



# LOGGING FOR WELL ABANDONMENT ...IT IS GOOD BUSINESS!

An experience from Brent.



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Petrophysicist

# AGENDA

The Project

Abandonment Philosophy

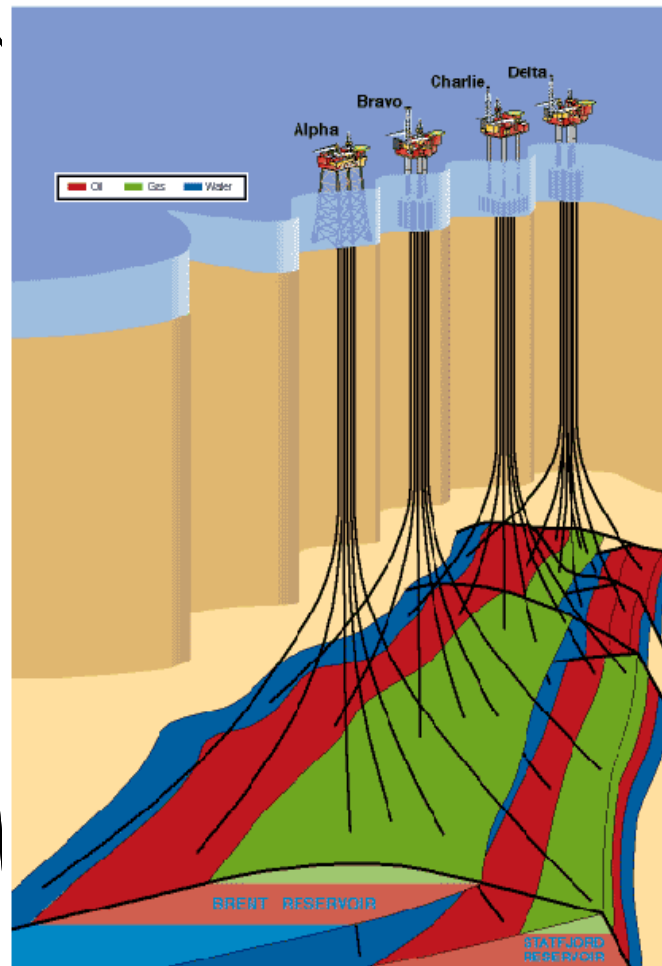
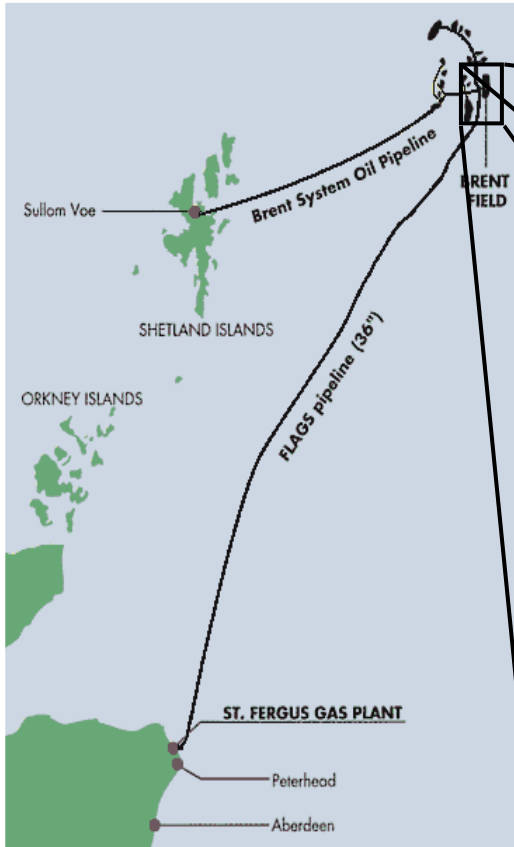
Well Integrity / Cement Logging

Q&A

# 1.0

## THE FIELD

# BRENT FIELD



- Brent + Statfjord Reservoirs.
- Developed using four platforms – Alpha, Bravo, Charlie and Delta.
- Production started in 1976.
- Water Injection
- Depressurisation

