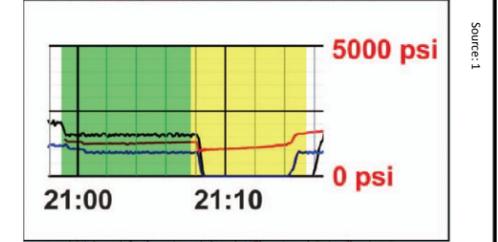


	February	March	April	April 20, 2010
General	2/6: Deepwater Horizon starts drilling Macondo well.	3/12 - 3/16: Lloyd's Research Group conducts "safety culture" interviews.	4/4 - 4/12: Lloyd's Register Group returns to rig to investigate "poor" or "bad" components and systems. 4/9: At 18,193 feet below sea level, a "lost returns" event occurs. 4/11 - 4/16: Macondo well is declared stable. "Logging" tests indicate well is ready for final "production casing."	12:40 a.m. Primary cement job finished. 2:00 a.m. Halliburton cement tests show the cement blend is stable. 7:30 a.m. BP sends home Schlumberger technicians without performing cement bond log test. 11:00 a.m. BP shares temporary abandonment procedures with rig crew for the first time. Numerous changes made to original plans. 5:00 p.m. After normal positive-pressure test, negative-pressure test gives abnormal results. 8:02 p.m. Crew opens annular preventer and begins displacing mud and spacer from the riser. Evidence of "kick" appears. 9:01 p.m. "Drill-pipe pressure began slowly increasing, despite the fact that the pump rate remained constant."
Drilling Mud	<p>"This has been [a] nightmare well which has everyone all over the place." BP Engineer Brian Morel, April 15, 2010.</p>  <p>Centralizer "subs" screw into place between sections of casing. Weatherford</p>			<p>4/15: Compromises made with "bottoms-up" procedures due to fragile rock formation.</p> <ul style="list-style-type: none"> BP circulates 350 barrels of mud instead of the recommended 2,760. BP pumps cement down well at low rate of 4 barrels per minute. BP limits volume of cement Halliburton could pump down well. BP, in consultation with Halliburton, uses lighter "nitrogen foam cement."
Centralizers	<p>4/1: Rig BP management learns only 6 "sub" centralizers are in stock.</p> <p>4/15: Halliburton calculations suggest production casing needs more than 6 centralizers. 15 additional slip-ons ordered.</p> <p>4/16: Mechanical integrity concerns change decision to use slip-on centralizers.</p> <p>4/17: BP decides to only use 6 centralizers.</p> <p>4/18: Halliburton warns BP of a "SEVERE gas flow problem" if only 6 centralizers were used instead of 21.</p>			<p>4/19: Float valves will not convert normally. Anomalies reported. Crew concludes pressure gauge they have been using is broken.</p>
Cementing	2/10: Halliburton initiates cement blend testing.	3/8: Results indicate cement is "unstable" and go unaddressed.	<p>4/13: More cement tests initiated. First round declared unstable.</p> <p>4/14 - 4/15: BP flip-flops on production casing decision in light of fragile rock formation. Original long-string choice wins out.</p>	<p>4/18, 2:00a.m.: Halliburton initiates another cement test.</p> <p>9:08 p.m. Crew shuts down pumps to perform "sheen test" on spacer before dumping into the ocean. Drill-pipe pressure continues to increase without anyone noticing. 9:14 p.m. Pumps turned back on. Drill-pipe pressure and pump rate are increased. 9:18 p.m. Pressure relief valve on one pump blows. 9:30 p.m. Engineer notices an "odd and unexpected pressure difference between drill pipe and kill line." 9:36 p.m. Order given to bleed off drill-pipe pressure to eliminate pressure difference. 9:40 - 9:43 p.m. Drilling mud starts spewing from rotary onto rig floor. 9:41 p.m. Rig crew activated one annular preventer. 9:45 p.m. Gas flows above blowout preventer (BOP) - the well is blowing out. 9:46 p.m. Pressure readings suggest rig crew activated a variable bore ram. 9:49 p.m. Deepwater Horizon explodes.</p>
Well Design	<p>"But, who cares, it's done, end of story, will probably be fine." BP engineer Brett Cocales in an email to Brian Morel on April 16, 2010.</p> <p>4/13: More cement tests initiated. First round declared unstable.</p>			<p>4/19: Final section of long string production casing installed into the well.</p>
	<p>"There is no evidence that [BP's] abandonment changes went through <i>any</i> sort of risk assessment or management of change process." National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling (pp 104)</p>			<p>4/19: Final section of long string production casing installed into the well.</p>



“When events like this happen, we always ask the same question: how could people be so stupid? How could they ignore what is now plain to us? There will be a lot of answers to that question, but I’m willing to bet that a lot of it will end up sounding like ‘We’d ignored those problems before, and it always turned out all right.’”

– Megan McArdle, *The Atlantic*

Definitions

- Float valve – Valves which convert two-way flow to one-way during cementing process.
- Kick – Any unplanned influxes of gas or fluids.
- Cement bond log test – Acoustic test that determines whether the cement has bonded to casing and surrounding formations.

Sources

- Report to the President: National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. January 2011.
- Letter to Tony Hayward, CEO, BP, from the Congressional Committee on Energy and Commerce. June 14, 2010.



Credit: United States Coast Guard