CoThink Event Map: Blowout on Deep Water Horizon

Context

On April the 20th 2010 the Deep Water Horizon encountered a blowout. The Blow Out Preventer should have prevented the following disaster but only partly worked. In this Event Map based on the US CSB animation we explain the chain of events.

Location

Macondo well in the Gulf of Mexico

Author
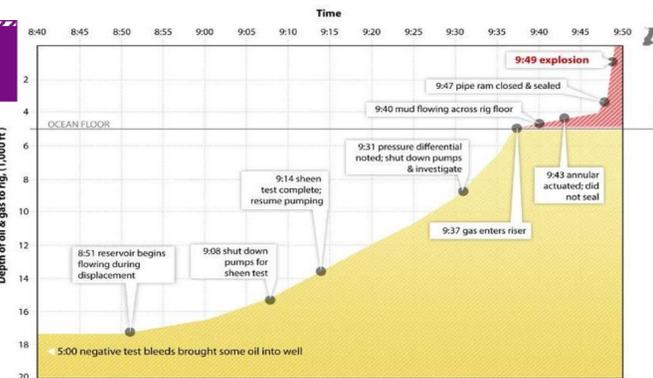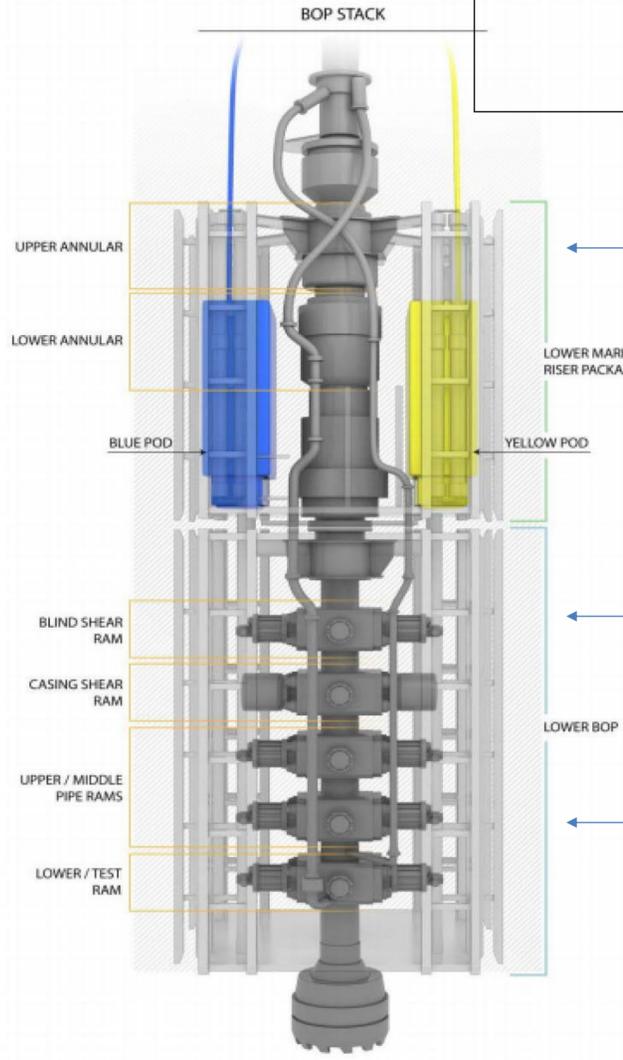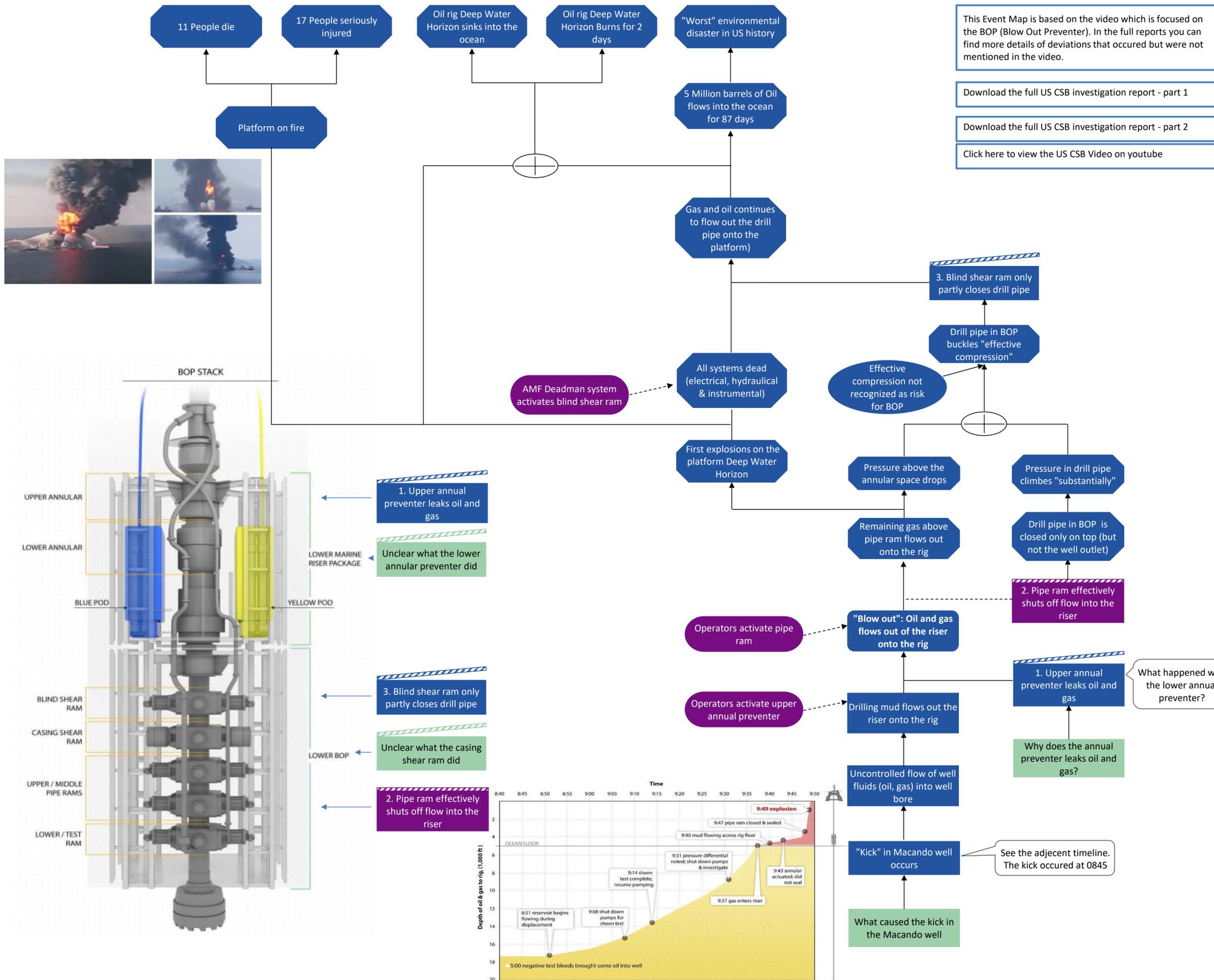
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Date of last update

