Importance of Well Review: Considering recent Control of Well (COW) incidents.

Background

The JNRC Well Review Guideline, JR 2018-012, available on the JNRC Technical Page provides tiered guidance to Underwriters as to the appropriate level of review for a given well or well portfolio to support risk selection decisions and ongoing risk management, as well as establishing some basic principles to which all well reviews should be executed.

Tiers include for in-house reviews, third party reviews on individual wells, else third-party reviews of an insured's well engineering process.

Well Review Tier selection should increasingly be considered against a background of:

- 'the easy wells having all been drilled';
- ageing well stock;
- changes of well ownership (and possible incomplete and inaccurate exchange of well as-built and inspection records);
- high levels of drilling activity onshore and offshore, placing demands on resources (both people and equipment);
- fluctuating competence levels amongst Operators, Drilling Contractors and Service Providers, and;
- well operations increasingly entering complex and highly fractured formations.

Further, in a current environment of buoyant oil prices and increasing demand for gas, drilling and workover activity has increased significantly both on and offshore, which in turn is fuelling an increase in well approval for expenditures (AFE).

In 2024, subject to resource availability, it is the intention of the JNRC Survey and Engineering Sub-committee (the custodian of the JNRC Well Review Guidelines), to review the 2018 document as part of routine 'housekeeping' process to ensure the document still is relevant and fit for purpose in a changing risk environment.

In the interim, this circular aims to highlight some of the issues largely taken from analysis of recent COW claims to which the industry has been exposed, both raising mutual awareness and providing some added background to help inform the planned technical revisit of the Well Review Guideline.

Whilst most influxes and COW claims occur during well construction, a considerable number of losses occur in other life cycle phases, noting the largest known (by $ value) single market COW loss in 2023 occurred as result of loss of well integrity from a prolific gas production well.

Discussion

Control of Well Issues highlighted by recent claims are:

1. Be aware of the **level of risk tolerance** that is associated with a given well design. Exploration wells are by their very nature associated with a higher degree of formation and reservoir uncertainty and can be informed by seismic studies (of varying quality) and offset experience. Further be aware that risk is viewed as different for Reservoir Engineering and Well Engineering – for example underestimated pore pressure will create field issues when 'drilling ahead' into formations weaker than expected. All too often a redrill solution after a loss is an added casing, which ideally should have been available and used in the original design and construction when problems were identified in the well bore.

2. Be aware of **completion costs and completion complexity** – claims have been seen associated with completion activity, and in one case where design completion cost was equal to the original dry hole drilling cost. Complex completions require informed and competent staff, and use of completing well on paper (CWOP) studies are to be encouraged.

3. Ensure there is a **learning culture** embedded in the operators approach to well life-cycle design. Kicks taken in the well bore should be investigated as 'near misses' and used to address deficiencies in the well engineering process. Well control incidents should be subjected to root cause analysis, ideally led by the Operator, and supported by drilling contractor and other well service providers, with visible demonstration of lessons learned. Publicly available lessons learned publications and websites such as those produced by the International Oil and Gas Producers Association (IOGP) and the International Association of Drilling Contractors (IADC) should be routinely reviewed by Operators, Drilling Contractors and Service Providers.

4. Much has been written recently about so called 'zombie wells' – wells long since abandoned (to a standard applicable/accepted at the time) coming 'back to life' with leaks to surface, else allowing for **inter formation movement** of fluids in areas of remaining high production and exploration activity – be aware of potential changing formation conditions over a field life.

5. Inter formation flow has also given rise to recent claims which have resulted from **'man-made' shallow gas pockets.** Further, in a recent offshore loss, injection water was found returning to surface via the outer casing of a production well, after injection tubing and casing failure.

6. Understand the robustness of the **field and supporting office troubleshooting** process when the well experienced is not the well that was

planned. The very nature of drilling, particularly exploration wells, is that well programmes are based on engineering interpretation of significant amounts of data, with a wide confidence range, and 'in-hole' reality can be significantly different. How the field manages change is crucial in this regard, combined with the formality of the **change approval process** and approval of all parties involved in the well engineering process.

7. Be aware of the depth and breadth of field and supporting office staff **experience and competence** in managing an influx into a well. Is there a call-off contract with an expert well control company who can supply independent opinion on the diagnosed condition of a well, and possibly avoid extended down hole intervention without result? In many loss examples an earlier move to P&A and redrill may have been a more cost effective solution.

