”SHARING TO BE BETTER”

Norges Rederiforbund
Norwegian Shipowners' Association

“Sharing to be better”

Under the direction of OLF, 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 occured on the NCS so lessons are shared and understood.

This is the first of a series of five case histories. This incident highlights the need to be focused on the well at all times, even when there are multiple other events occuring at the same time.

Please take some time at your next safety meeting to review this case history and discuss the questions raised during the presentation.

It is hoped that sharing of incidents is helpful and any feedback is welcome.

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Incident Summary

A well control incident occurred while drilling in 9 1/2" hole at 7328 feet (2234 m) MD with MW=14.5 ppg (1.74 SG). The situation developed after a power failure to both mud pumps at 10:25 hrs.

Over the next two hours and fifteen minutes an influx of approximately 98 barrels (15.6 m^3) of formation fluids entered the wellbore. Initial efforts to circulate the well with the rig's cement unit were unsuccessful.

Well control was successfully restored the same evening using conventional well control methods with MW=14.8 ppg (1.77 SG). Normal operations resumed the following day.

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Background

Day 93 / 94	**Drilling with MW = 14.5 ppg, ECD=15.00 ppg. Flow check @ 6394'. Observed flow. Increase MW to 14.7 ppg & circulate with well on choke. Flow check = static.**
Day 95	**07:15: Stop drilling @ 6407' due to mud losses (5–6 bbl lost). ECD = 15.21 ppg. Reduced MW to 14.6 ppg. Attempt to achieve drilling parameters at 475 gpm, 150 rpm, still seepage loss. Reduce mud weight to 14.5 ppg.**
Day 95	**12:30: Drilling resumed with 475 gpm, 140 rpm, ECD = 14.95 ppg, ROP 50 fph.**
Day 95 – 96	**See drilling data charts that follow**

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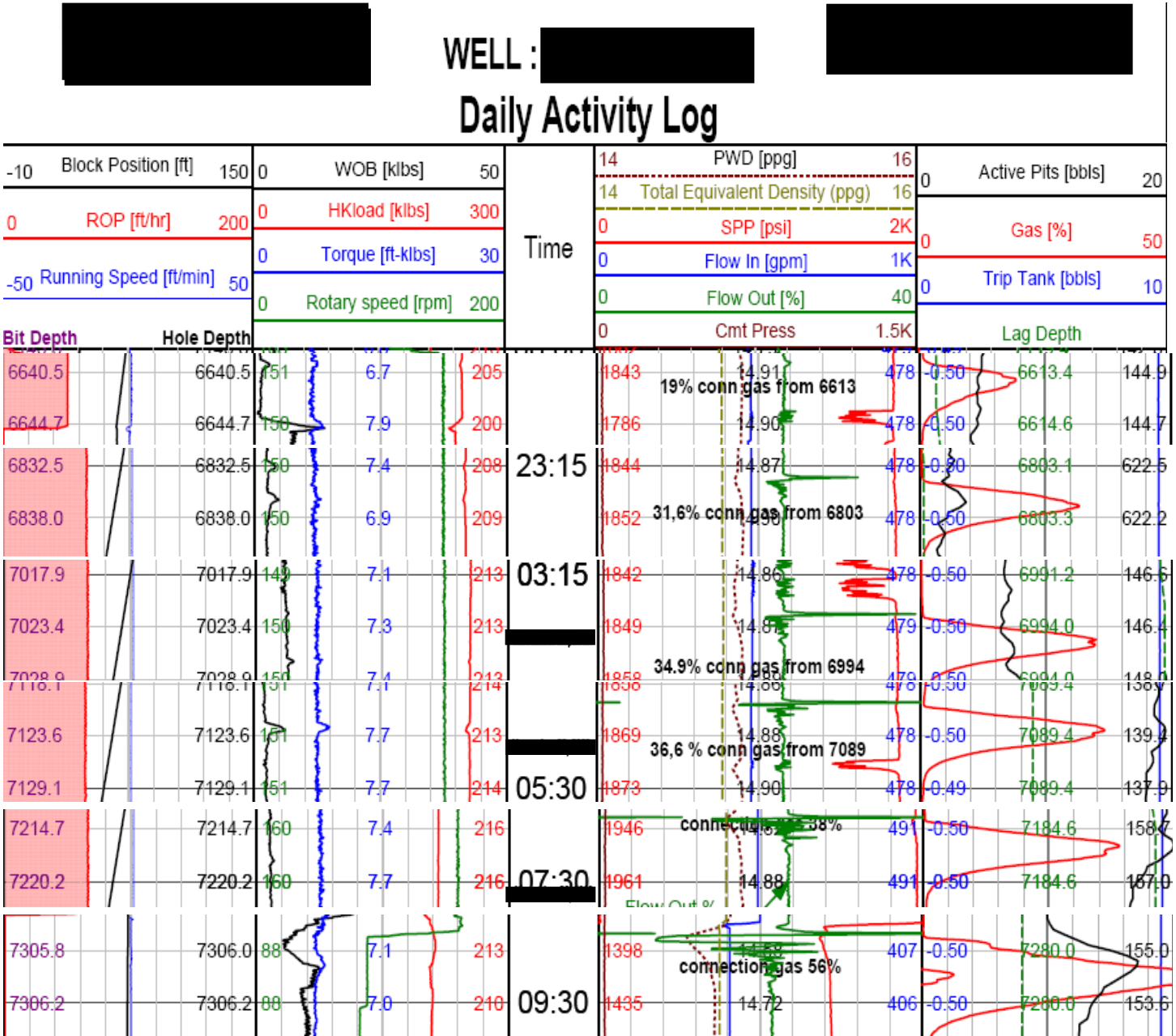
18:00 on Day 95 to 09:30 on Day 96