# THE PROJECT

- Brent Delta well P and A
- 46 wells slots
- ~90 reservoir penetrations

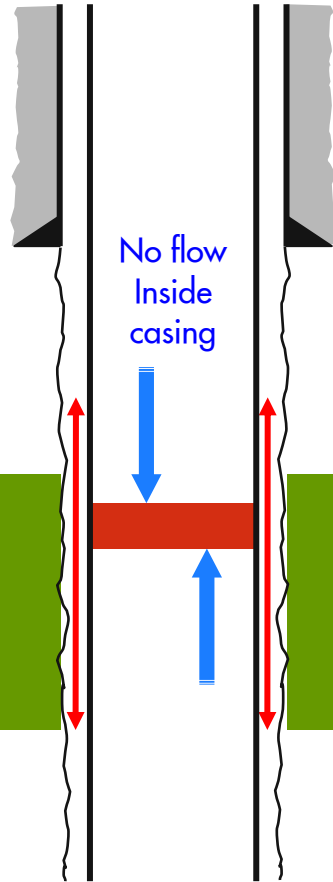
# 2.0

## ABANDONMENT PHILOSOPHY

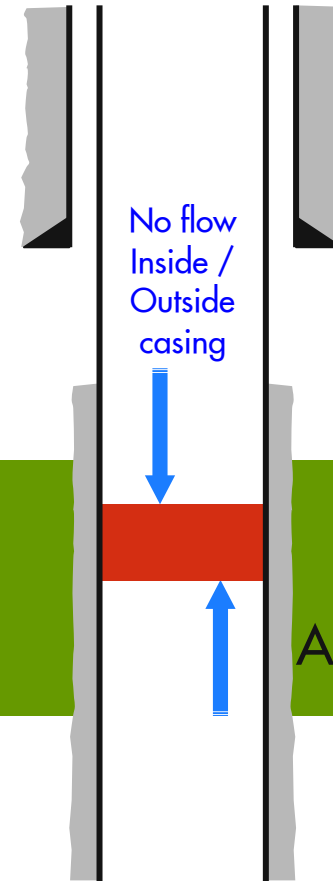
Setting barriers, not plugs.

