



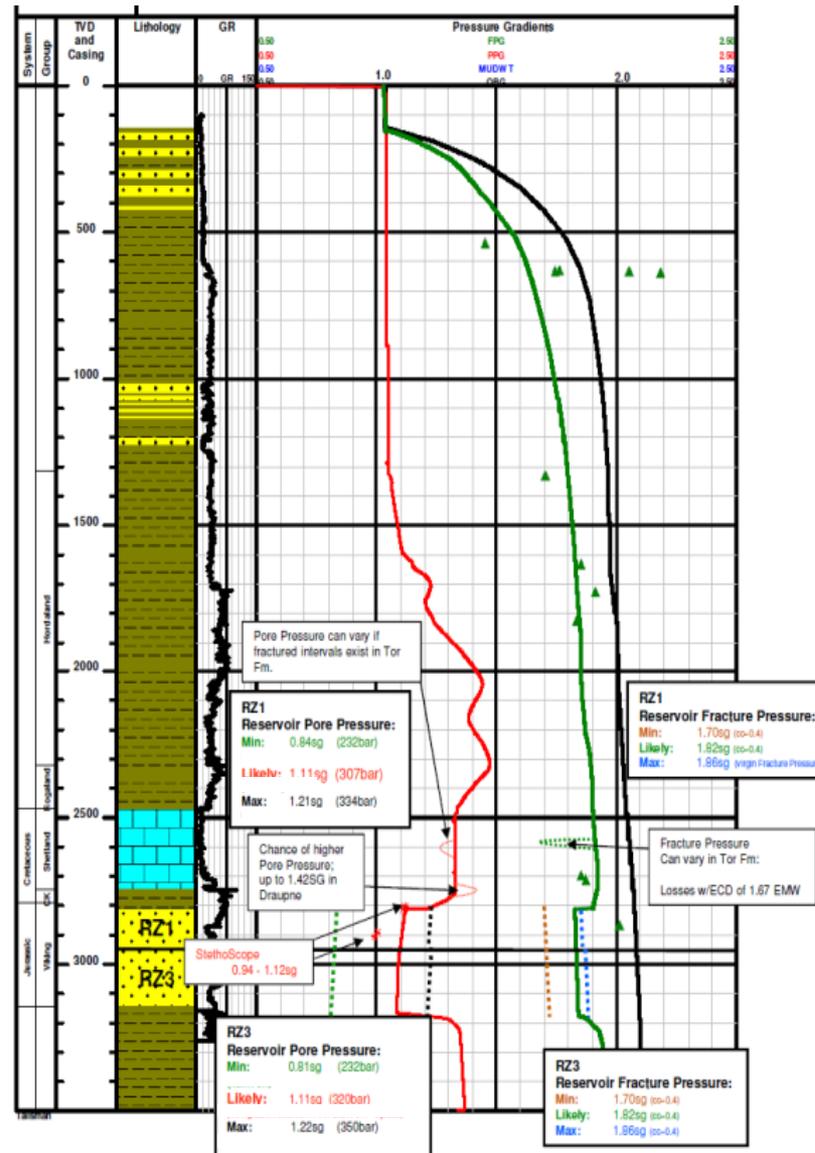
"Sharing to be better"