QUESTION

What can you see from this plot which would give you cause for concern ?

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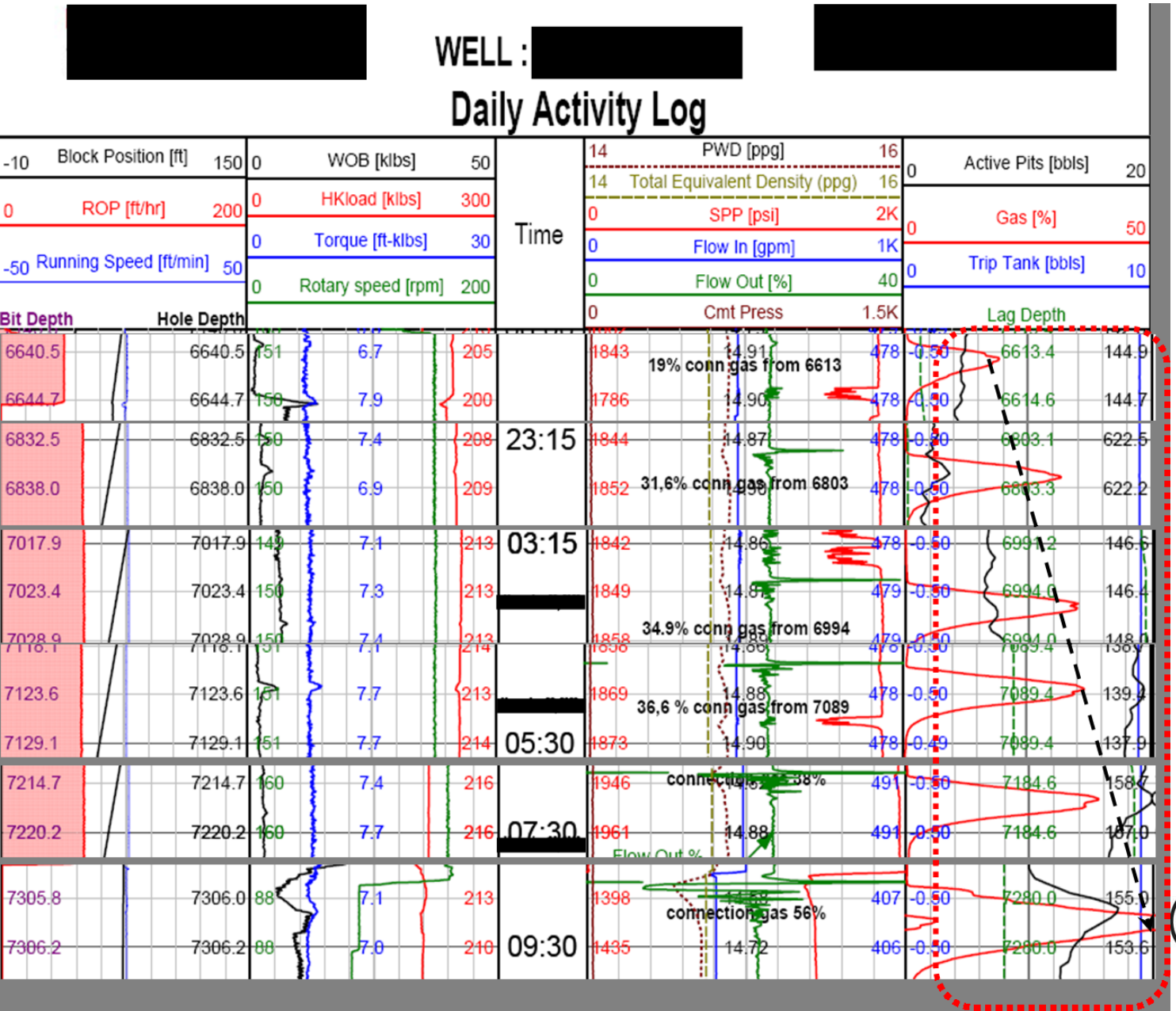
18:00 on Day 95 to 09:30 on Day 96