# PLUGS VS. BARRIERS

## PLUG



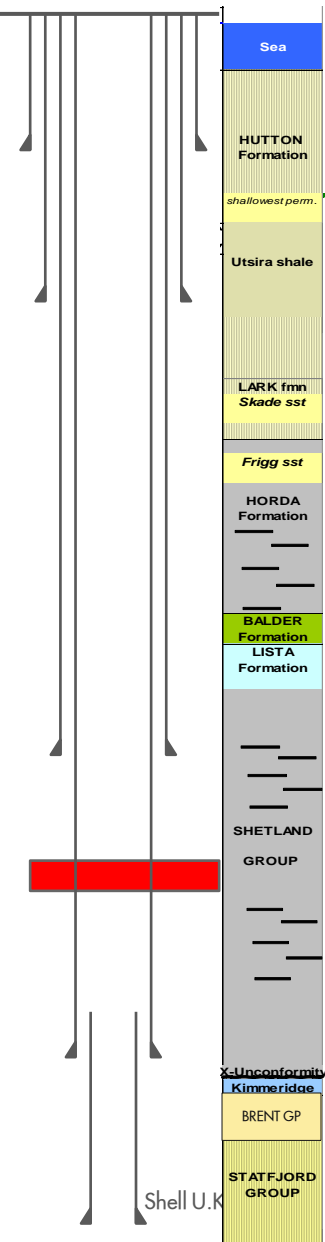
## BARRIER



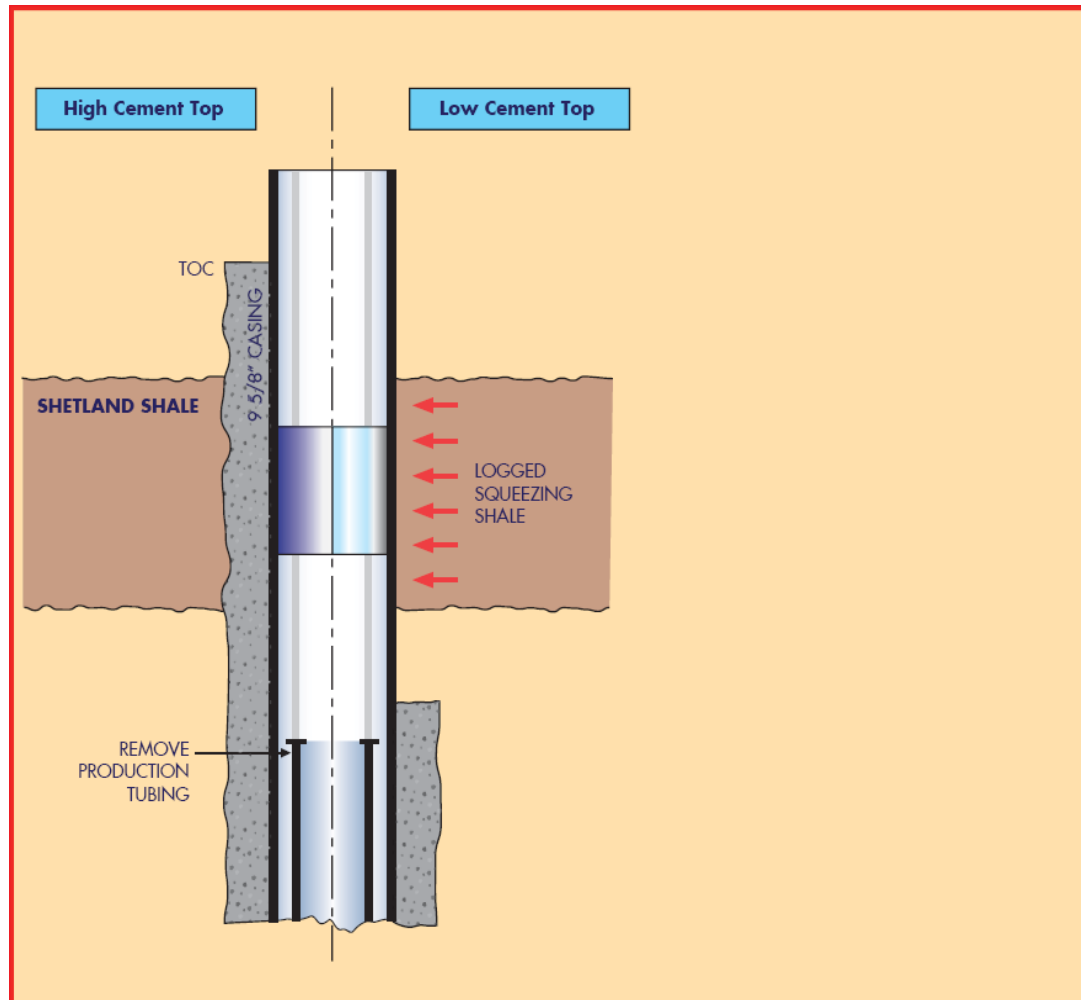
CAP ROCK

Annulus Integrity!

# ABANDONMENT PHILOSOPHY



## Reservoir Barrier



# 3.0

## CEMENT LOGS

...not only cement.

# ASSESSING ANNULUS INTEGRITY THROUGH CEMENT LOGGING

Three objectives of Cement Logging:

- Top and Quality of Cement, including intermediate casings.
- Top of Solids (free pipe) for Cutting and Pulling Casing.
- Qualify Squeezing Formation (Shales).