Offshore Platform Well Control Incident

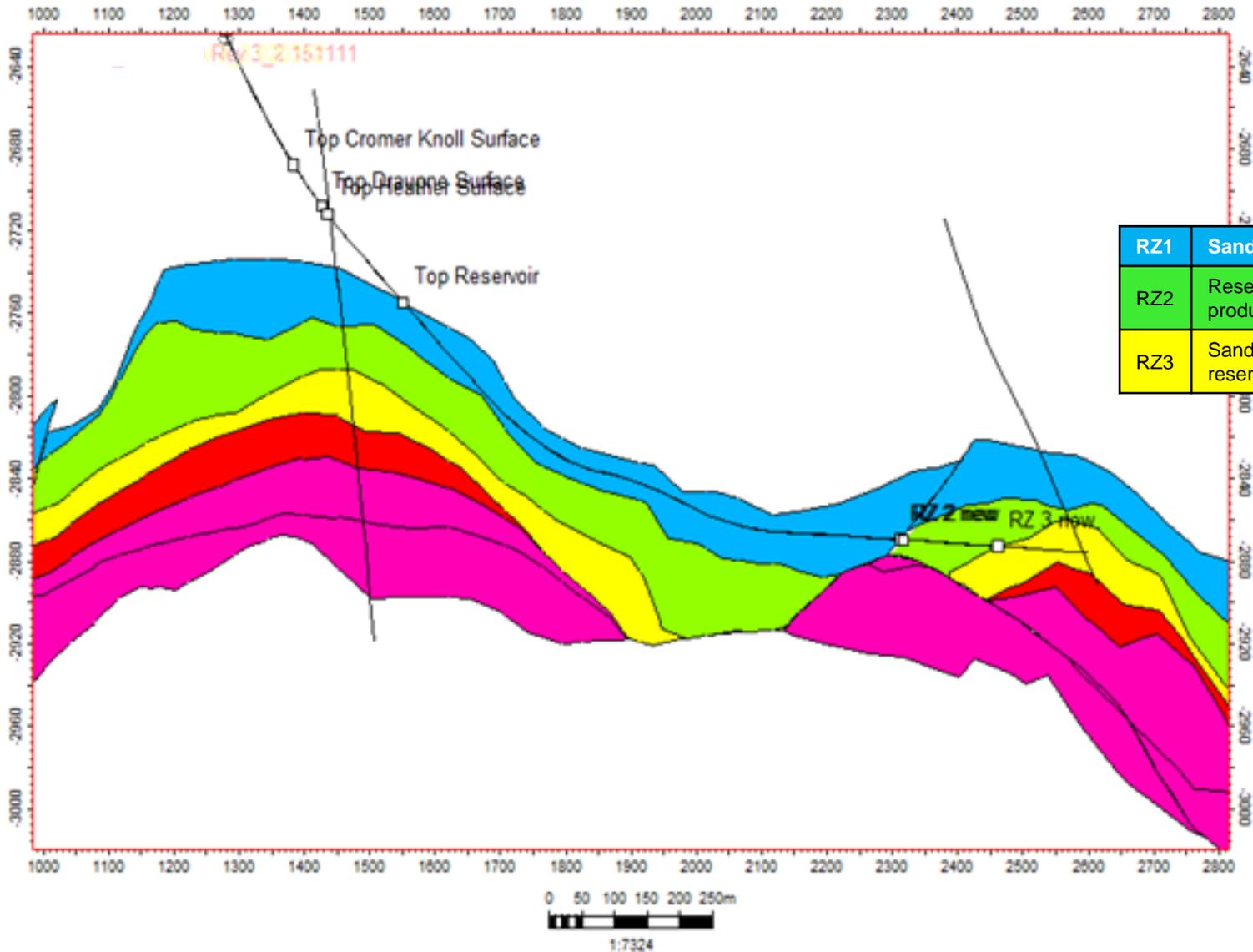
”Sharing to be better”

- **Under the direction of Norwegian Oil and Gas, a joint industry task force of Operator and Drilling Contractor personnel has been formed to recommend ways to reduce the number and potential severity of well control events on the NCS.**
- **One team recommendation was communicating actual well control incidents that have recently occurred on the NCS so lessons are shared and understood.**
- **This is the eight in a series of case histories. The incident highlights the importance of volume control when experiencing a “drilling break”.**
- **Please take some time to review this case history with the drilling crew and discuss the questions raised during the presentation. Please invite and encourage related drilling service personnel to participate.**
- **It is hoped that sharing of incidents is helpful and any feedback is welcome.**

- Made up and ran in hole with 8 1/2" rotary steerable drilling BHA with solid float
- Drilled shoe track and displaced to 1.25 sg Low Solid Oil Based Mud.
- Drilled the RZ1 sand reservoir according to subsurface instructions
- Geosteered and drilled RZ1 sand to stay within the reservoir. Recorded pressure points in RZ1 reservoir to 1.13 sg during drilling: 33 bar static overbalance exerted by the drilling fluid



Well incident in 8 1/2" hole section



RZ1	Sand, top part of reservoir
RZ2	Reservoir, sealing – non producing
RZ3	Sand, lower producing reservoir

