problem
- Design, engineer and fabricate containment systems in a matter of weeks
- Install untested technology in an environment only accessible by Remotely Operated Vehicles (ROVs)



Pollution Containment

FIRST ATTEMPTS



Riser Hot Tap

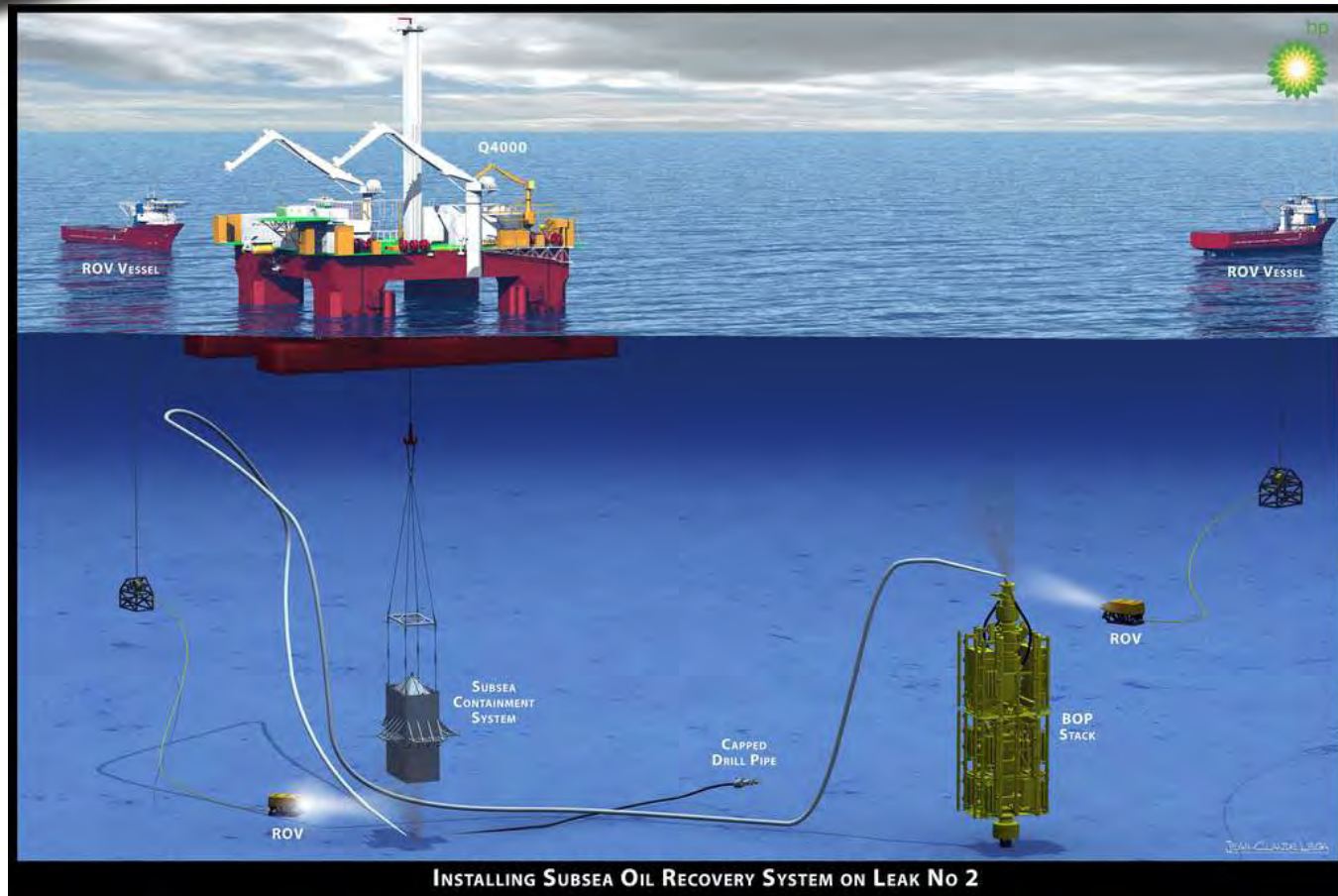
- Consisted of coiled tubing placed inside the broken end of the Deepwater Horizon riser
- Intended to capture a portion of the oil flowing out of the riser
- System failed to capture any measurable amounts of oil due to the lack of a sufficient seal with the riser and was abandoned



Cofferdam (Containment Dome)



Cofferdam (Containment Dome)



Cofferdam (Containment Dome)

DID IT WORK?



Cofferdam (Containment Dome)

Unfortunately hydrates (or ice crystals) formed within the Containment Dome and plugged the system