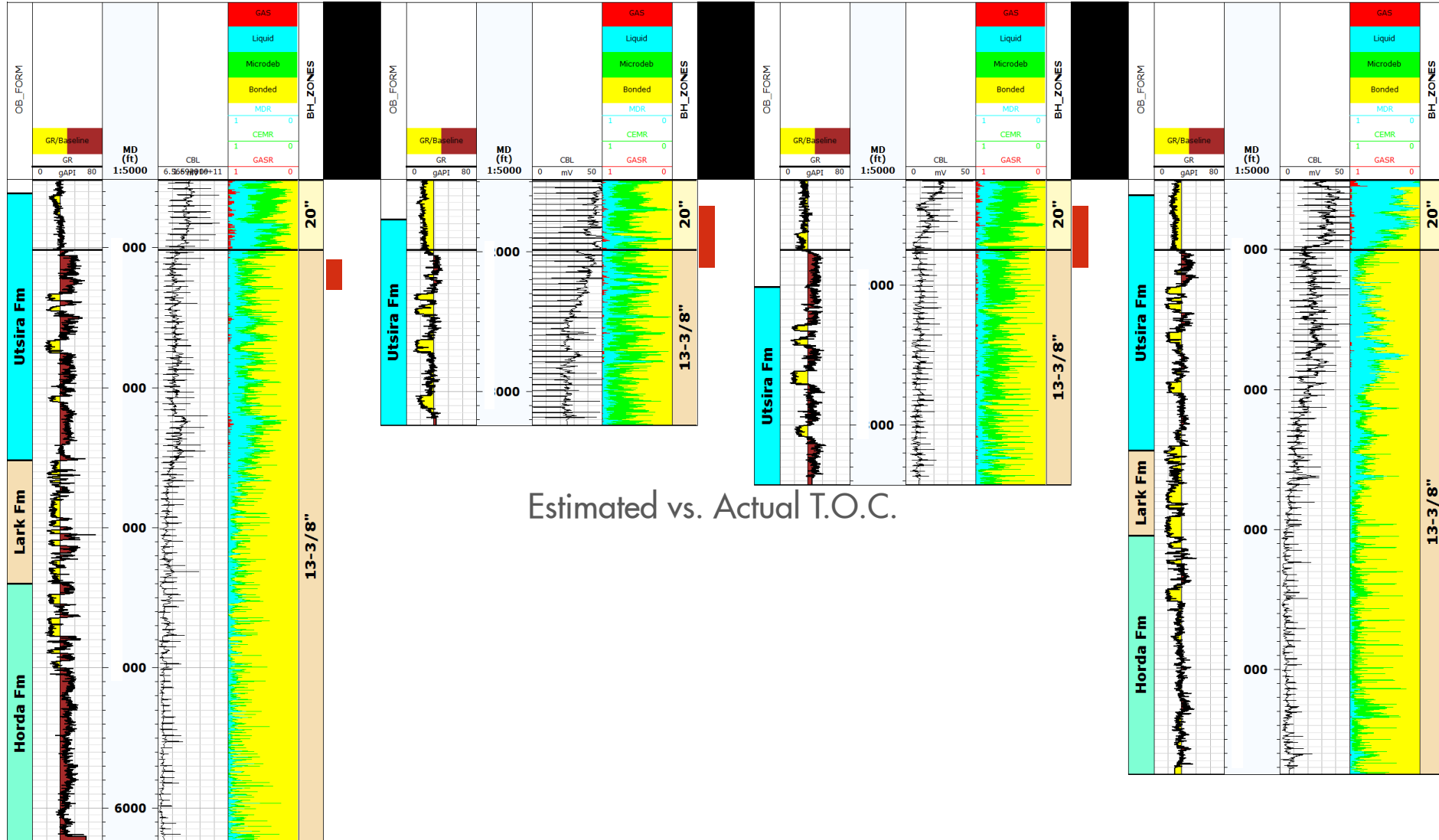
# CEMENT QUALITY ASSESSMENT

Well 1

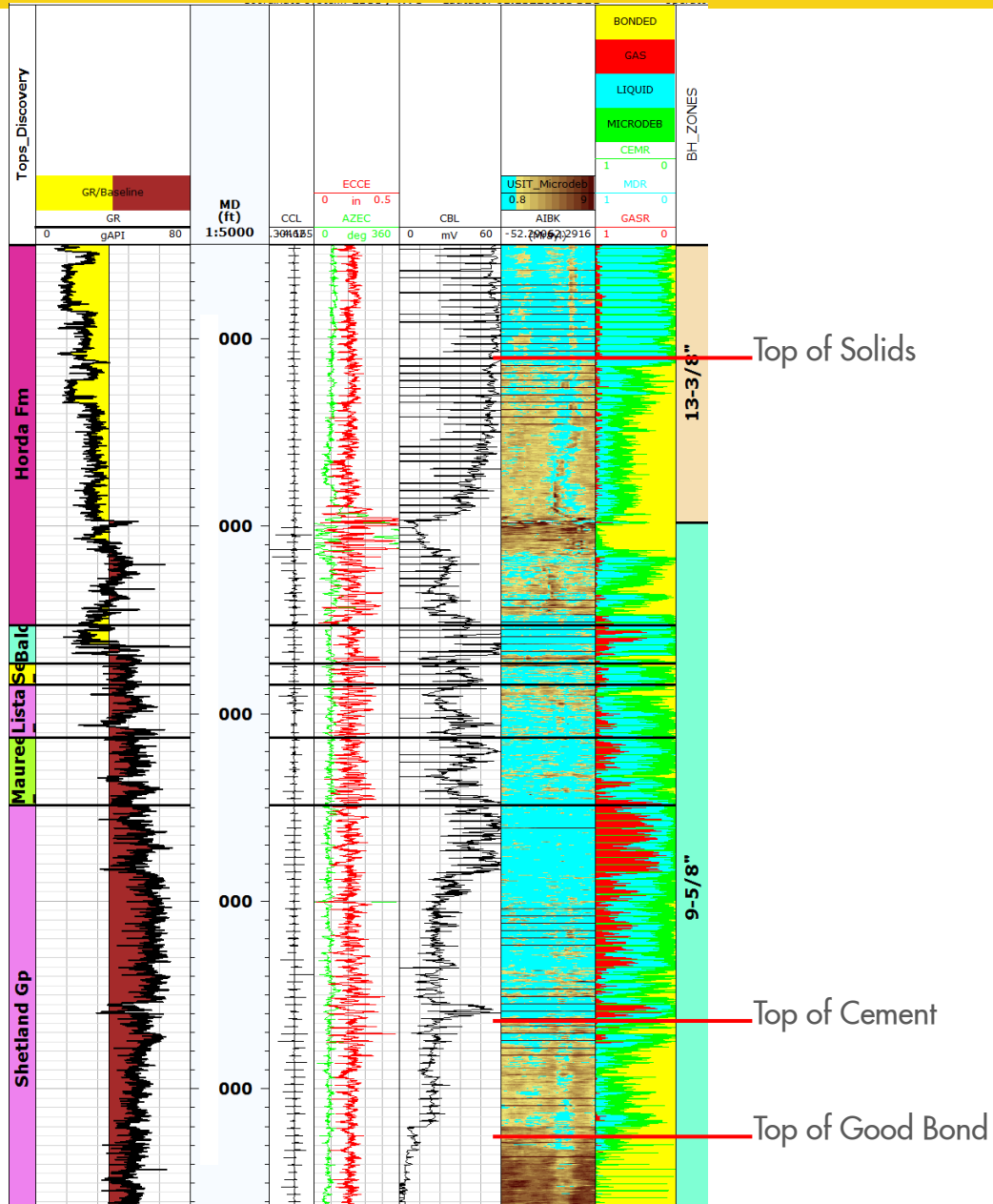
Well 2

Well 3

Well 4



# FREE PIPE DEPTH



# FREE PIPE DEPTH

Pulled out in 1000 ft sections...took one week!

