The Role of Geoscience in Liability Management

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Summary

The management of liability reduction is of growing importance. The expectations on energy companies to increase spending to achieve liability reduction through to reclamation certification (or closure) of well, pipeline and facility sites is expected in the years to come. Geoscientist skills are easily transferred into the site-closure space, as mapping (of pipeline infrastructure) and well log analysis (for downhole abandonments) play key roles. Whether you are seeking an opportunity to pivot into the closure space or wish to continue developing energy assets, there are opportunities for Geoscientists to continue playing leadership roles in the effective, life-cycle management of energy assets and liabilities.

To make best use of dedicated liability reduction dollars, organizations such as Canadian Natural strive for area-based closure (ABC) programs. An efficient and cost-effective ABC program includes: a one-time well abandonment program (suspension and abandonment at the same time); all pipelines, facilities and well equipment to be decommissioned with shared services in one season; site assessments achieved in the same season; earthwork and contouring of all sites in the next season; minimizing hectares to be reclaimed; and revegetation established within two growing seasons. There are some factors that inhibit ideal ABC outcomes, many outside of our control; such as, inconsistent well production declines (staggered shut-ins), remediation requirements, site access conditions and weather restrictions. Optimizing factors that are within our control that will improve ABC programs and ensure effective and efficient liability reduction and use of capital. Factors to consider include: surface casing vent flow (SCVF) wells, active infrastructure that inhibits closure activity and over construction or placement of pad sites that may increase land requiring reclamation. The best time to consider the factors that contribute to expensive ABC programs is at the time a development program is conceived.

Geoscientists have a crucial role in limiting current and future liability exposure and facilitating the reclamation of the opportunities we identify and present for approval. Now is a great time to review our best practices with the end in mind: where we consider the impact of the decisions we make when drilling or recompleting wells on costs throughout the entire site selection-production-reclamation process. Our ability to influence: 1) the site selection, location and access, 2) identification of risk zone properties to inform to drilling mud selection, directional survey design and drilling control practices as well as 3) pipeline location, size and to-from logic, will provide the ability to improve the economic life of each producing well.

Opportunity Selection with a "Life-Cycle Management Lens" Methodology

There are three key stages where Geoscientists may influence the lifetime economics of a given field or play, the following offers the "life-cycle management lens" (LCML) methodology for your consideration:

1) Site selection, location and access

There are many factors we routinely consider when selecting a location for drilling. First, we consider the reservoir thickness, quality and areal extent to optimize its development, including well spacing requirements. Then, we consider the best approach (i.e. thick to thin, known to unknown) and the setback distance on the surface needed to achieve the landing points at depth (of a horizontal) and a radius from it. We select sites for drilling at optimum spacing and timely development. If diligent, we consider: the reuse of existing sites and work closely with our construction and surface land teams to ensure the site access and topography are minimized in consultation with key stakeholders; and whether we are disturbing sensitive habitat so we may seek to relocate. These activities are a means of completing field development plans.

To shift from development plan thinking to LCML logic, Geoscientists must ask the following questions: 1) Where may I be wrong? 2) Where might we see poor results? 3) What data will I need to determine early evidence of downside risk? and 4) With the downside risk in mind, how may I reduce the number of drills and surface disturbance required to develop this asset in the most cost effective way now and in the future.

Alberta Environment and Parks (AEP), through the Alberta Energy Regulator (AER), is increasing the reclamation standards and closure expectations associated with sites within environmentally sensitive areas, such as wetlands or species at risk. It is commonly understood that access is restricted at times for sites in these areas and, exceptional Geoscientists make best efforts to avoid placing pads in these areas. With a LCML, one should consider preserving and reusing existing sites wherever possible and limiting the addition of sites in wetlands, muskeg or with species at risk.

2) Identifying and limiting washout in "at risk" zones

In Alberta, there are ~10,000 surface casing vent flows (SCVFs) and it is estimated that the inventory is increasing by 5%/year*. Current abandonment technology is often not able to eliminate vent flows below 4m3/d while current regulations do not provide a path to reclamation certification with any vent gas present. In 2019, National Resources Canada completed the Technology Roadmap to Improve Wellbore Integrity** that summarizes the magnitude and impacts and the technology available to prevent, remediate and abandon SCVFs. The roadmap offers technology practices currently available that successfully prevent SCVFs while drilling and completing wells. The role of the Geoscientist in consultation with a drilling engineer, with a LCML, in preventing the occurrence and improving the abandonment outcomes associated with SCVF wells, includes:

1) Identify zones that may cause washout or narrowing
2) Run X-Y caliper logs to estimate the volume of cement required
3) Assist in identifying the appropriate mud formula based on any hydrocarbon-charged zone formation geochemistry
4) Ensuring directional deviations through unconsolidated formations allow for adequate rotation of the drill bit to maintain a circular hole for successful mud removal, casing placement and cement to surface
5) Optimize the well integrity management systems to ensure cement integrity is maintained through completions and operations.
    a. Geoscientist may contribute to the selection of cement properties that consider the completion strategy and hydrocarbon properties expected throughout the production life. Analyze and provide the reservoir's geochemistry information in order to contribute cement selection that will maintain integrity. For example, determine whether there is bacteria present that may degrade the cement over time and communicate this information to your drilling and completion department.

The LCML reminds us to ensure the work we Geoscientists do to identify washout zones and their properties are well understood by the drilling team, the directional programmer and wellsite geologist. Ongoing communication and a plan to avoid loss of circulation while drilling is key to preventing the creation of SCVFs while drilling and completing.