Summary of incident:

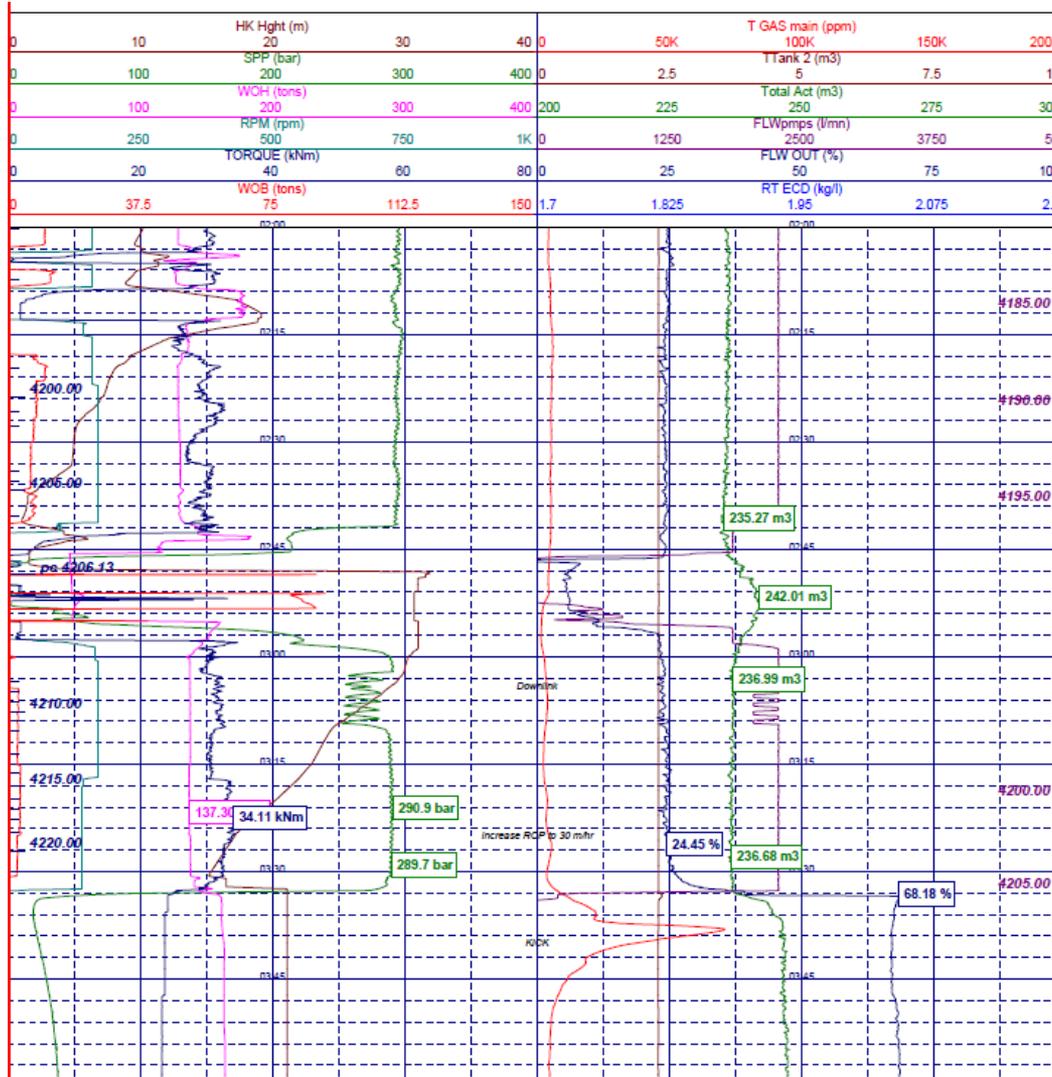
- 9 5/8" casing set into top of reservoir at 3295 m MD
- Drilled into lower reservoir sand formation RZ3 (TD formation) at 4201 m MD and experienced a drill break (earlier than prognoses)
- Had connection at 4206 m MD

Note:

- A significant part of the driller's focus during the connection was towards the top drive position as a result of an earlier incident where the top drive collided with the pipe handling system.
- Furthermore, the camera picture in used on the drillers console was at an earlier stage changed from the flow line camera to the a derrick camera showing the top drive position.