13 3/8" Casing

400 ft MD

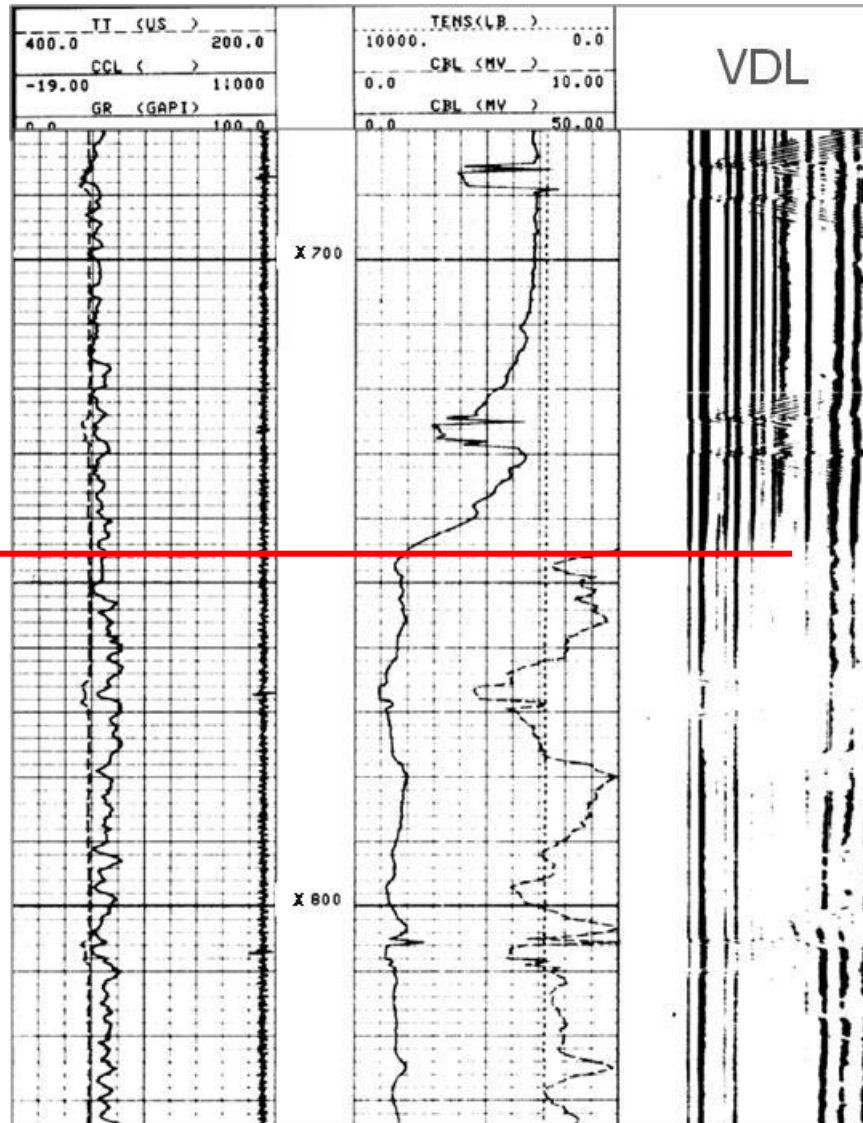
Some strong-out cement can prevent pulling the casing free. Cement found strung-out over a long distance.