3) Pipeline mapping

There are many parallels to mapping reservoirs when mapping active pipelines. It is important to understand the hydrocarbon source direction and any barriers to flow, the same is true when mapping a pipeline system: What is the pipeline's to-and-from locations? Can the reverse be true? What other wells may be impacted if this well falls off production? If other wells fall off production, how will it impact the economic life of this opportunity?

When analyzing ways to reduce operating costs to prolong the life of an existing asset, pipeline connectivity is crucial. Surface rentals, often one of the biggest fixed costs of an asset, cannot be reduced to zero unless a reclamation certificate is achieved. This requires all wells to be cut and capped, all well equipment to be removed and all pipelines properly purged and abandoned. Any above ground risers that remain after the wells are abandoned will inhibit a site from progressing through to reclamation certification. Figure 1 show the active pipelines inhibiting inactive sites from continuing to reclamation certification.

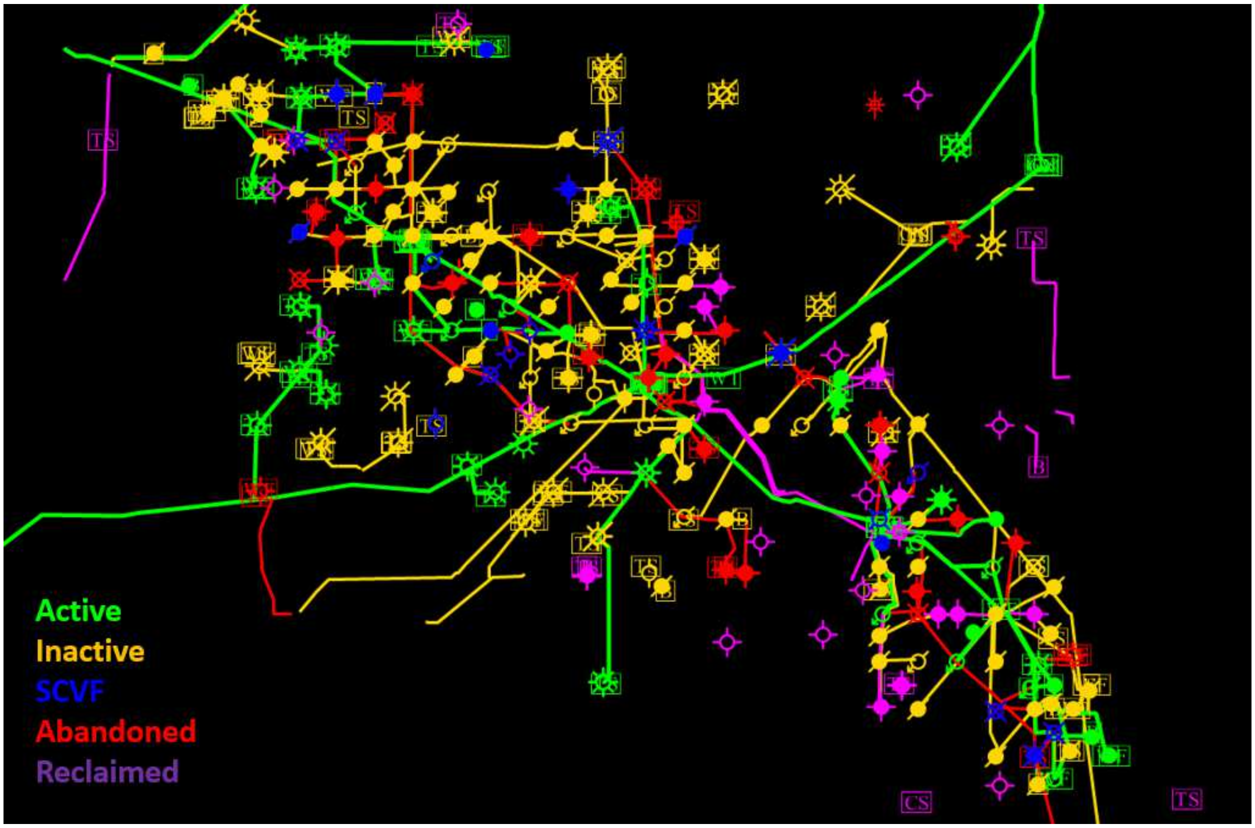

Figure 1: An example of a legacy field consolidation accounting for both the continued production and the closure of inactive infrastructure.

A geoscientist, using their LCML, will remain actively involved in the pipeline design process. Offering information about reservoir quality and uncertainty analysis and the risks either may pose to existing production through the pipeline design or selection process will be impactful in increasing the production life of a given field.

Conclusions

Pressure from regulatory bodies to increase closure activity, support species at risk, restore and maintain wetland areas and limit the overall footprint of our industry is increasing rapidly. This pressure requires all disciplines to move from asset development to life-cycle management plans. A geoscientist plays a crucial role in limiting the current and future liability exposure of our industry by appreciating and communicating the value of uncertainty and the importance of holding each other accountable to best practices with a sustainability lens.

There is an opportunity to reinvigorate what is considered to be common practice and offer our expertise to all professionals that we work with to make the opportunities we identify a reality in the best way possible, both now and into the future.

Acknowledgements

Naomi Wiebe, P. Geol, Selachian Geologic Consulting Inc.

References

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