What happened?

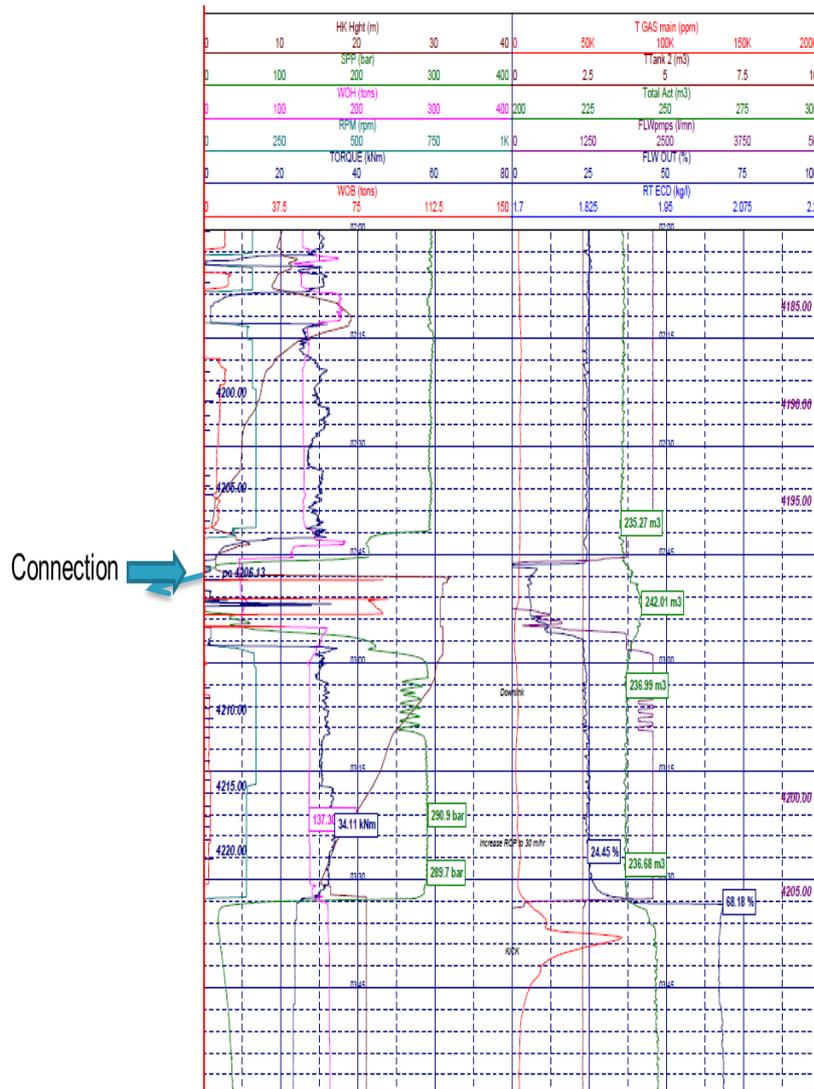
Connection →



Summary of incident continued:

- Experienced positive drill break when drilling in to RZ3 reservoir sand
 - Did not carry out a flow check
- Had connection at 4206 m MD
 - took kick, but it was not observed
- Continued drilling 8 ½" hole to 4221 m MD using 1.25 SG Low Solid Oil Based Mud
 - Note that the driller was relieved by the tool pusher after the connection.
- Observed sudden increase in return flow
 - Mudlogging return flow increased from 24 % to 68 %
 - Shut in well on annular
 - Gas in mud increased from 0.5 % to 7 % in
 - Observed pressures increase