# SQUEEZING SHALES

StatoilHydro application as detailed in SPE/IADC 119321

9-5/8" CBL/VDL Log  
1981



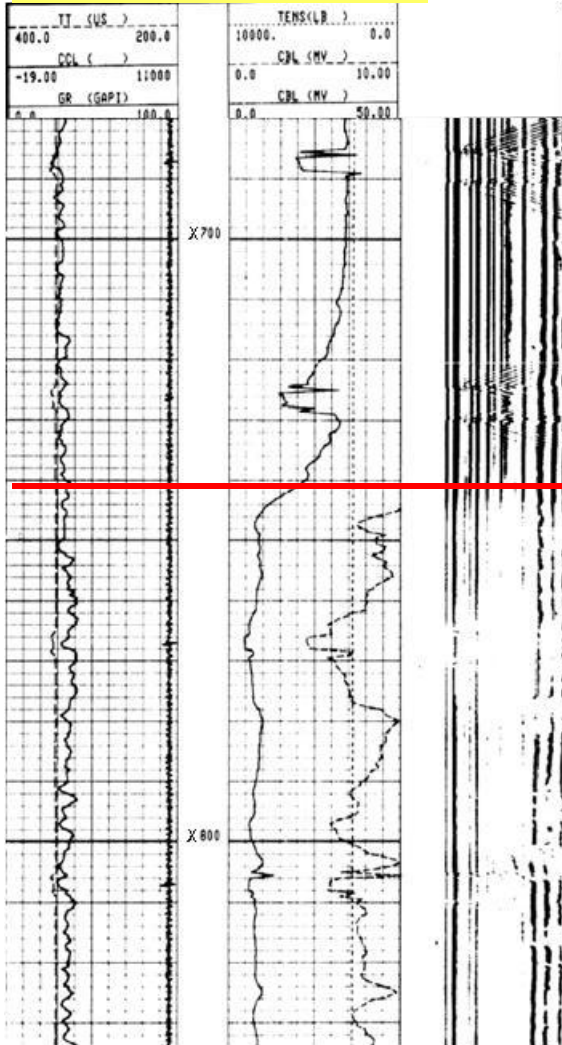
T.O.C. @ X750 ft ahbdf

# SQUEEZING SHALES

USIT Feb 2010

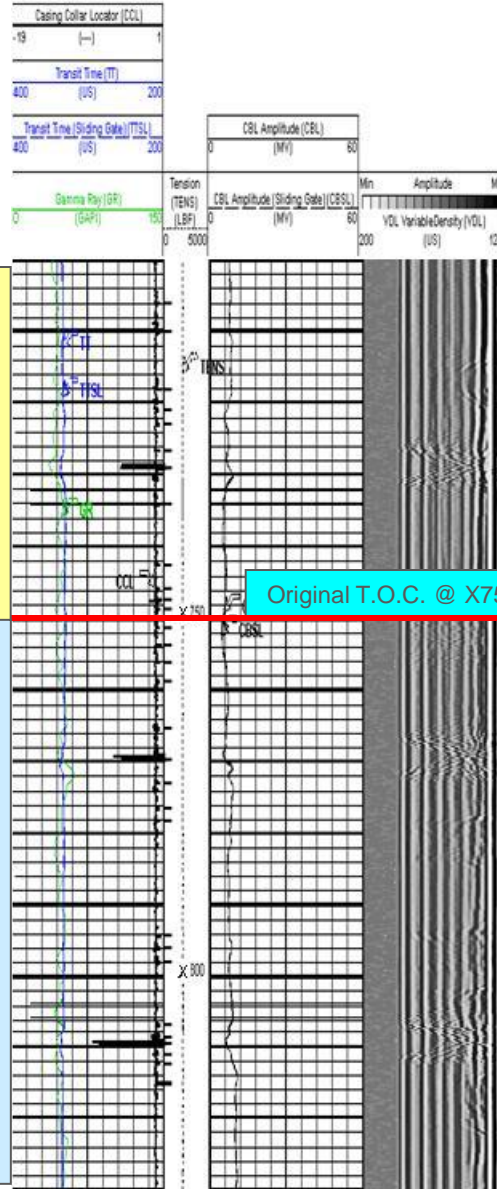
CBL Feb 2010

CBL Nov 1981

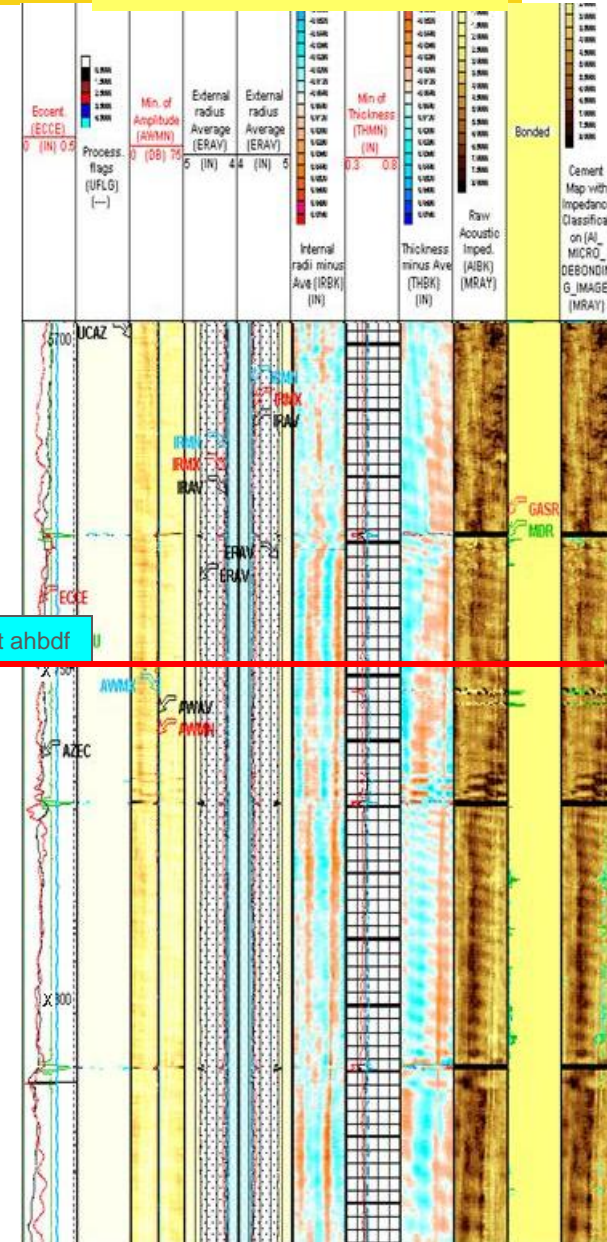


Formation Bond

Cement Bond



Original T.O.C. @ X750 ft ahbdf



# SQUEEZING SHALES

TT (US)	200.0	TENS(LB)	0.0
CCL ( )	11000	CBL (MV)	10.00