Subsequently, this effort was abandoned



Riser Insertion Tube Tool



1 Insertion tube is guided into riser.



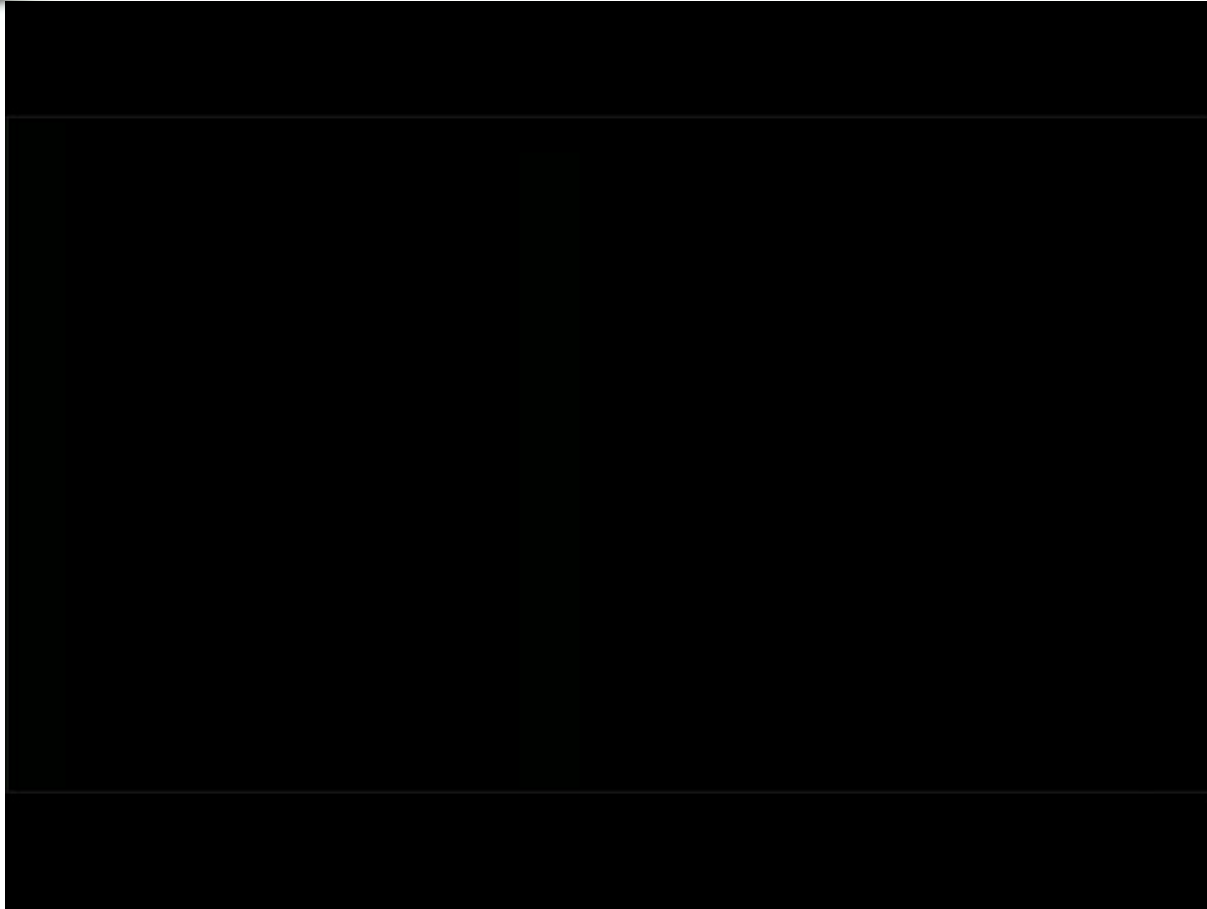
2 Rubber diaphragms conform around drill pipe to plug riser as much as possible.



3 Hydrocarbons are "lifted" to the drillship by inducing nitrogen in the drill pipe. Rubber diaphragms minimize seawater ingress near the insertion tube inlet which significantly reduces the appearance of hydrates.



Riser Insertion Tube Tool



Riser Insertion Tube Tool

DID IT WORK?



Riser Insertion Tube Tool

The Riser Insertion Tube Tool did in fact work to an extent and was able to recover approximately 8,000 barrels of oil a day at the peak of its use

However...



Lower Marine Riser Package (LMRP) Cap

Though the Riser Insertion Tube Tool was able to recover a portion of the oil flowing from the end of the broken Deepwater Horizon riser, the riser had also been compromised at another location closer to the well-head

BP now needed a way to contain more significant amounts of oil

As such, the LMRP Cap, also known as a Top Hat, was developed



Lower Marine Riser Package (LMRP) Cap



Lower Marine Riser Package (LMRP) Cap

One problem. . .

The Deepwater Horizon riser was still attached to
the BOP package



Lower Marine Riser Package (LMRP) Cap

Diamond Saw



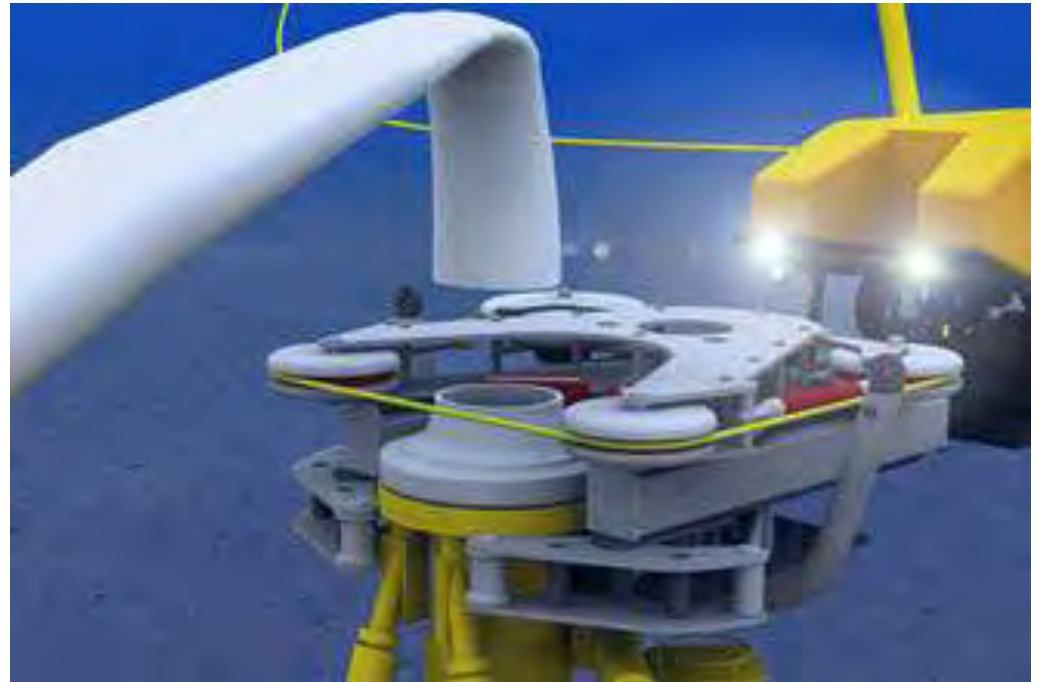
LMRP Cap Prior To Deployment



Shears

Lower Marine Riser Package (LMRP) Cap

The first attempt to completely cut the riser with the Diamond Wire Saw was unsuccessful as the Diamond Wire became stuck