Note:

- **Connection gas trend increasing**
- **ROP increase from 50 to 60 feet / hour**

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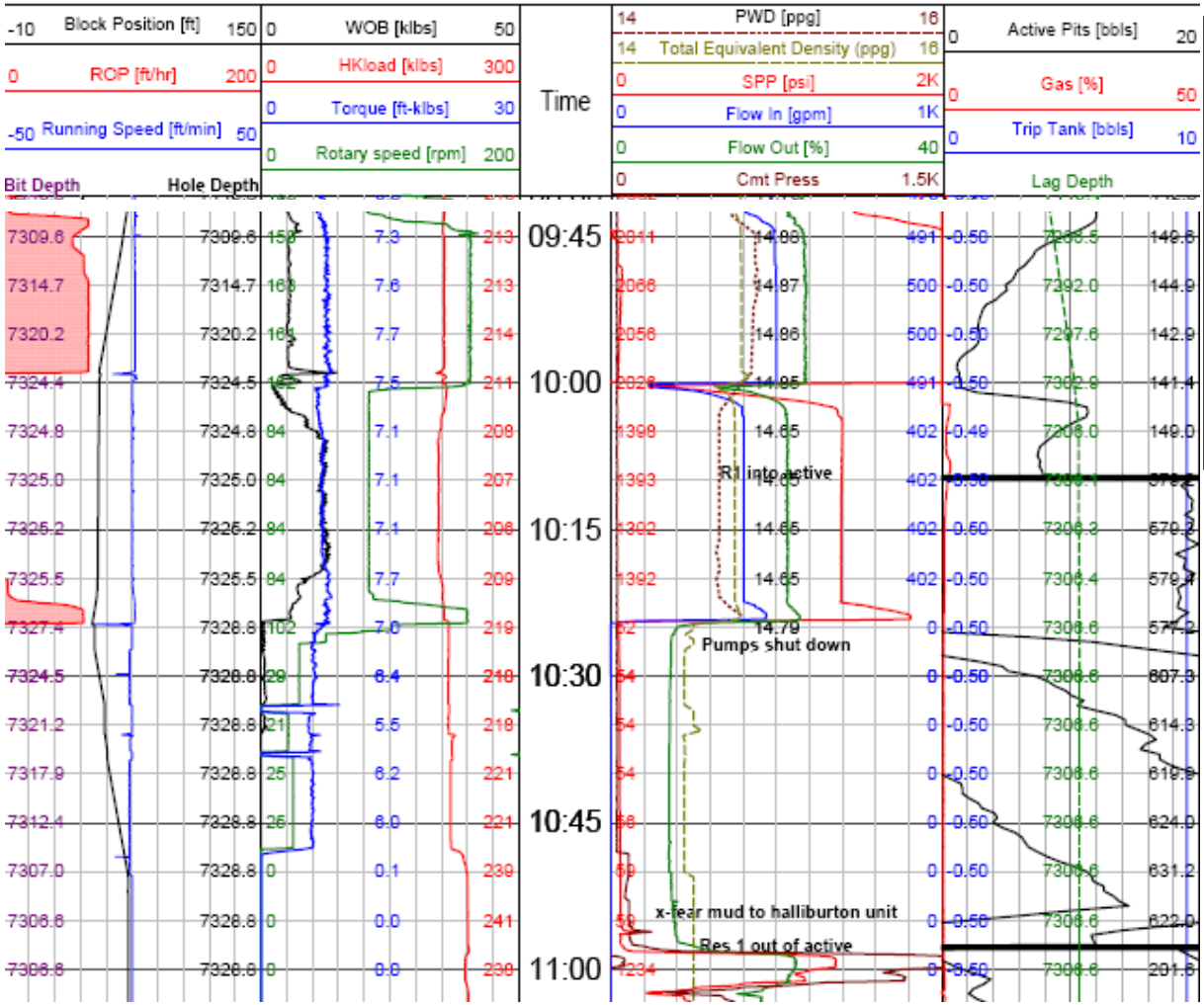
[redacted] WELL : [redacted] [redacted]

