



## ICORR Aberdeen Branch – IOM3 Annual Joint Technical Event – Q&A

Paul Carragher - Founder & CEO, BiSN  
Lance Underwood - Principle Engineer, BiSN  
Angus Macleod - Senior Drilling Engineer, BP



**M2M** *Sealing Solutions*

# Q&A - ICorr/IOM3/MIS Joint Event - November 2019

- Q.** Can this technology be used for Horizontal Wells.

**A.** Not presently but it's under development for both Plug and Abandonment and Well Modification, Control of Water Production etc. Refer SPE Paper 194275 - MS. <https://www.onepetro.org/download/conference-paper/SPE-194275-MS?id=conference-paper%2FSPE-194275-MS>
- Q.** What are the critical factors in Plug and Abandonment.

**A.** Downhole Temperature, pressure, well bore fluids, deviation. Temperature Control is obtained using different thermites and using appropriate Alloy combinations.
- Q.** What is the max Downhole Temperature serviced to date.

**A.** 155 Deg C. in Angola but can be varied by changing Thermite Mix.
- Q.** What is the duration of the Liquid Phase.

**A.** Typically 15-20 mins but the range can be 20 Secs to 1Hr according to size of tool being used and Dia of Tubing being Plugged.
- Q.** What is the typical time from initial Engineering thru' Testing to Final Application.

**A.** This can vary between 1M-18M a recent project was only 6 Wks.
- Q.** To what % of Total Wells Market can this Technology be applied.

**A.** Estimated > 80% of all Wells. Even small coiled Tubing's are possible.
- Q.** Does the Plug Pack Material enter and contaminate the Reservoir.

**A.** It does to a limited extent as the whole process is influenced by Gravity Effects. The alloy will only flow while it is molten so the depth of penetration will depend on the heater being used.
- Q.** What happens when the Alloy contacts the Heater Pack.

**A.** Bismuth Alloy does not directly contact the Heater Pack. The thermite is contained inside a steel tube so doesn't contaminate the alloy seal created.

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**9 Q.** What about Thermal Expansion / Phase Change Effects.

**A.** A key property of Bismuth is its natural expansion with up to 3% change in volume.

**10. Q.** How do you avoid contamination by other Materials.

**A.** Where other Materials are contacted, they will melt also / be displaced.

**11. Q.** Is Bismuth now a good investment, will there be a huge demand for it.

**A.** The price of Bismuth is currently at a 10yr low with most of it coming from China and Korea.

**12. Q.** What happens when the downhole plug is not successful / does not hold pressure, do you get a 2<sup>nd</sup> chance.

**A.** Yes this can be engineered but it is a very rare event and has not happened in the last 30 Well Plugs. On occasion, the supplied Operator information is incorrect, wrong downhole temperature etc.

**13. Q.** How do you manage Thermite Control.

**A.** We have undertaken more than 9 yrs R&D and have over 60 successful projects worldwide (and probably 10x as many workshop full-blown tests). We are now able to have a high degree of Thermite Control (such technologies having originally been electric heated). According to application and travel distance etc, we will pull the Heater Pack between 10mins and 2Hrs usually. It is rare for a Heater Pack to be stuck downhole. We are generally 95% accurate on controlling plug temperature.

**14. Q.** Is downhole galvanic corrosion one of your main obstacles presently to having this technology fully signed off by the Regulatory Authorities.

**A.** For good corrosion control we do rely on operators providing us with accurate construction information on downhole Materials and it is sometimes difficult to simulate all possible effects in the workshop, such as cooling rates. Some alloying components do cause specific galvanic issues, such as Tin. We have ongoing testing programmes in place (with assistance from Operators such as BP/CONOCO that are developing alternative solutions for situations where galvanic corrosion might be a risk to L/T Plug Integrity and are working to NACE and NORSOK testing and well control standards. Refer: NORSOK <https://www.standard.no/pagefiles/1317/d-002.pdf> The critical thing to remember is that current failure rate of Bismuth Alloy Plugs is very low, 1/25 of that for Cement Plugs.

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### References:

1. NORSOK <https://www.standard.no/pagefiles/1317/d-002.pdf> The critical thing to remember is that current failure rate of Bismuth Alloy Plugs is very low, 1/25 of that for Cement Plugs.
2. SPE Paper 194275 - MS. <https://www.onepetro.org/download/conference-paper/SPE-194275-MS?id=conference-paper%2FSPE-194275-MS>