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Risk Minimization by the use of Failure Mode Analysis in the Qualification of New Technology –

Recent Project Experience relating to intelligent well completions, permanent downhole gauges, expandables and new sand control technologies.

ABSTRACT

Industry has recently recognised the value of failure mode analysis, which is now being used on a rapidly expanding scale.

Early applications showed forcefully that some of the methods used in other industries, for which there are internationally accepted standards, are not directly usable in oil and gas projects. Significant effort has now been applied to correcting these shortcomings.

This paper explores the aspects in which traditional methods have been found to be inappropriate, and demonstrates current best practice, including a number of new developments, illustrated by examples from recent case studies on well completions, intelligent wells, permanent downhole gauges, expandables, and new sand control technologies.

Those new developments address key issues that have been recognised as result of recent project experience, namely –

- Having a good definition of functional requirements before embarking on failure mode analysis.
- Handling the life-cycle phases (primarily installation and production) in a coherent manner, especially where downhole equipment is concerned, because many failure modes impacting production and value/investment criteria originate during installation.
- Maintaining sufficient traceability to drill-down from critical risks to specific components or process steps, so that avoidance or remedial measures can be accurately focused.
- Relating consequences of failure to the true economics of the project in hand, representing the different life-cycle phases realistically.
- Producing useful results beyond just identifying critical failure modes, namely identifying important test processes and well procedures, thus becoming an integral art of a coherent qualification process.

These issues are important wherever the risk of applying new technology is high, which is true of most oil and gas E&P projects. The risks are higher still when projects have significant downhole complexity, because the downhole elements are subject to the worst operating conditions and have the highest consequences of failure.

This work has been instrumental in developing the methods that are now being widely adopted in oil and gas projects because they satisfy the unique needs of this industry.

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