Daily Activity Log



- **10:25 hrs – Power to pumps lost**
- **10:48 hrs – Power to top drive lost**

<u>QUESTION</u>

What actions should have been taken during this time ?

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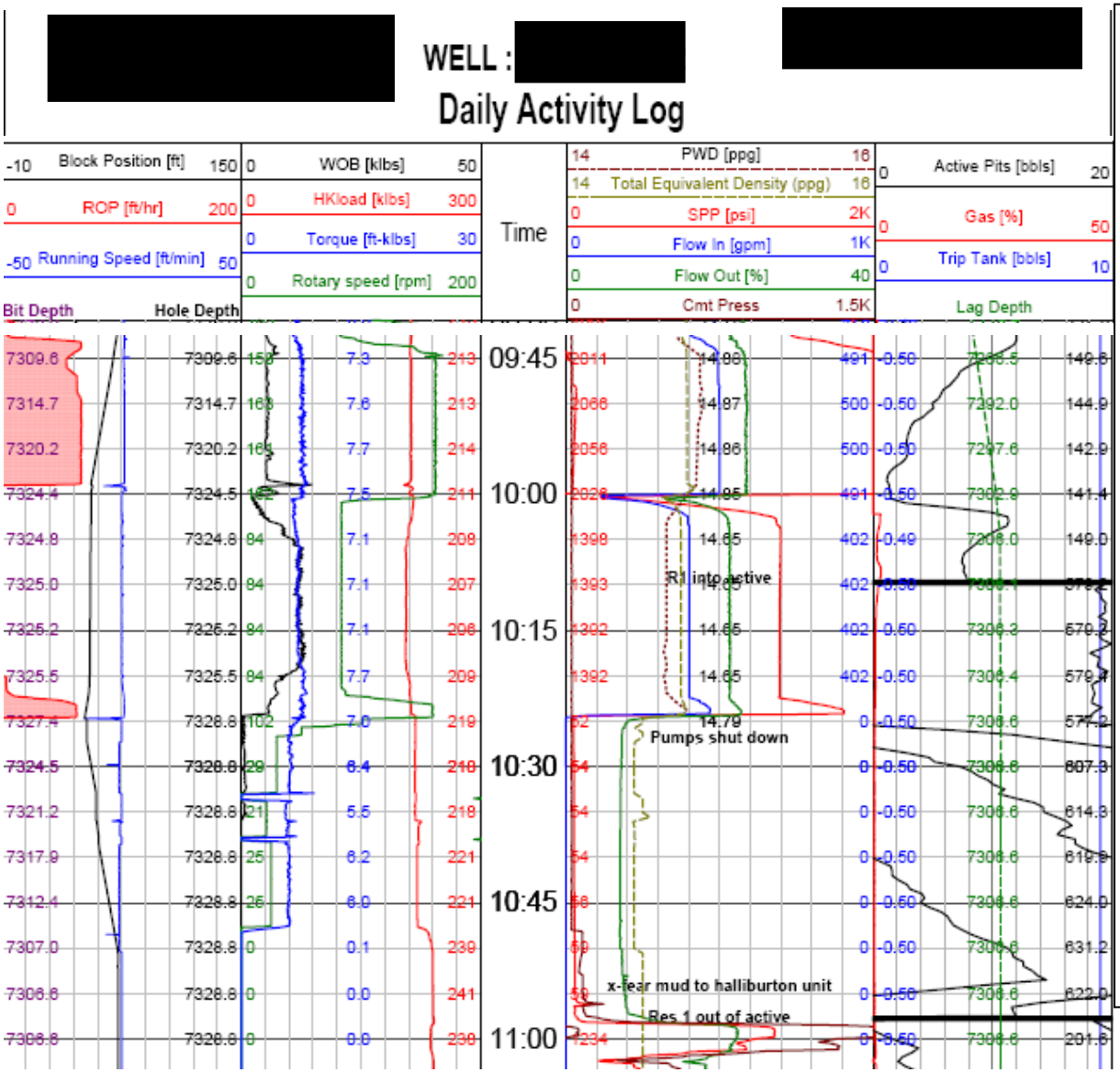