8. Increased use of **Managed Pressure Drilling (MPD)** where combination of mud (underbalanced) and surface backpressure applied through a Rotating Control Device (RCD) and surface MPD skid allows for more accurate control of bottom hole pressure, enabling wells with narrow 'drilling windows' to be drilled safely, and in turn may eliminate the need for additional casings. Training, competence and communication are all seen as critical here. Often a MPD specialist will be contracted to assist in the drilling of lower hole sections, although this should not relinquish the overall responsibility of the drilling contractor for well control. Claims have been seen when MPD was used, and a drilling contractor over reliant on the expertise of the MPD specialist, leading to misinterpretation of the well condition when the MPD package 'handed back' the well the driller, i.e. going from a 'closed loop' (automatic response to changing bottom hole pressure) to conventional 'open loop' (human response to changing bottom hole pressure) .

9. There has been a recent example where a **'twist-off'** occurred of the drilling string above the rotary table when drilling with MPD, which resulted in the well immediately going underbalanced and taking a large kick that could not be circulated out without formation breakdown.

10. Ensure **correct torquing of drill string assembly and reinspection**, noting good practice to 'move the breaks' on stands during tripping.

11. Ensure **drill pipe** is subject to a rigorous and audited **integrity management policy and programme**.

12. Operational well integrity is still in many cases the 'elephant in the room' with Operators often having an incomplete view of the integrity of all operational or suspended pressurised wells, and often absent or flawed annulus pressure monitoring. Critical in this regard is a demonstration of a **Well Integrity**

Management System (WIMS) with routine monitoring and testing and a Well Operational Risk Assessment (WORA) process that handles deviation from an agreed well integrity standard. There is often over reliance on the prescribed regulatory environment (the rigour of which can vary globally and sets a 'low bar') rather than following recognised industry good practice. This issue is of increasing importance with a globally ageing well stock.

13. Operational well losses are often caused by **legacy well construction issues**, and a WIMS process is important to be able to 'listen' to often 'weak signals' alerting to possible deterioration in the well integrity.

14. Ensure there is **clarity and compliance** of either **formation integrity test** (FIT) or **leak off test** (LOT) requirements when drilling out of a shoe, and that **kick tolerances** for a given formation have been calculated, are adequate and understood – these all inform safe well design and drilling operations.

15. **Extended drilling ahead whist taking significant mud losses should be an 'alarm bell'** to an increased probability of a well taking a 'kick', which could lead to either an underground or surface blowout. Such losses need to be arrested before drilling ahead, and as necessary to use a contingent casing to isolate the loss zone.

16. Be prepared to challenge well programme decisions, which appear to be driven by desire for **early release of the drilling rig**. Two recent losses arose during cementing using an under-specified workover rig in one case, and use of off-line cementing in the other case. Such techniques were justified based on releasing the more expensive drilling rig for other duties yet resulting in reduced integrity of well control.

17. A **minimum of two proven and independent well control barriers** to be present at all stages of a well life cycle.

18. **Management system failures and human factors** dominate the contributing factors to an influx, with close to 80% of such incidents falling into categories that are influenced by human behaviour based on recent independent analysis of 3,673 incidents from 8 publicly available databases.

19. The need for a **competent and informed Drilling Contractor** cannot be overstated.

20. Encourage use of proven **automated well control techniques** – instrumentation reliability and supporting technology has improved in recent years, and such techniques should be part of the Operator's 'toolbox' of well control options.

21. Consider wider opportunities for use of the **JNRC Tier 4 Corporate Well Risk Engineering Survey.** This supports opportunity for a more detailed overview of an Operators approach to Well Design, Well Engineering and Drilling Operations and Operational Well Integrity. This has mutual dual benefits of providing Underwriters with increased confidence in the Operator's approach to life-cycle well integrity and provides an expert independent audit/review for Operators with a focus on life-cycle well control and opportunity for improvement identification.

Conclusions

Notwithstanding the understandable historical focus on a worst case scenario of a major surface blowout during drilling that requires the drilling of relief well, Operators and Insurers alike can experience a control of well incident at any stage of the well's life cycle, and invariably this will not be a 'headline' grabbing event. This is evident from the range of control of well events reviewed in preparation of the bulletin. Of the twenty-one points raised above, some were specific to individual losses, but many common to the incidents reviewed. Whilst it would be folly in this circular to try and identify 'silver bullet' loss prevention items, when considered as whole, the issues raised can be distilled down to basic must have risk management principles, which are echoed in the JNRC Well Review Guideline:

- Get the design right, and ensure additional conservatism is 'baked-in' when data informing the design has a reduced level of confidence;
- Verify drilling rig and associated drilling and well control equipment is suitable for the well to be drilled, completed, worked over or P&A, and both third party verified and operating within rated capacity;
- Drill, complete, operate, work-over and P&A wells with competent risk aware staff, who are supported by fit for purpose and audited systems and procedures;
- Give staff the necessary tools to manage and mitigate risk;
- Expect the worse when it comes to emergency response capability because no matter how smart you think you are, bad things happen;
- Analyse, document, plan and learn from near misses (such as kicks) and more significant COW incidents.

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