

**Umbilical Blockages JIP Launch Meeting**  
Wednesday 29th November 2006  
Hilton Treetops Hotel, Aberdeen

# Umbilical Hydraulic Control Line Blockage

## Cause & Prevention

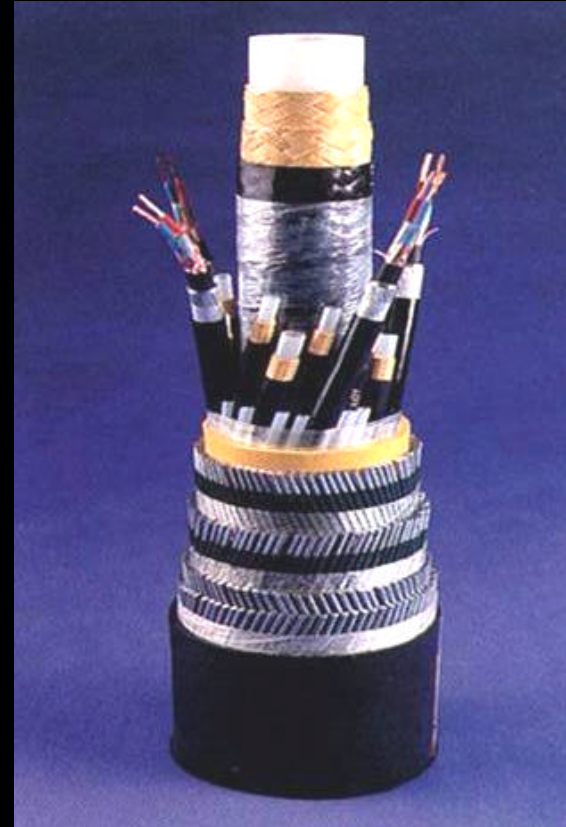


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# Subsea Control Fluids

- Control fluids are
  - very complex products
  - in contact with every part of the control system
- Maintenance of control fluid condition is critical
- Majority of hydraulic control line blockages caused by ingress of contaminants

# ISO 13628 - Annex C

- Annex C – Properties & testing of control fluids
- Requires umbilical liner test to API 17E
- Requires mixing of a small number of typical offshore chemicals
  - Completion fluids & miscellaneous operational fluids
  - Test various ratios for 4 weeks storage at 5 and 20°C
  - Assessment of visual effect
  - Does not cover all the possible chemicals that may come into contact with the control fluid



# Case studies

## Moisture Build-up in Operation

- Atmospheric moisture and seawater ingress into control fluid
- Oil purification units not operated as required
- No ongoing fluid condition monitoring programme
- Lack of awareness by platform personnel
- Training, maintenance and monitoring regime required



Pall Oil  
Purification  
Unit (OPU)



Castrol  
WS01  
Moisture  
Sensor

# Case studies

## Contamination from WOCS

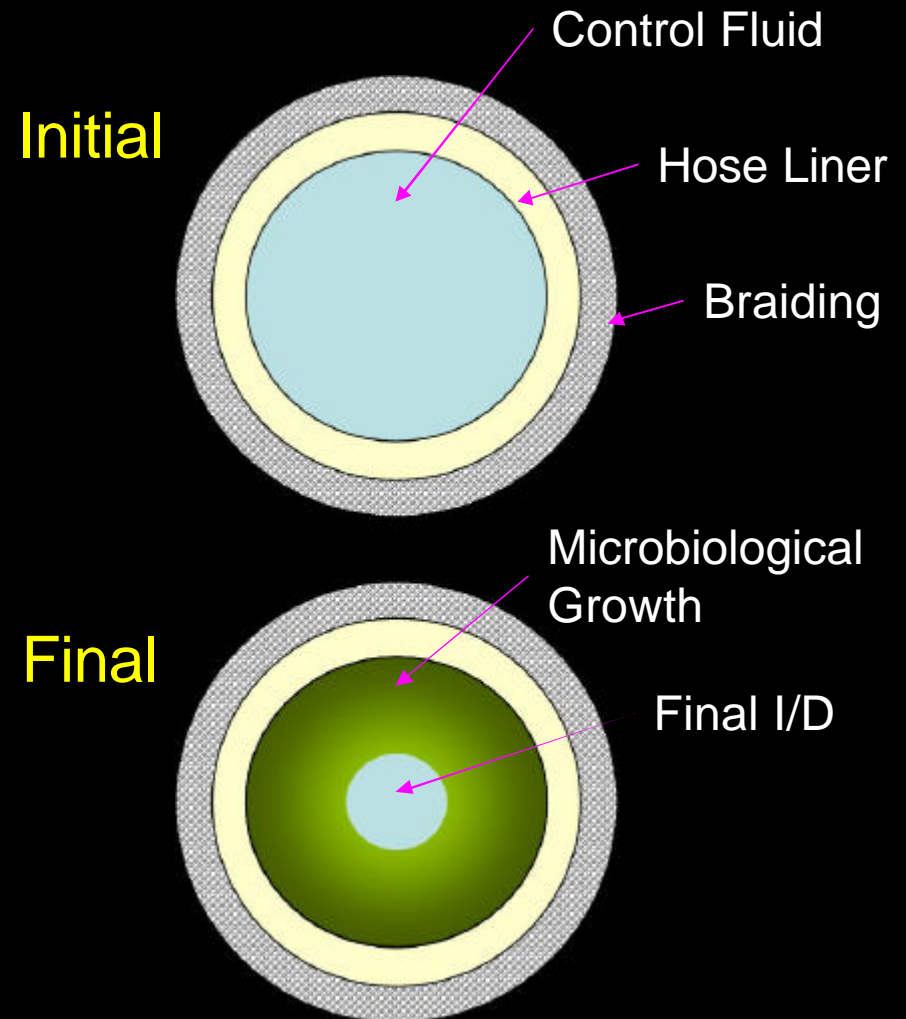
- Scale inhibitor introduced into control system via WOCS
- Chemical hoses connected to hydraulic system
- Inhibitor promoted formation of deposits
- Rectification required recovery of blocked equipment
- Tightening of workover procedures required