- **10:28 hrs– Power to pumps lost**
- **WELL LEFT OPEN**

WELL SHOULD HAVE BEEN MONITORED ON THE TRIP TANK

- **10:48 hrs – Power to top drive lost**
- **WELL REMAINS OPEN**

WELL SHOULD HAVE BEEN SHUT-IN

- **10:50 hrs – Flowback = 57 bbl; +15 bbl over trend**
- **10:58 hrs – Circulate 11 bpm with cement unit – lots of vibration**

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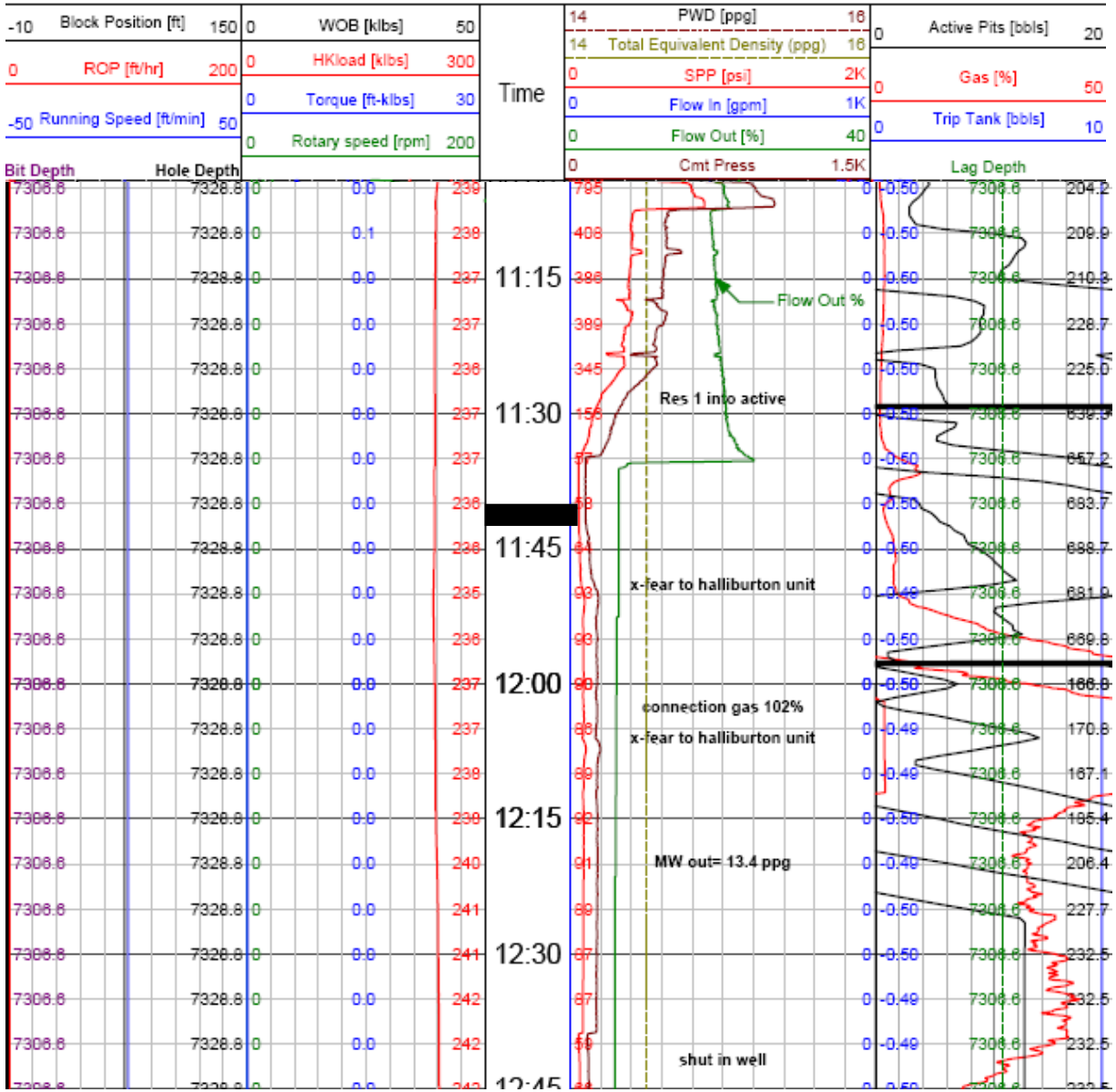
[redacted]