Lower Marine Riser Package (LMRP) Cap

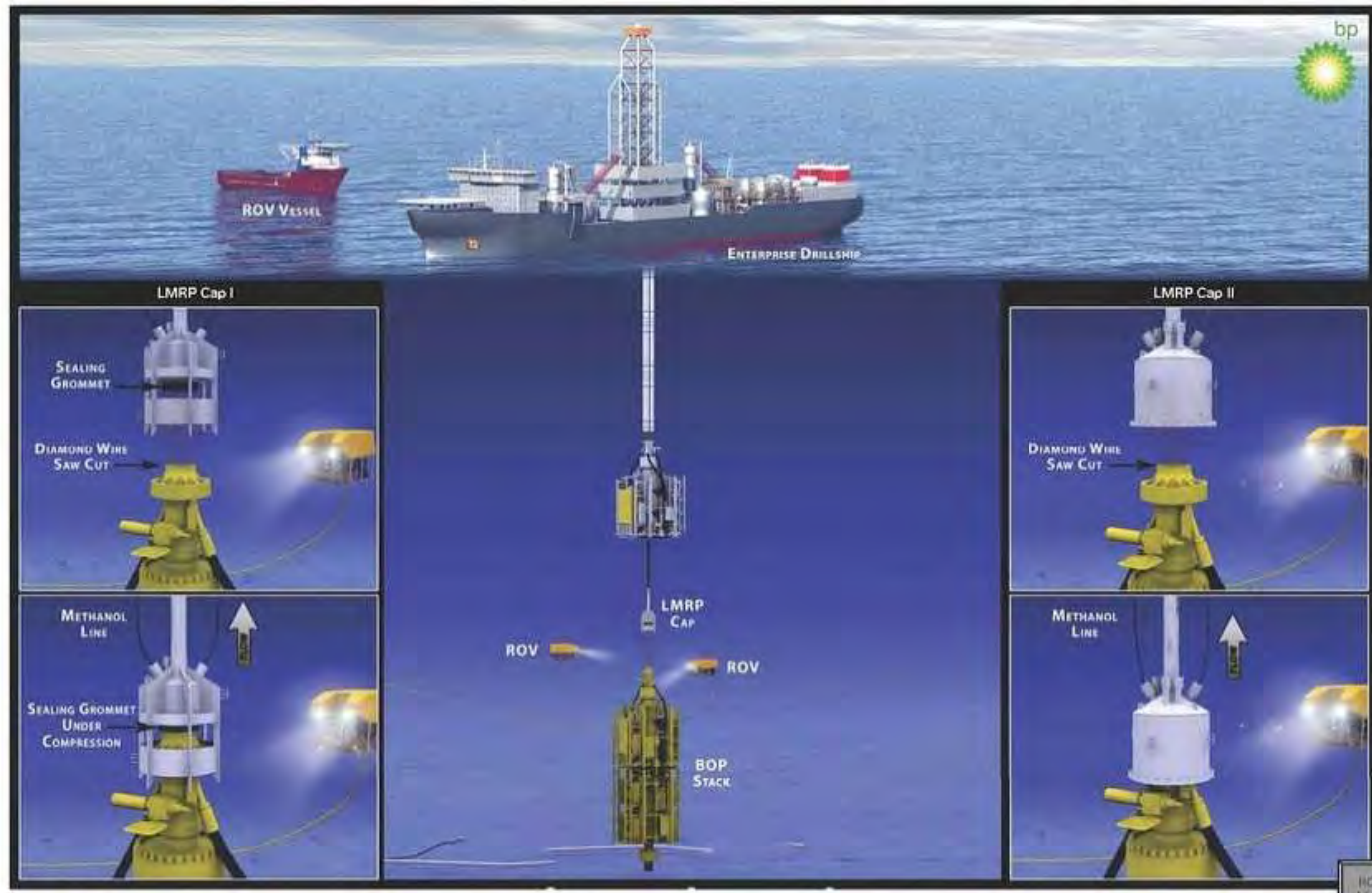
BP then utilized
large hydraulic
shears to complete
removal of the riser