GR (GAPI)	100.0	CBL (MV)	50.00

CBL Nov 1981



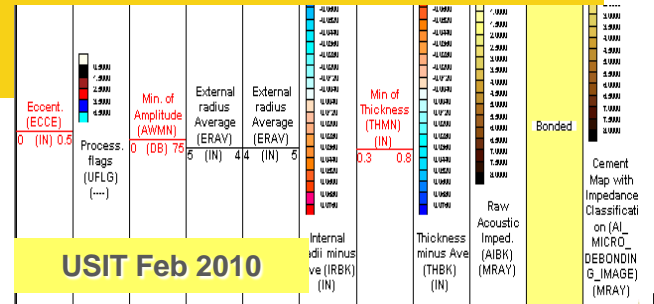
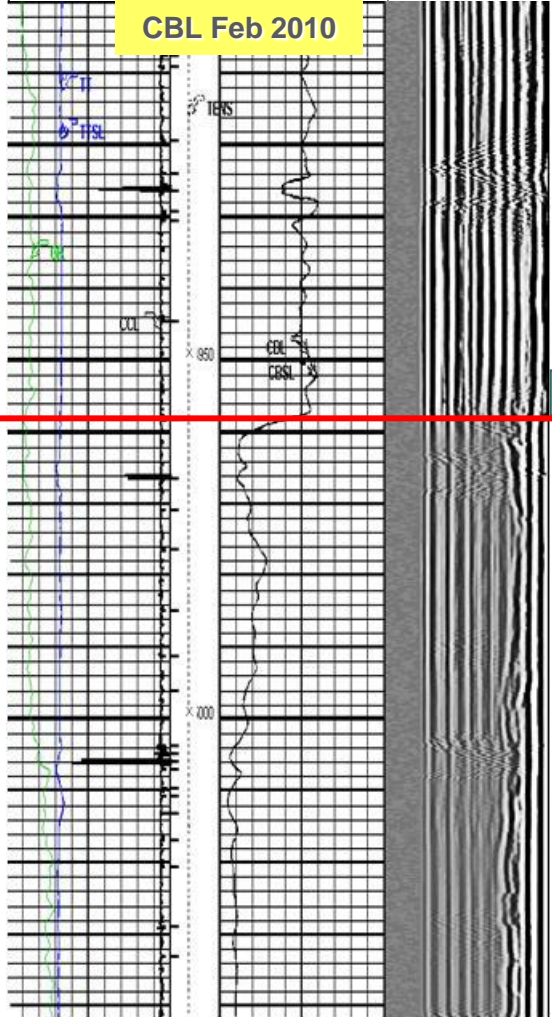
Transit Time (TT)	400 (US)	200
Transit Time (Sliding Gate) (TSSL)	400 (US)	200
Gamma Ray (GR)	150 (GAPI)	0

CBL Amplitude (CBL)	0 (MV)	60
CBL Amplitude (Sliding Gate) (CBSL)	0 (MV)	60

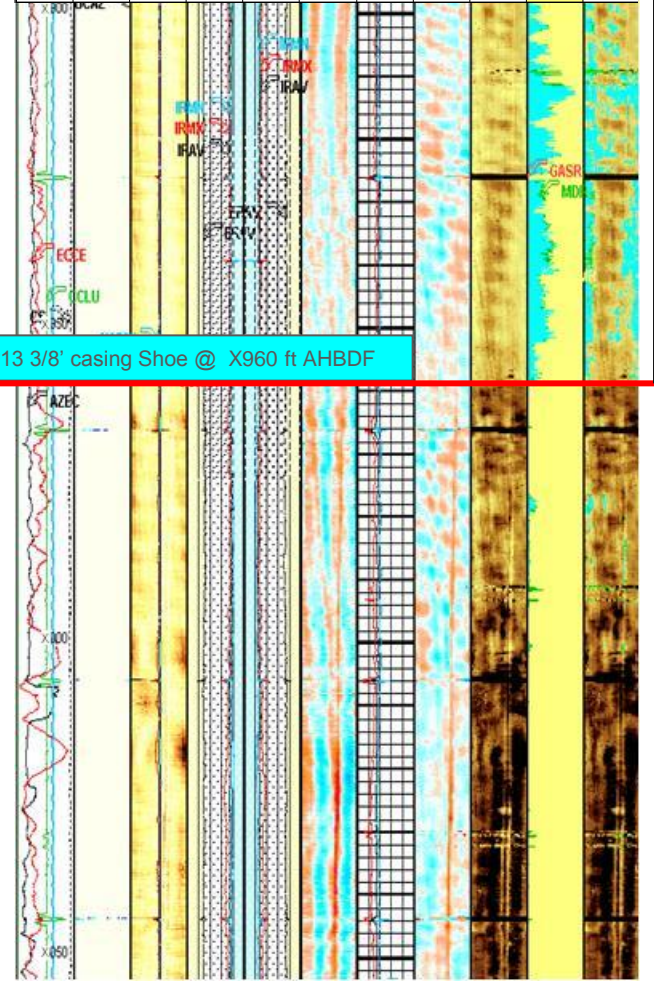
Tension (ITENS)	0 (LBF)	5000
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Min	Amplitude	Max
200	(US)	1200