WELL : [redacted]

[redacted]

Daily Activity Log



10:58 – Circulate 5 bpm with cement unit - no vibration

- **Well remains open**
- **11:25 – Drilling supervisor notes flow increasing & pit gain**

<u>QUESTION</u>

WHAT SHOULD BE DONE AT THIS TIME ?

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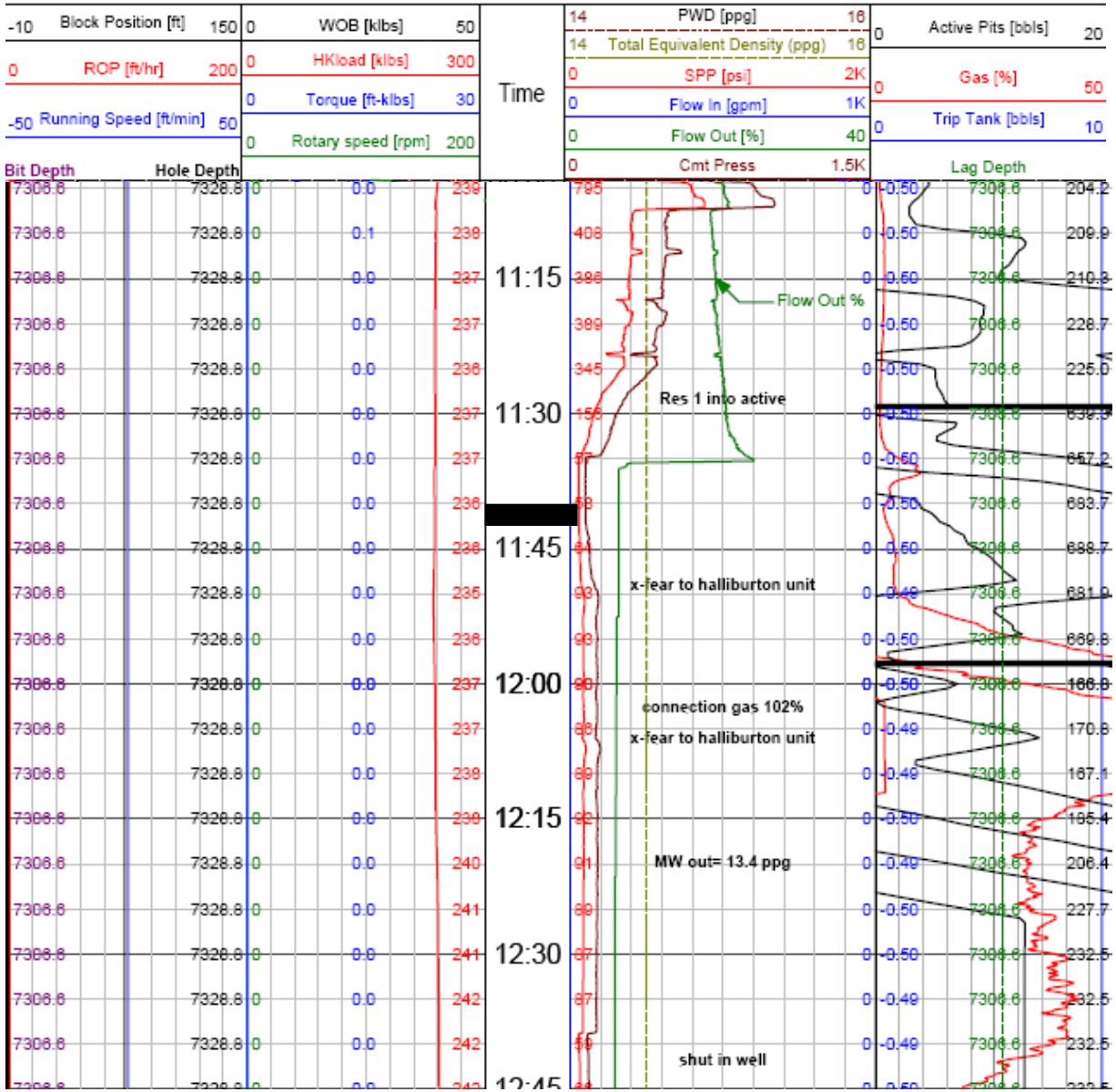
[redacted]