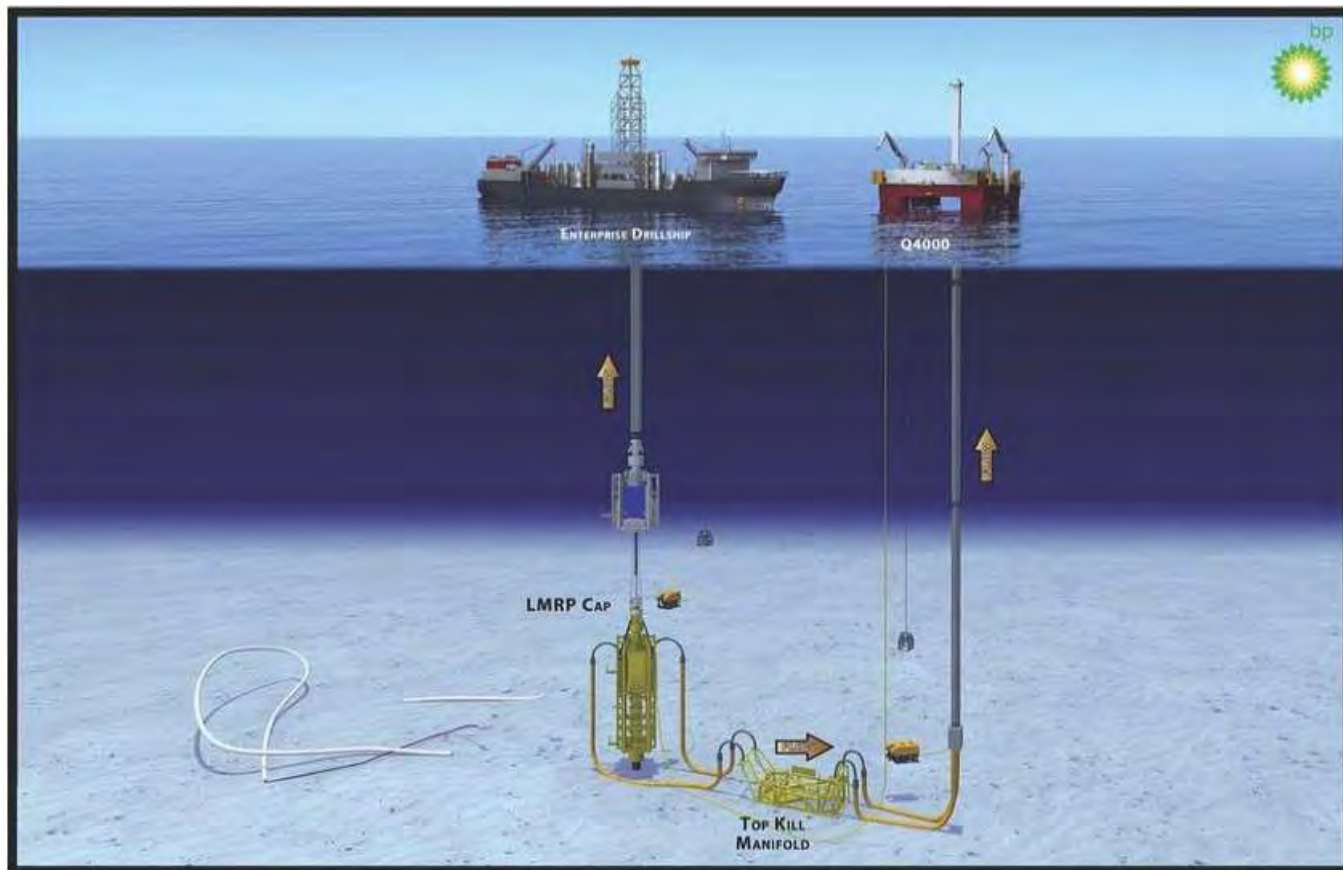
©2008 Paladin Brands



Lower Marine Riser Package (LMRP) Cap



Recovery through Choke and Kill Lines



Issues

The LMRP Cap and Choke and Kill line systems were able to capture a significant amount of oil flowing from the Macondo Well, however, BP was still looking to recover 100 percent of the flow into a “closed” containment system

