

UMBILICAL CONTROL LINE BLOCKAGE POSSIBLE CAUSES AND SOLUTIONS

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Introduction

- History of control line blockages with MacDermid (Water based systems)
- Possible causes of control line blockages
- Preventative measures
- Conclusions

History of Control Line Blockages with MacDermid

- MacDermid, Canning, Marston Bentley, Isaac Bentley, have not had involvement in any major umbilical control line blockages in the past 10 years.
- Over 10 years ago some umbilical line blockages did occur, mainly in South America.

History of Control Line Blockages with MacDermid

- MacDermid have had some control line blockages inside the control system.
- Hydrate formation.
- Calcification of vent ports.
- Degradation of control system components.
- Chemical and biological contamination.

Possible Causes of Umbilical Control Line Contamination

- Seawater ingress
- Biological Contamination
- Chemical Contamination
- Fluid Degradation

Seawater Ingress

- Seawater contains:
 - Water
 - 35000 ppm dissolved solids
 - 19350 ppm Chloride
 - 10710 ppm Sodium
 - 2690 ppm Sulphate (SO₄)
 - 1304 ppm Magnesium
 - 419 ppm Calcium, 390 ppm Potassium.....
 - Biological organisms (varies at depth and location)



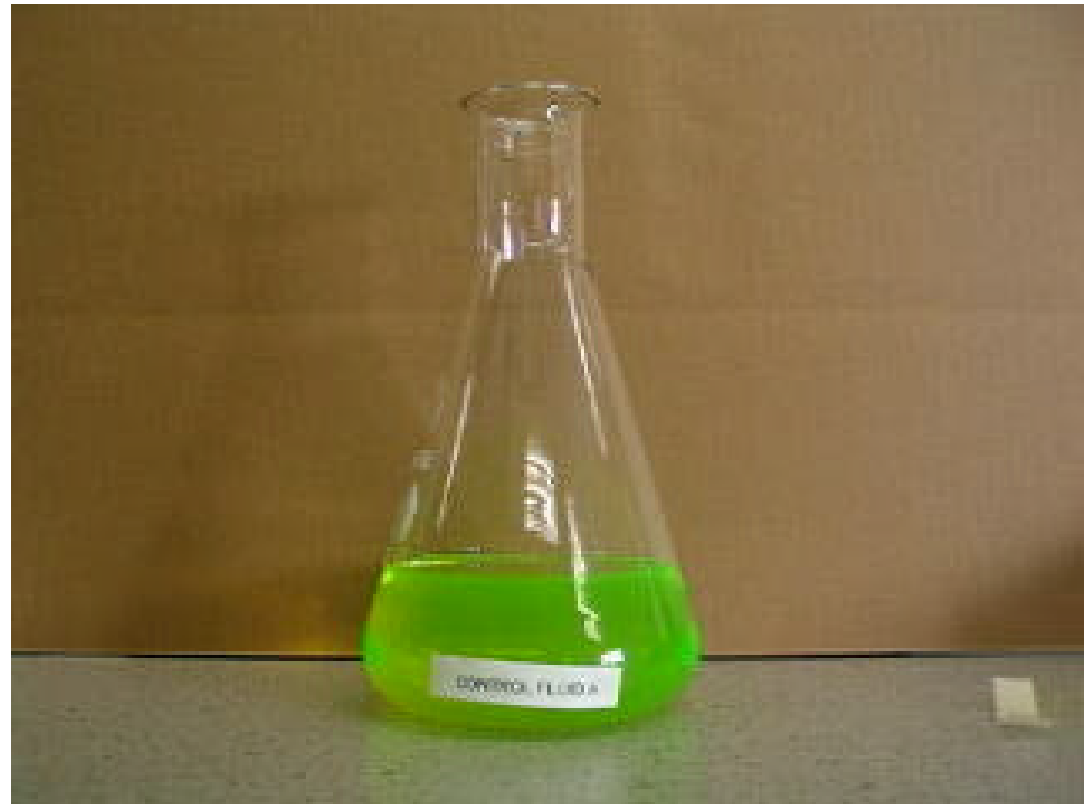
Biological Organisms

- Subsea control fluids are biodegradable.
- Will withstand micro-organisms if the fluid is neat
- Will start to degrade if diluted.
- Micro-organisms will become attenuated.