WELL : [redacted]

[redacted]

Daily Activity Log



- **10:58 – Circulate 5 bpm with cement unit - no vibration**
- **Well remains open**
- **11:25 – Drilling supervisor notes flow increasing & pit gain**

WELL SHOULD BE SHUT IN, PRESSURES OBSERVED & SITUATION FULLY ASSESSED.

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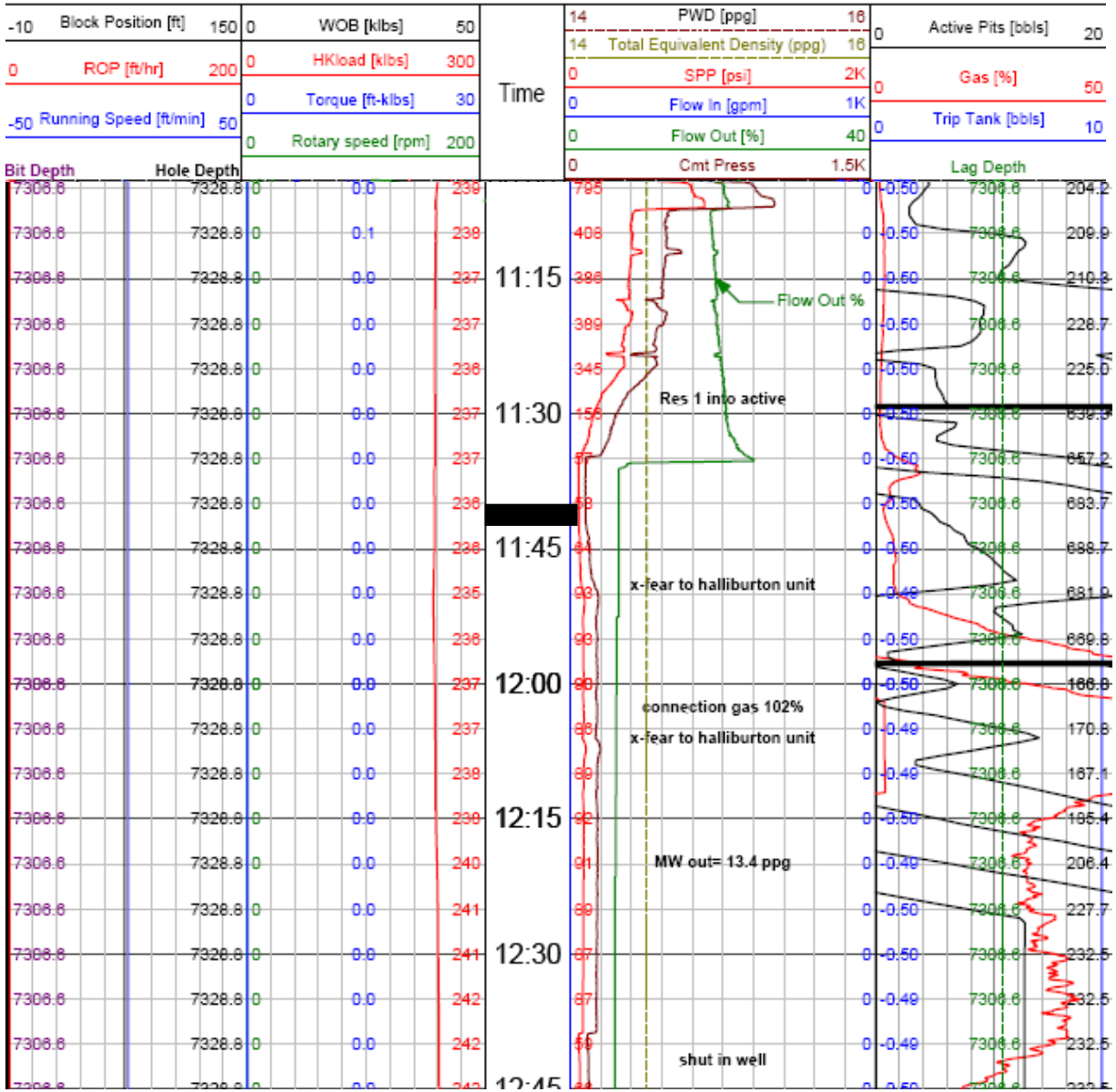
[redacted]