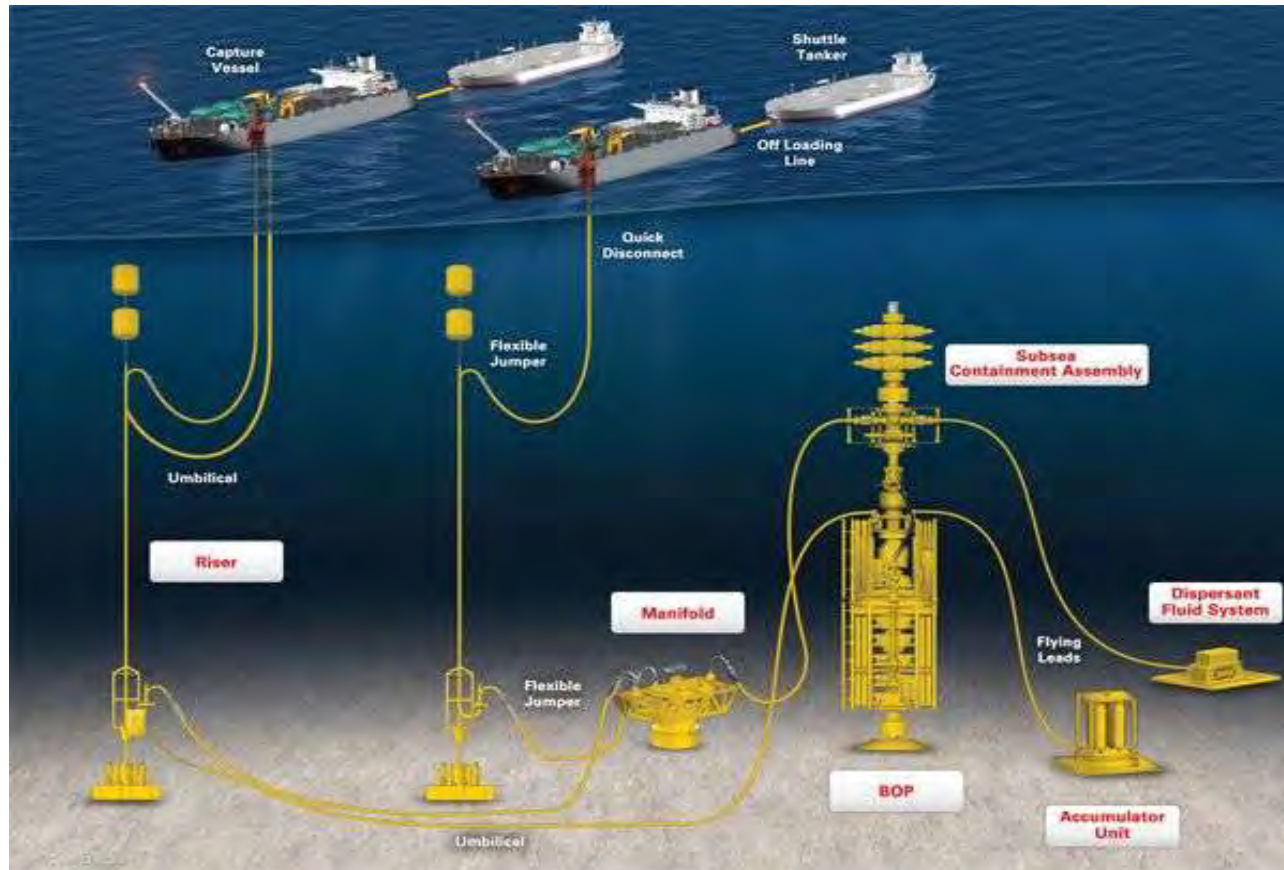


Containment Disposal Project (CDP)

As other containment systems were being developed and deployed, BP engineers were designing a “closed” containment system, known as the Containment Disposal Project (CDP)



Containment Disposal Project (CDP)



Three-Ram Capping Stack



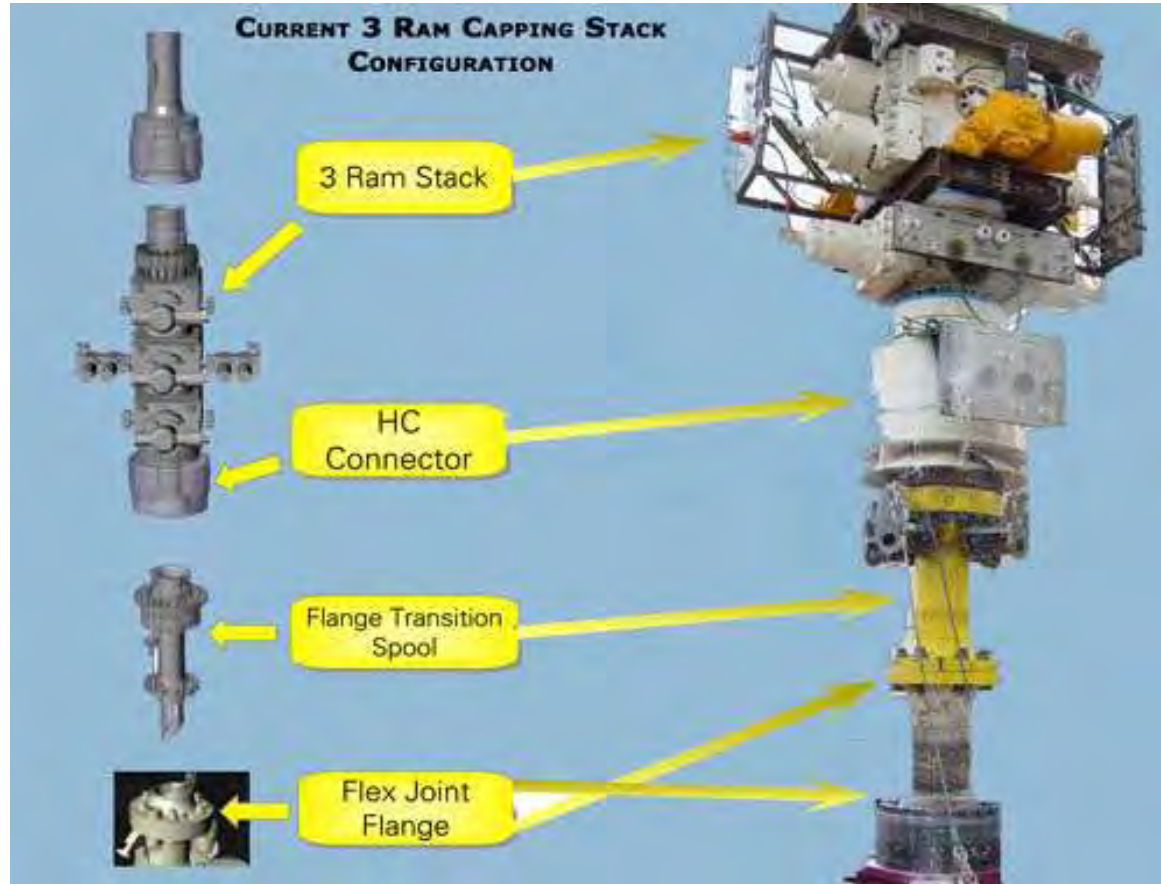
Three-Ram Capping Stack

Consisted of:

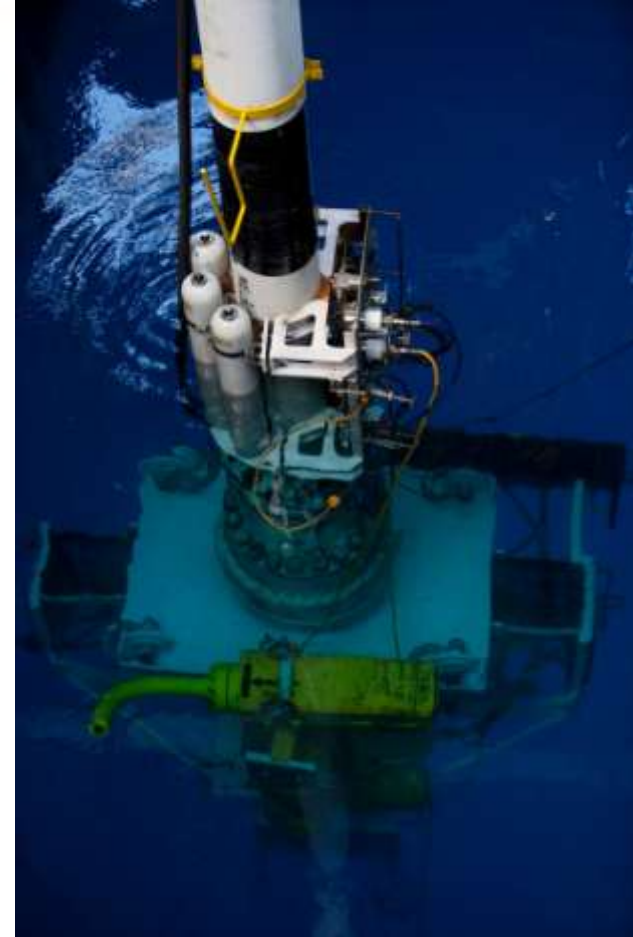
- Flex Joint Flange to encompass broken drill pipe inside Deepwater Horizon riser and BOP
- Flange Transition Spool connecting Flex Joint Flange to HC Connector
- HC Connector (transfers to load of the Capping Stack above)
- 3 Ram Stack (fabricated using traditional subsea BOP components)
- Remotely Operated Vehicle “Hot Stabs” and control module