21-2-2018

Status description

The causes identified by the US CSB also apply to other BOP's in operation. The US CSB warned manufacturers of the risks of effective compression in drill pipes in BOP's.

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11 People die

17 People seriously injured

Oil rig Deep Water Horizon sinks into the ocean

Oil rig Deep Water Horizon Burns for 2 days

"Worst" environmental disaster in US history

This Event Map is based on the video which is focused on the BOP (Blow Out Preventer). In the full reports you can find more details of deviations that occured but were not mentioned in the video.

Download the full US CSB investigation report - part 1

Download the full US CSB investigation report - part 2

Click here to view the US CSB Video on youtube

Platform on fire

5 Million barrels of Oil flows into the ocean for 87 days

Gas and oil continues to flow out the drill pipe onto the platform)

3. Blind shear ram only partly closes drill pipe

AMF Deadman system activates blind shear ram

All systems dead (electrical, hydraulical & instrumental)

Drill pipe in BOP buckles "effective compression"

Effective compression not recognized as risk for BOP

First explosions on the platform Deep Water Horizon

Pressure above the annular space drops

Pressure in drill pipe climbes "substantially"

Remaining gas above pipe ram flows out onto the rig

Drill pipe in BOP is closed only on top (but not the well outlet)

2. Pipe ram effectively shuts off flow into the riser

Operators activate pipe ram

"Blow out": Oil and gas flows out of the riser onto the rig

Operators activate upper annual preventer

Drilling mud flows out the riser onto the rig

1. Upper annual preventer leaks oil and gas

What happened with the lower annual preventer?

Uncontrolled flow of well fluids (oil, gas) into well bore

Why does the annular preventer leaks oil and gas?

"Kick" in Macando well occurs

See the adjecent timeline. The kick occured at 0845

What caused the kick in the Macando well

BOP STACK

UPPER ANNULAR

LOWER ANNULAR

LOWER MARINE RISER PACKAGE

BLUE POD

YELLOW POD

1. Upper annual preventer leaks oil and gas

Unclear what the lower annular preventer did

BLIND SHEAR RAM

CASING SHEAR RAM

UPPER / MIDDLE PIPE RAMS

LOWER / TEST RAM

LOWER BOP

3. Blind shear ram only partly closes drill pipe

Unclear what the casing shear ram did

2. Pipe ram effectively shuts off flow into the riser

Time

8:40 8:45 8:50 8:55 9:00 9:05 9:10 9:15 9:20 9:25 9:30 9:35 9:40 9:45 9:50

9:49 explosion

9:47 pipe ram closed & sealed

9:40 mud flowing across rig floor

OCEAN FLOOR

9:31 pressure differential noted; shut down pumps & investigate

9:14 sheen test complete; resume pumping

9:43 annular actuated; did not seal

9:37 gas enters riser

Depth of oil & gas to rig (1,000 ft)

8:51 reservoir begins flowing during displacement

9:08 shut down pumps for sheen test

5:00 negative test bleeds brought some oil into well

Legend

Event

Effect

Known cause

⊕ AND

⊘ OR

Contributing circumstance

Broken barrier

Owner

Unknown cause

Analysed cause

Contributing circumstance

Broken barrier

Possible action

Possible barrier

Chosen action

Chosen barrier

Implemented action

Implemented barrier

Proven action

Proven barrier

Additional info, question or action