WELL : [redacted]

[redacted]

Daily Activity Log



- **11:35 hrs – Decision made to circulate through open choke at 3 bpm**
- **12:00 hrs – Return mud cut to 13.4 ppg**
- **12:40 hrs – Pit level too high. Well shut in**

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Key Findings

- Influx volume = +/- 98 barrels
- Key personnel were aware of drilling close to balance
- There was a trend of increasing connection gas over the previous 24 hours
- Well was left open when mud pumps failed
- Key personnel did not properly monitor the well after the pumps failed
- Drawworks & top drive failed 23 minutes after pumps failed & well was left open
- Well was circulated at 5 bpm (210 gpm) with cement unit, compared to 11.3 bpm (475 gpm) while drilling – implication: reduced ECD
- Onshore support center technician called driller at 10:50 to discuss well conditions
- Onshore support center technician did not call the operator's drilling supervisor
- The mud engineer did not play an active role in the situation
- The rig team successfully regained well control with the application of conventional well control practices

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What should have happened when mud pumps failed?

Driller:

- Pick up off bottom
- Secure well & work pipe while sorting out problem with mud pumps
- Monitor well & mud volumes

Toolpusher:

- Go to rig floor & assess situation with driller & AD
- Take charge of situation – assure that driller is focused on monitoring well; assure maintenance supervisor & electrician focus on sorting out electrical problem

Operator's Drilling supervisor:

- Go to rig floor & assess situation with driller & toolpusher
- Take charge of situation – assure that well is under control. Direct other resources as required to support operation

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What actually happened when mud pumps failed?

Driller:

- ✓ Picked up off bottom
- ✘ Secure well & work pipe while sorting out problem with mud pumps **(Left well open)**
- ✘ Monitor well & mud volumes **(Focused on equipment problem)**

Toolpusher:

- ✓ Went to rig floor & assessed situation with driller & AD
- ✘ Take charge of situation – assure that driller is focused on monitoring well; assure maintenance supervisor & electrician focus on sorting out electrical problem **(Focused on equipment problem)**

Operator's Drilling supervisor:

- ✓ Went to rig floor & assessed situation with driller & toolpusher
- ✘ Take charge of situation – assure that well is stable & secure. Direct other resources as required to support operation. **(Focused on equipment problem)**

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Points to consider:

1. **Why do you think key personnel did not interpret the connection gas trend as a potential problem?**

2. **Who could have stopped this situation from turning into a well control incident? How?**

3. **If equipment problems (such as a power failure to the top drive and drawworks) or other situations occur, what measures do we have to prevent these distractions from leading to a well control problem?**

4. **Why were people with less experience (driller, onshore support center staff) unwilling to challenge decisions of senior leaders with more experience (toolpusher, operator's drilling supervisor)? How can we improve this situation?**

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Learnings / Conclusions

- Key personnel did not interpret connection gas trend as a potential problem.
- Fundamental procedures to secure and monitor the well were not followed after power failure to the mud pumps.
- Key Drilling Contractor and Operator personnel focused on the equipment problems instead of taking charge of the situation.
- Power failure to the top drive and drawworks was a major distraction and added to the complexity of the well control problem.
- Communication between onshore support center and the driller was not effective.
- The situation was further complicated by the number of people who were in and out of the driller's cabin during the 30 minutes after the pumps failed.
- Distractions and congestion in the driller's cabin hindered communication between the driller, toolpusher, and operator's drilling supervisor.
- People with less experience (driller, onshore support center staff) were unwilling to challenge decisions of senior leaders with more experience (toolpusher, operator's drilling supervisor).
- Existing procedures and systems provide adequate well control risk mitigation if key personnel respond as they have been trained to do.