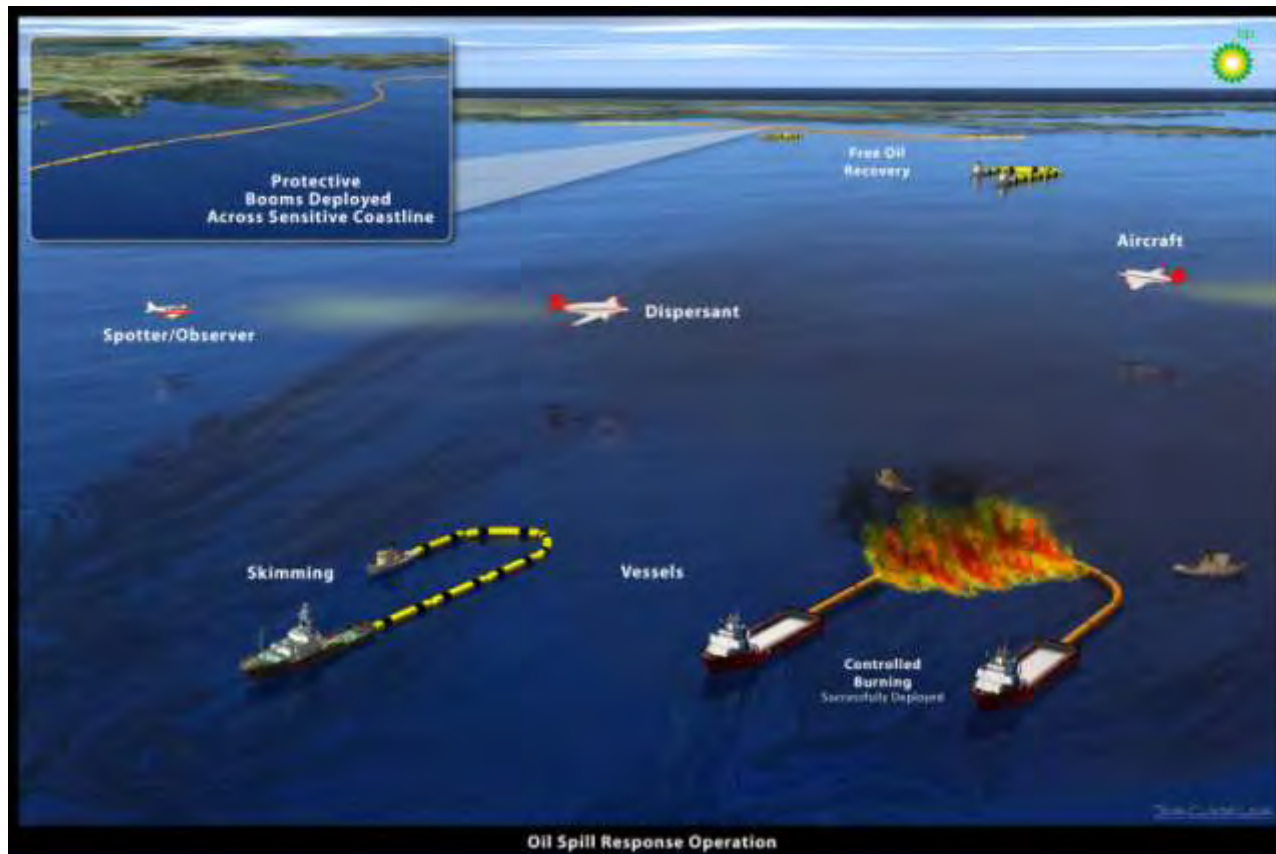
Three-Ram Capping Stack



Three-Ram Capping Stack



Pollution Remediation and Clean-Up

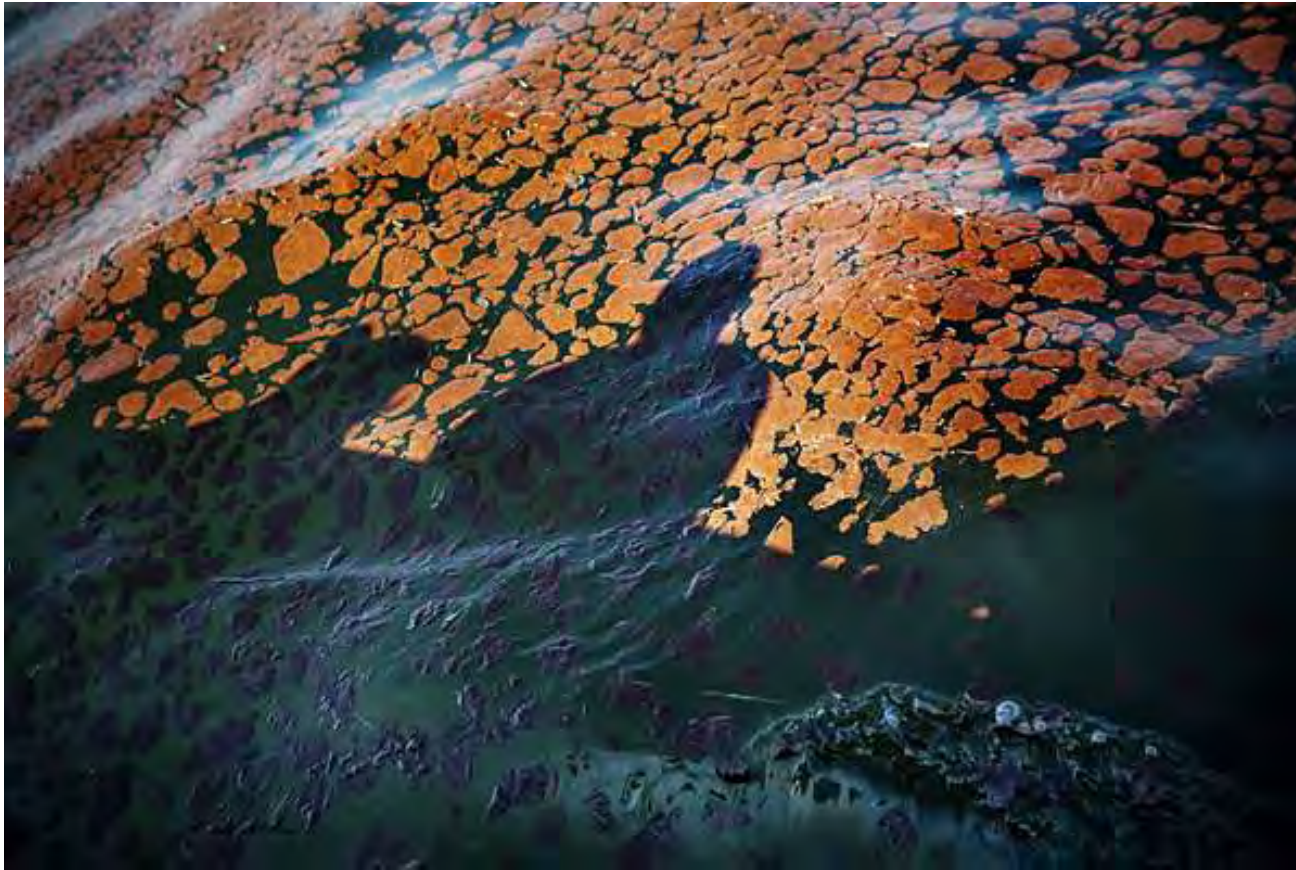


Pollution Remediation and Clean-Up

So what exactly were all these resources used for?