CBL Feb 2010



USIT Feb 2010

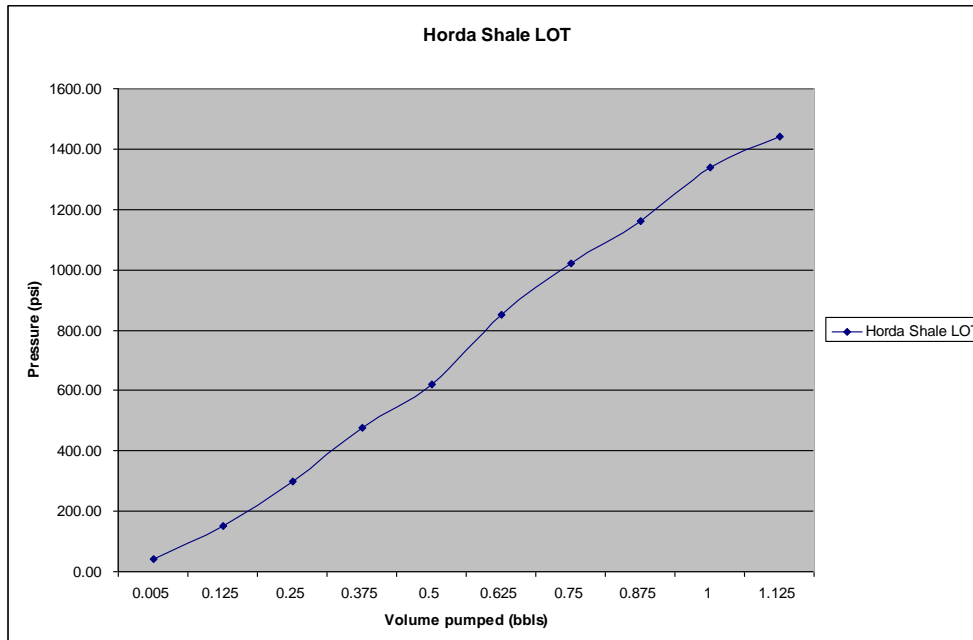
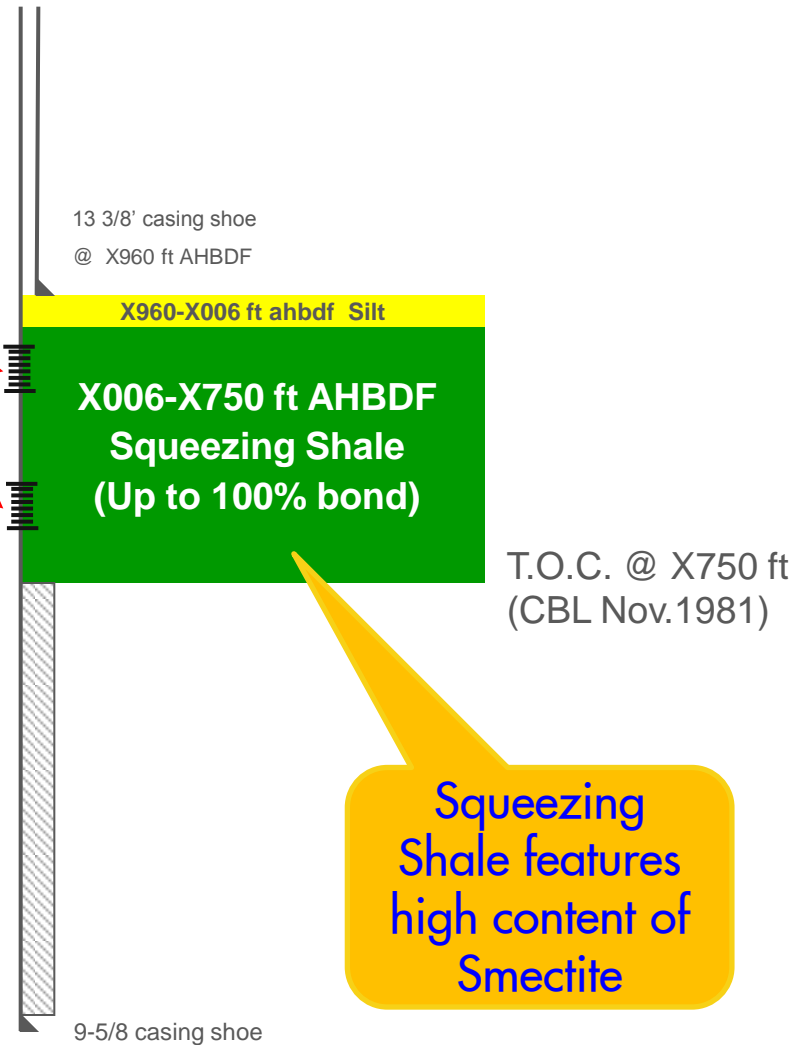


13 3/8" casing Shoe @ X960 ft AHDBF

# SQUEEZING SHALES QUALIFICATION

- 2 independent logs in every well
- Communication tests for field/formation

Communication Test Successful



# SUMMARY

- Assessing well integrity is key for a successful well abandonment.
- Logging is key for assessing well integrity, and “do it right the first time”.
- With logging, we ensure setting Barriers, not Plugs.
- Potential cost saving greatly pay for the cost of logging.
- Squeezing shales can be used as hydraulic seal, if properly assessed.

# Q & A