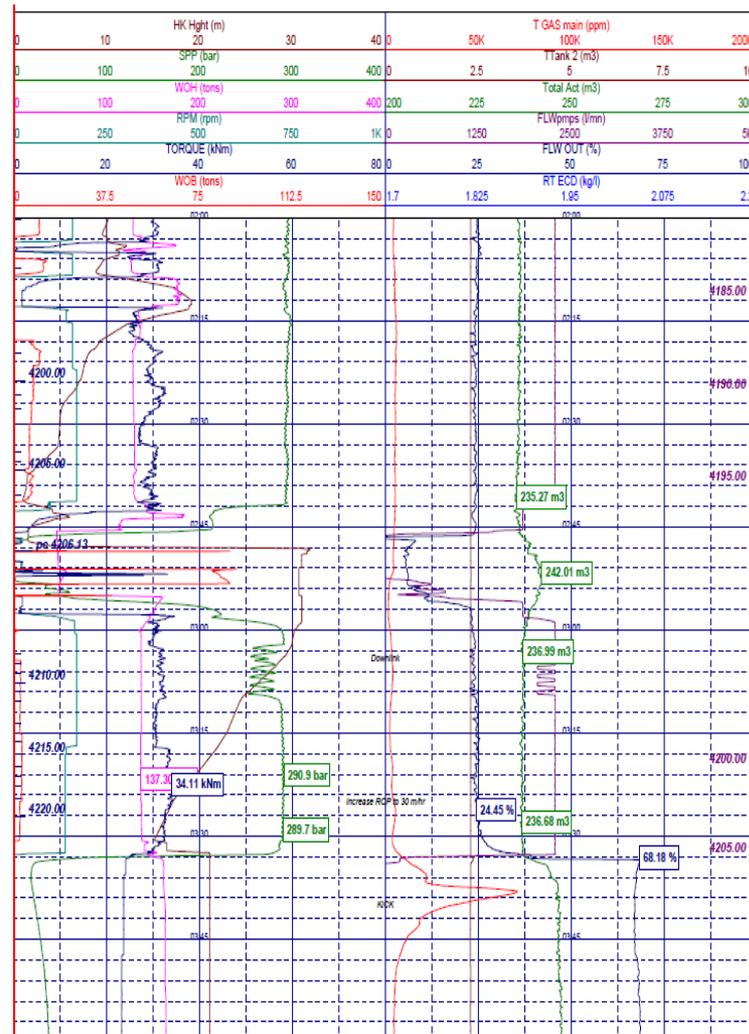
What happened?



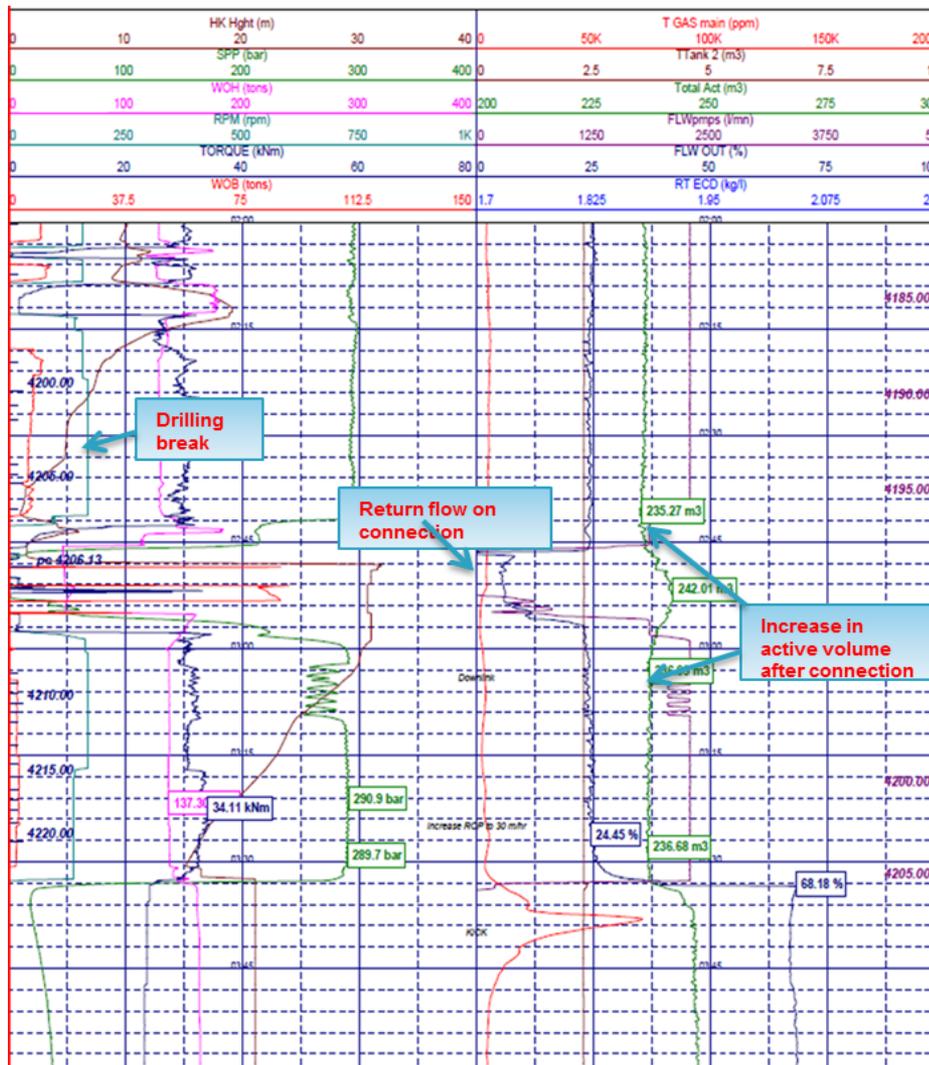
What happened?