Chemical Dispersants



Methods of Dispersant Application

Aerial Application

Over 400 sorties flown

Used trained spotters in small aircraft to locate pockets of oil

Most effective and fast moving tool for minimizing shoreline impact



Methods of Dispersant Application

Subsea Application

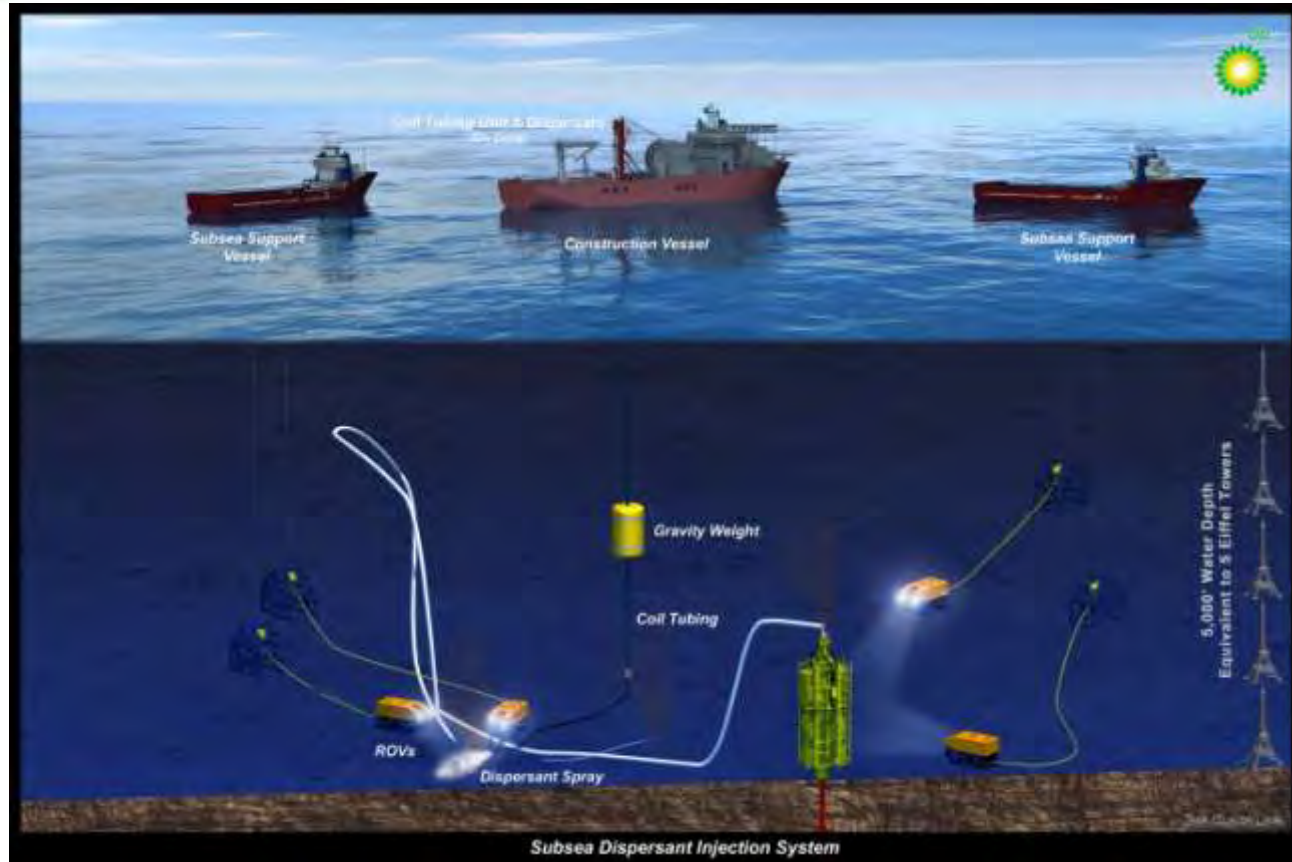
Use permitted since the 1990's

Originally developed by Exxon, use of subsea dispersants was purely experimental at the time of the Macondo incident

Allowed use of surface dispersants to be reduced by 70 percent and reduced overall Volatile Organic Compound (VOC) emissions



Chemical Dispersants



Controlled In-Situ Burns



Controlled In-Situ Burns

BP, along with the U.S. Coast Guard carried out 411 controlled burns

Approximately 265,000 barrels of oil remediated

Drove improvements in fireproof boom, water-cooled and reusable boom technology



Open-Water Skimming



Open-Water Skimming

Deployed more than 60 open-water skimmers including 12 purpose-built vessels

Fleet had skimming capacity of 1.2 million barrels of oil per day

Developed enhanced booming and skimming methods and capability to convert offshore supply vessels into skimmers



Pollution Containment Booms



Pollution Containment Booms

Two types of Pollution Containment Booms
were utilized



Pollution Containment Booms

Traditional Containment Booms

Reusable boom used to
block or contain the oil slick

14 million feet (4.3 million
meters) of boom mobilized

4.2 million feet (1.3 million
meters) actually deployed



Pollution Containment Booms

Sorbent Booms

A one-time use, selectively permeable boom used to absorb oil and not water

9.1 million feet (2.8 million meters) deployed



Vessels of Opportunity (VOO)



Vessels of Opportunity (VOO)

BP utilized a VOO fleet of over 5,800 vessels

VOO vessels carried out booming, skimming, oil collection, monitoring and reporting operations

The program will be included as part of future response systems established in the Gulf of Mexico



Shoreline and Waterway Protection



Shoreline and Waterway Protection

Sandbags



Shoreline and Waterway Protection

Sand filled man-made barriers



Shoreline and Waterway Protection

Sand berms



Shoreline and Waterway Protection

And floating barriers such as barges to protect inlets



Shoreline Clean-Up



Manual Clean-Up

BP trained more than 11,000 community responders to lead teams of workers

Night-time shifts were also adopted to reduce intrusion for beachgoers and reduce heat stress on workers



Mechanical Clean-Up



Mechanical Clean-Up

BP designed and fabricated five purpose built “Sand Sharks”

Designed to lift and sift sand to remove oil while minimizing actual sand removal

The unit was self-contained and did not require any supporting machinery



Marsh Clean-up



Marsh Clean-up



Marsh Clean-up

Several established techniques included:

- **Vacuum/pumping** – removes pooled oil on marsh sediment or on the surface of the water
- **Low-pressure flush** – pushes oil towards collection points where other equipment can recover the oil
- **Vegetation cutting** – selective plants are cut and removed so that other techniques may be employed
- **Bioremediation** – a low-impact cleaning technique using microorganisms and their enzymes to facilitate decomposition of the oil



Marsh Clean-up

- BP developed a “small spill” approach utilizing over 2,500 workers divided into task forces of 16 to 20 responders
- BP also developed and adapted new tools and techniques for more effective and non-invasive clean-up



Marsh Clean-up

For example, BP utilized concrete pumping arms to inject water deep into marshes to accelerate natural flushing of the oil



New Ideas and Proposals



M/V: A WHALE or a Whale of a Ride?



M/V: A WHALE or a Whale of a Ride?

Unfortunately the Vessel only collected negligible amounts of oil and was dubbed a bust



The BIG GULP and LITTLE GULP



“You’re a Fool to Believe in Something You Have Never
Seen” (Waterworld 1995)



AquaTerra
Adjusters 

V16 Centrifuge and Trans Rec 150 Skimmer

The system was
built in 10 days

BP ordered 32



Other Ideas



Gelling Agents



Hay is for Horses



A Hairy Situation



What's All The Buzz About?



Pine Shavings



Oil Eating Mushrooms



And Finally.....



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