Formate brines are prepared principally from sodium and potassium, which are the most abundant metallic elements in the sea. Where required to further boost fluid density, a formate brine system may be prepared from caesium, which is another alkali metal that is natural to the marine environment. The natural occurrence of these elements, combined with the ready biodegradability of the formate anion, minimises the likelihood of significant – or persistent – environmental impacts associated with the discharge of drilling and completion fluids based on formate brines.

**Chemistry**
- Highly soluble in aqueous environment
- Alkali metal cations naturally abundant in seawater
- Stable hydrated ions in solution
- Potential sorption to sediments
- Insignificant amount hydrolysed to formic acid

**Ecotoxicology**
- Low toxicity to marine pelagic organisms
- Low toxicity to marine sediment reworkers
- Non-clasogenic
- No significant genotoxicity
- High biodegradation rate
- Low bioaccumulation/biomagnification potential

The key findings from an extensive environmental impact assessment study conducted by Metoc plc are:
- The use of formate brines may decrease the overall toxic load on the receiving environment
- Formate brines have a high potential for reclamation and reuse, thereby reducing the overall volume of chemical discharges
- Any toxic effects are likely to be short term. The chronic toxicity in the marine environment is not significant and no significant mortality or sub lethal effects are expected, although some organisms may exhibit temporary avoidance behaviour
- Quantitative Risk Assessments, following OSPAR recommended approaches, indicate that the use and discharge of formate brines, in a manner similar to those of several test cases, does not pose a significant risk to the environment

The use of formate brine drilling and completion fluids presents the operators with opportunities for minimising the environmental impact of a well construction operation. These opportunities can best be described in terms of the 5Rs, associated with achieving the Best Practicable Environmental Option.

- **Reuse** in several sections of the same well and reduce the need for different drilling fluids, spacers and cleaning chemicals
- **Recover** formate brines for use in the next well and save on overall fluid use
- **Reduce** overall waste volume and toxicity by eliminating solid weighting agents and minimising chemical additives
- **Recycle** easily and efficiently without the use of additional chemicals or emission-producing thermal treatment
- **Residues** from waste are minimised through relatively low losses on the cuttings and an absence of oil, surfactants, halides or solid weighting agents in the waste

Signed

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Signed

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Metoc plc’s summary from its extensive report on formate brines