- Flow check?
- Alarms?
- Camera picture not changed back from derrick to flow line.
- Data engineers focus?

Connection →

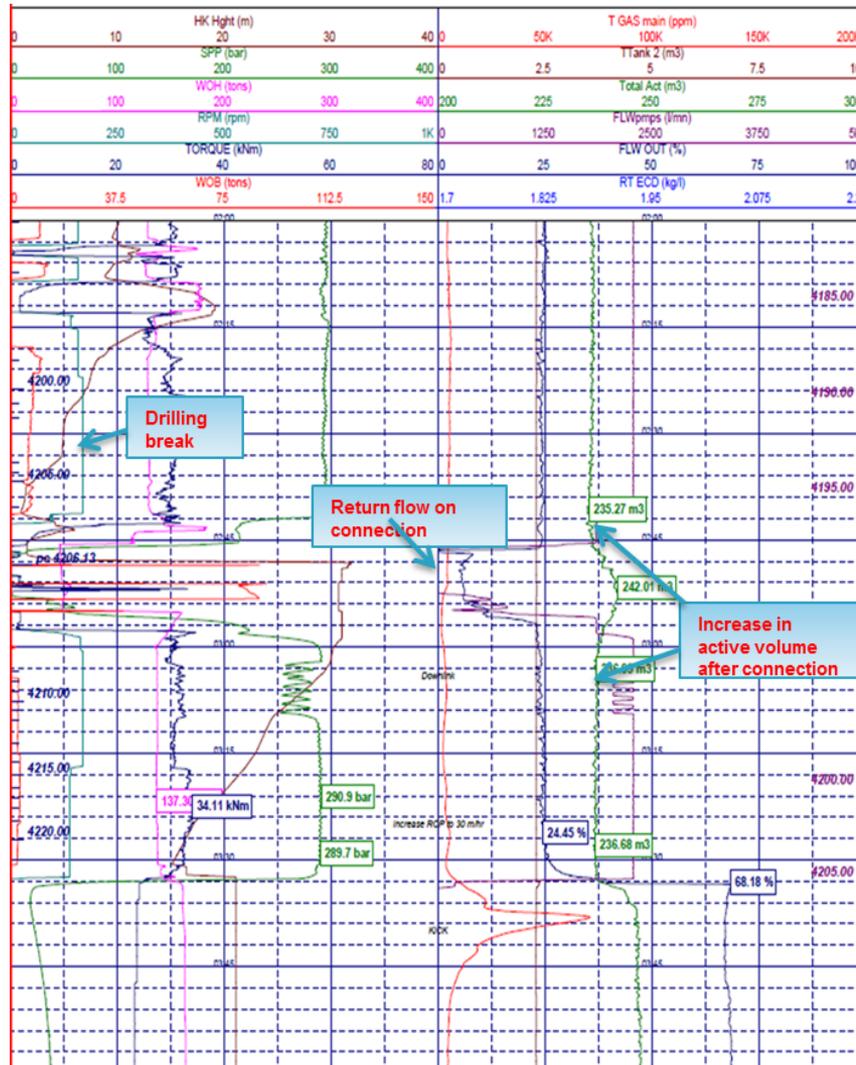


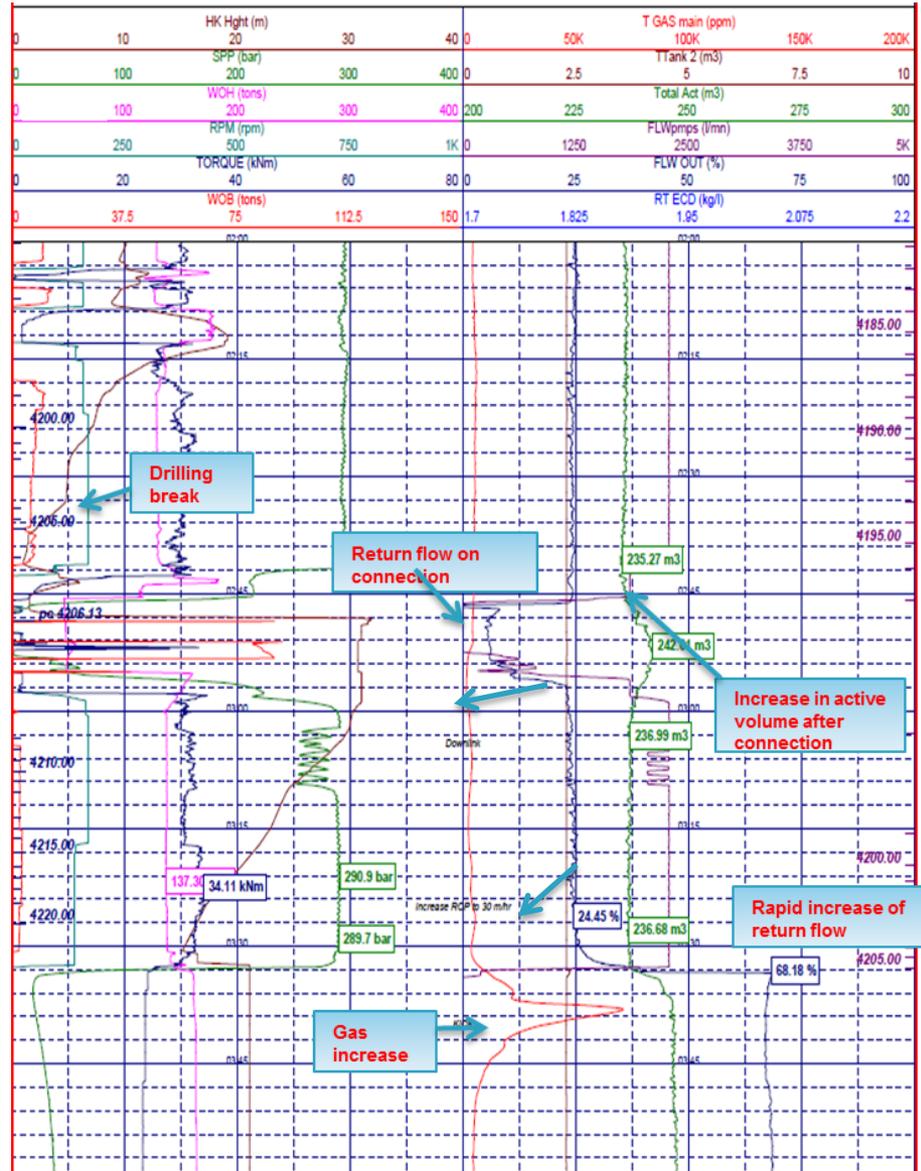
What happened?