# Case studies

## Microbiological Growth

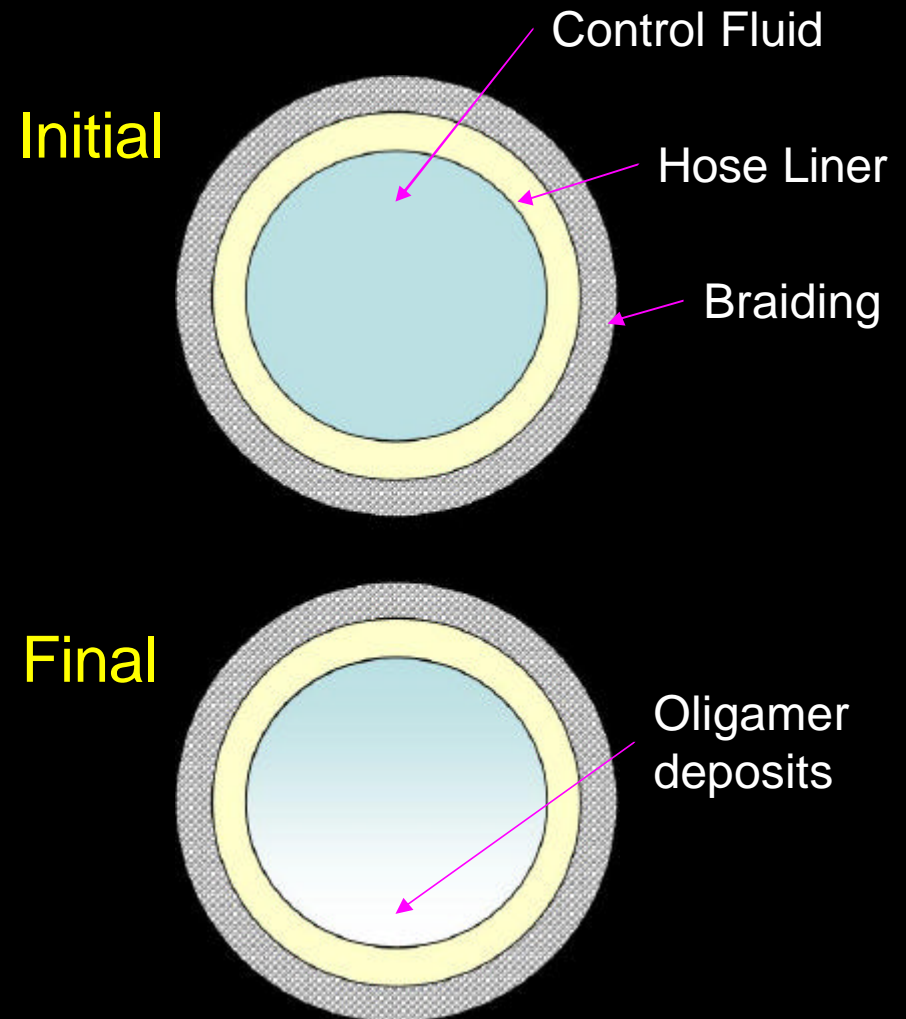
- Reduced bore due to microbiological growth
- Dilutable control fluid with no effective dilution control
- Excessive system response times
- Inadequate potable water supply / seawater
- No monitoring of control fluid condition
- Prolonged diver intervention required



# Case studies

## Hose Liner Polymer Extraction

- Flushing filters blocked prior to umbilical installation
- Low molecular weight polymer (oligomers) extracted from liner
- Rectification by prolonged flushing & filtration
- Additional polymer manufacturing process to eliminate oligomers
- Improved testing of new polymers required



# Other General Problems

- Wrong fluid installed in hose (or right fluid in wrong hose)
- Switching hose duty after filling
- Spare hoses filled with inappropriate fluid
- Switching treatment chemicals
- Thread sealing compounds & PTFE tape
- Subsurface Safety Valve control lines
  - Well bore fluid ingress at tubing hanger
  - Breakdown of fluid in SSSV control line

# Other Contamination Effects

- Effect of treatment chemicals on control system materials
- Contamination with water dilutes subsea control fluid, reducing performance
- Solid particulate matter causes abrasive wear and erosion, affecting reliability

# Prevention

- The most effective way to eliminate blockage is to **prevent contamination**
- Understand the effects of the chemical interaction
- Understanding the root causes.....leading to better standards for build, installation and maintenance

# Summary

- Most control line blockages result from ingress of contaminants
- Preventing contamination must be the priority
- Important to minimise effects of contamination when it occurs