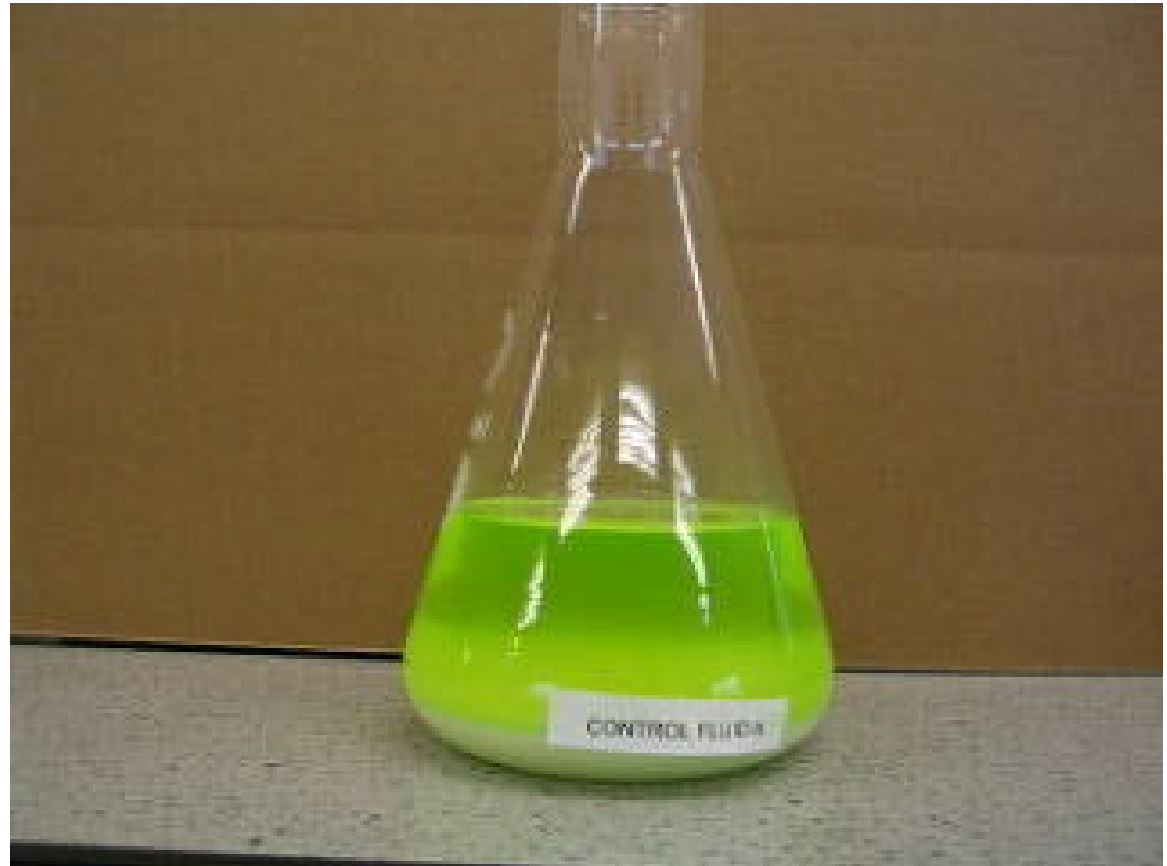
Chemicals in Seawater

- Some Control fluids will create solids with seawater salts.



Chemicals in Seawater

- The Solid will settle, but in most cases is light and easily dislodged



Chemicals in Seawater

- In most cases we have experienced the solid will dissolve if more fresh fluid is available.



Chemicals in Seawater

- Some Hydraulic fluids have no reaction with seawater



Chemicals in Seawater

- Seawater contamination would need to be significant to block umbilical control lines.
- Micro-organism attack is more likely to cause a block than chemical reactions.
- Chemical reactions may still cause the hydraulic system to fail.

Chemical Cross Contamination

- Methanol is one of the main contaminants found in water based fluids
- Sodium and Potassium brines have problems with some fluids, much the same as seawater



Chemical Cross Contamination

- Zinc brines, and in particular, Zinc Bromide can cause serious issues in water based fluids.



Preventative measures

- Do not leave an umbilical or control system on the seabed 'unplugged'.
- Use a barrier grease to prevent foreign material ingress.
- Barrier chemicals can be used between chemicals and control fluids when commissioning a chemical injection system



Conclusions

- Blockage of control lines is easily prevented.
- The main risk is from mixing in chemical injection or spare lines
- Testing of chemicals before they are mixed is required.