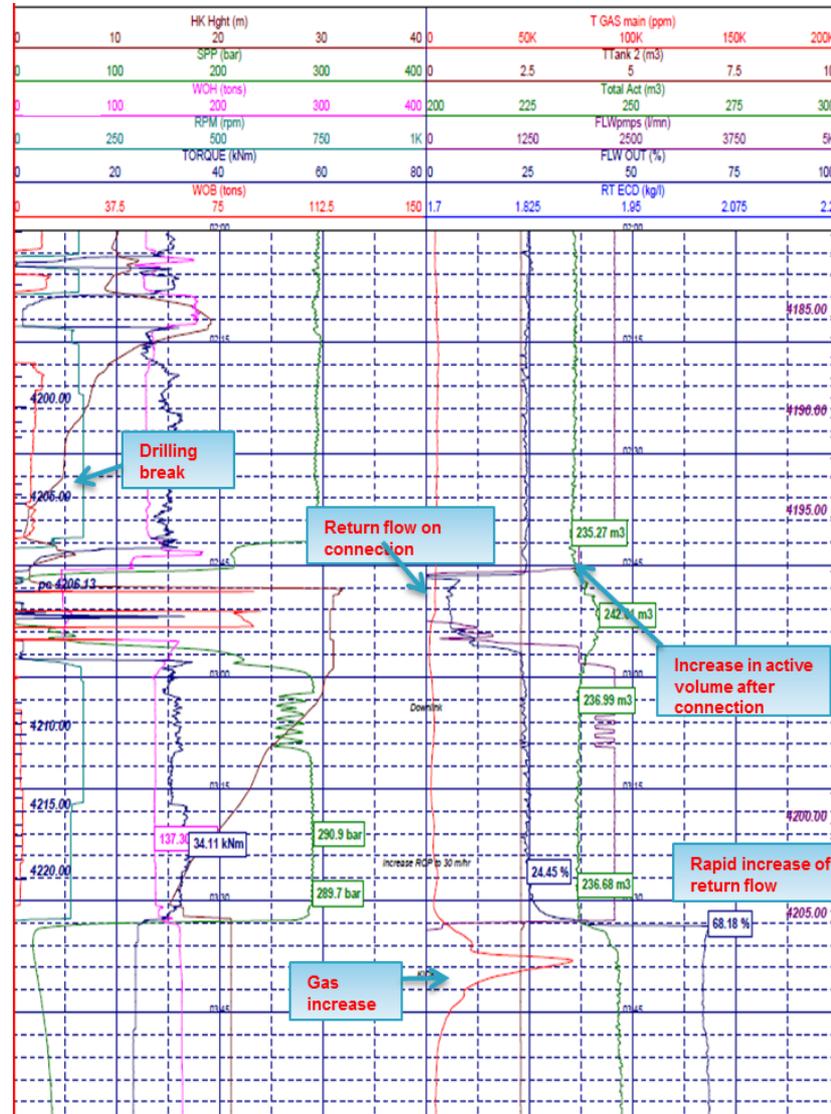
What happened?

- Alarms?
- Focus on trends
- Driller and Data engineer are barriers.
- Continue drilling





- Rapid return flow due to gas expansion in annulus
- Shut in BOP
- Gas circulated through poor boy
- Kick in 8 1/2" hole



Kick in 8 1/2" hole section

Summary of incident:

- Started to circulate out kick with Drillers method through mud gas separator
- Observed gas alarms in shakers ventilation and flow line
- Shut in well after gas was circulated out and observed pressures
 - 48 bar on annulus/ casing pressure
 - 53 bar on DP indicating a reservoir pressure of 1.43 SG EMW

Summary of incident:

- Decided to kill well using 1.47 SG mud
- The Formation pressure was later measured to **1.42 SG EMW**
- During drilling a mud weight of **1.25 SG** was used
 - Based on most likely formation pressure
 - Based also on original formation pressure
- During circulation an ECD up to **1.58 SG EMW** was experienced
 - 33 points (**95 bar**) safety margin during drilling
 - Used 5 ½" DP with 7 ½" tool joints
- Drilling a section with high ECD may "hide a kick" during drilling and full focus during connections in these sections is essential!

How should this incident have been prevented?

- Follow established drilling practices on positive drilling breaks by carrying out a Flow Check.
- Follow established drilling practices on Volume Control, both during drilling and at connections:
 - Driller keeping control on flow lines and trip tanks
 - Data operator keeping control on volumes and flow rates, including correct use of the threshold control possibilities available in the Mud Logging System's software.