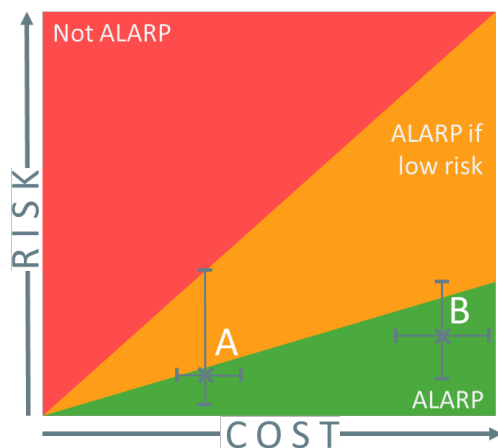
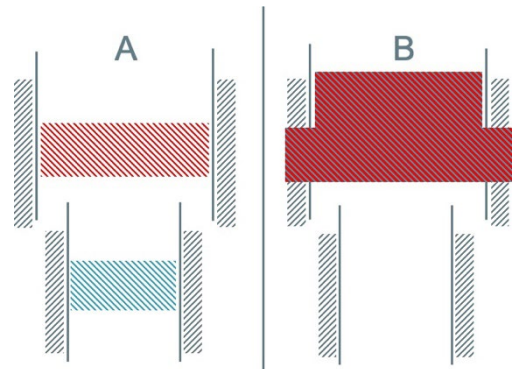


Industry guidance and best practice is driving increasing interest in the application of a risk-based approach to well plugging and abandonment. Astrimar has successfully developed and implemented a process to support operators with their well P&A barrier design decisions, understanding uncertainty, well risk assessments and determination/ demonstration of ALARP. Astrimar’s approach is in alignment with the OGUK Well Decommissioning Guidelines (Issue 6) and provides a detailed process for application of the risk-based decision-making that should accompany well decommissioning activity; this is particularly relevant for with integrity or cross-flow uncertainty.

Astrimar has an established track record supporting operator well P&A design decisions and ALARP justification to the regulator. Many wells to be decommissioned will have challenges requiring designs that deviate from those specified in OGUK or NORSOK guidelines or application of new plugging technologies. For these wells, a quantified or semi-quantified risk assessment is fundamental to demonstrating ALARP. Astrimar’s well P&A risk assessment and assurance process, which follows these guidelines, systematically and comparatively evaluates well barrier designs for their potential risk and associated uncertainty and addresses:

- Failure mode and effects (FMEA) for well bore and cross-flow barriers
- Failure likelihoods using system reliability models (e.g. event tree analysis)
- Risks and uncertainties associated with alternative barrier designs
- Time dependence of reservoir recharge, cross-flow potential or other mechanisms (such as barrier degradation)
- Quantification of leak potential using our bespoke STEM-flow analysis
- Selecting the best P&A design option and demonstrating which design risks are ALARP
- Demonstrating ability to meet regulatory requirements



All P&A design parameters can be modelled as statistical distributions to address uncertainty. These include, for example: the time for reservoir recharge or cross-flow breakthrough; the likelihood of barrier failure or cross-flow being enabled; and associated environmental, financial and reputational risks. Additionally, if required, Astrimar’s STEM-flow software can support the analysis by quantifying estimated leak rates and times to breakthrough across a variety of well barriers and materials. Monte Carlo Simulation is an integral part of these analyses and enables the impact of input parameter uncertainty to be reflected in the outputs, a necessary requirement for higher risk wells.

Astrimar’s proven efficient and pragmatic approach provides value to operators by systematically evaluating risks associated with well P&A barrier design options enabling defensible comparison, and through a risk-based cost benefit analysis, assisting in determining and demonstrating the ALARP design.

For more information about our risk based well plug integrity assurance services, contact Brian Willis or Caroline Roberts Haritonov (info@astrimar.com).