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External benchmarking simplifies time and cost estimation for well abandonment

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Oil and Gas Operators are required to assess their asset retirement obligation (ARO) to fulfil regulatory and accounting requirements, or in support of an asset sale. Cost estimations are usually revisited annually, with an increasing level of accuracy required as cessation of production (COP) approaches.

Well abandonments can make up a significant portion of the total decommissioning cost, or ARO[1]. Therefore, a structured and data driven approach is recommended when generating an estimate. Well Engineers typically face several challenges when tasked with generating a time and cost estimate for well abandonment operations:

- Lack of representative internal data on abandonment operations
- External data, if available, does not accurately reflect abandonment complexity
- External data, if available, is incomplete and not quality controlled
- Evolving regulatory requirements make older data sources less relevant
- Evolving practices and technologies make older data sources less relevant

Rushmore Reviews Abandonment Performance Review (APR) provides an industry recognised framework that allows Operators to prepare a time and cost estimate for well abandonments. At the time of writing the APR database contains over 800 global wells. The data is submitted by participating Operators in a standardised format on a quarterly basis. The well data is subjected to a quality control process before being published to the website database.

The standardised format of data collection enables users to search relevant well types with representative abandonment complexities and well conditions. Abandonment operations are split into three phases and four complexity types, using recognised industry definitions[2]:

- Phase 1 – Reservoir has been permanently isolated
- Phase 2 - Intermediate zones with flow potential have been permanently isolated
- Phase 3 - Wellhead and conductor removal

Each phase is assigned a complexity type:

- Type 0: No work required, a phase of abandonment work may already have been performed.
- Type 1: Simple rig-less abandonment, using wireline, pumping, crane, jacks. Subsea wells would involve a LWIV and be riser-less.
- Type 2: Complex rig-less abandonment, using coiled tubing, HWU, wireline, pumping, crane, jacks. Subsea wells would use a heavy duty well intervention vessel with riser.
- Type 3: Simple rig-based abandonment, requiring retrieval of tubing and casing.
- Type 4: Complex rig-based abandonment – The well may have poor access and poor cement requiring retrieval of tubing and casing, milling and cement repairs.

1 Oil & Gas Authority, 2020. UKCS Decommissioning Cost Estimate 2020. [online] Oil and Gas Authority. Available at: <https://www.ogauthority.co.uk/news-publications/publications/2020/ukcs-decommissioning-cost-estimate-2020/> [Accessed 23 February 2021].

2 Oil & Gas UK, 2018. Well Decommissioning Guidelines. 6th ed. Oil & Gas UK.

When performing a future estimate, the complexity type selected will depend upon the anticipated or actual well conditions at the time of abandonment. For example, wells may have known integrity issues or restricted access. The facilities present at the wellsite will also drive the complexity type. For example, in the case of platform wells, the use of coiled tubing or a hydraulic workover unit (HWU) may not be feasible. This would drive a rig-based operation. In the case of subsea wells, the water depth may exceed the limitation for a Light well intervention vessel (LWIV). This may drive the use of a heavy duty well intervention vessel with riser, or rig-based P&A.

Defining the abandonment operation in phases and complexity types enables users to search for representative, or comparable offset information. A summary of the database structure and search functionality is presented in figure 1 below.

Location	• Country or Region
Well Category	• Land well, • Offshore - platform, subsea, mudline suspension
Well Conditions	• Number of zones with flow potential to be isolated • HPHT, H2S or CO2 present, xmas tree type, completion type, access restrictions
Phase 1	• Preparatory work required i.e BOP activites, well kill, establishing well access • Complexity - Simple or complex rigless, Simple or complex rig based • Annulus remediation and verification techniques, through-tubing abandonment
Phase 2	• Preparatory work required i.e upfront intervention operations, establishing well access • Complexity - Simple or complex rigless, Simple or complex rig based • Annulus remediation and verification techniques, Through-tubing abandonment
Phase 3	• Preparatory work required i.e upfront intervention operations, establishing well access • Complexity - Simple or complex rigless, Simple or complex rig based • Wellhead, conductor, casings cut at surface, or removed

Figure 1 Database structure and search functionality

Search results will provide tabulated information that is useful for generating a time and cost estimate. A summary of the data available to the user is described below:

- Description of workscope:
  - Facilities used
  - Cement barriers placed in the well
  - Annulus remediation techniques performed
  - Number of wells in campaign
- Operational time and cost, by phase and total
  - Including or excluding preparation activities
- A description of major NPT events
- Performance metrics, by phase and total
  - % Productive time, % NPT, % WOW
  - Cost per day
- A well schematic before and after abandonment

The level of accuracy required in the estimate will be determined by the context and phase of abandonment planning. Users looking to generate a generic liability cost estimate during field life may wish to use the search results without further analysis. Conversely, where COP is imminent, users may wish to refine the search further or exclude certain data points. In the case of Authorisation for expenditure (AFE) estimates, the user might only use the APR to benchmark their detailed 'bottoms up' estimate.

Once satisfied with the offset well list, the user can generate graphs and charts to present the results. The results can be analysed in percentiles such as P10, P50 and P90 as presented in figure 2. This provides the user with a median (P50), plus a range of uncertainty (P10/P90). It also allows the user to investigate the best, and worst, performers in more detail.

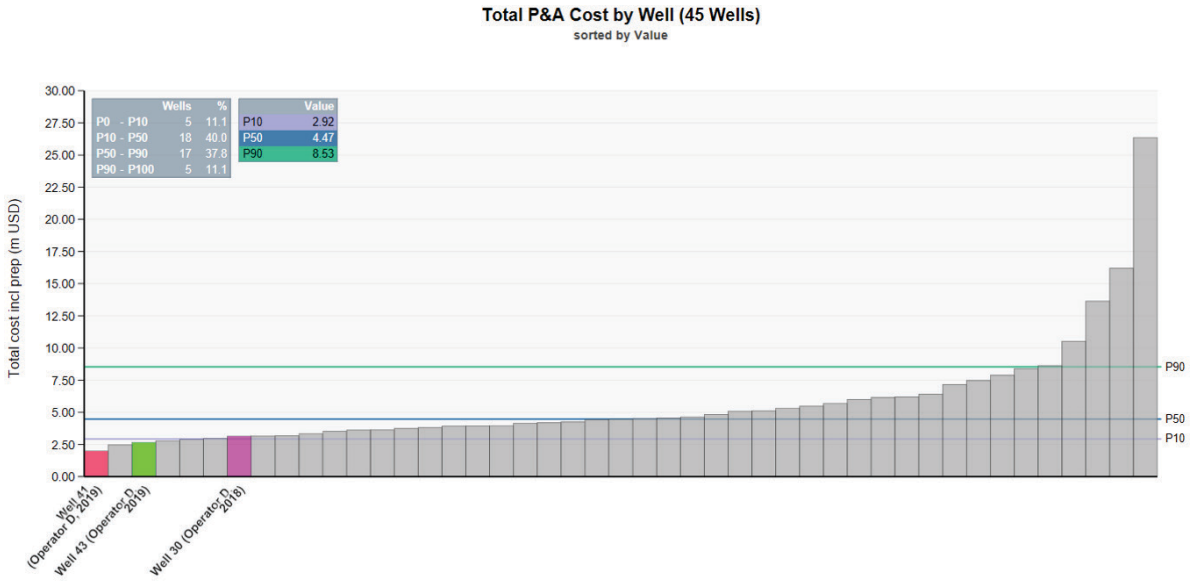

Figure 2 Total P&A Cost by Well

The user can also break the costs down further by P&A phase as presented in Figure 3.

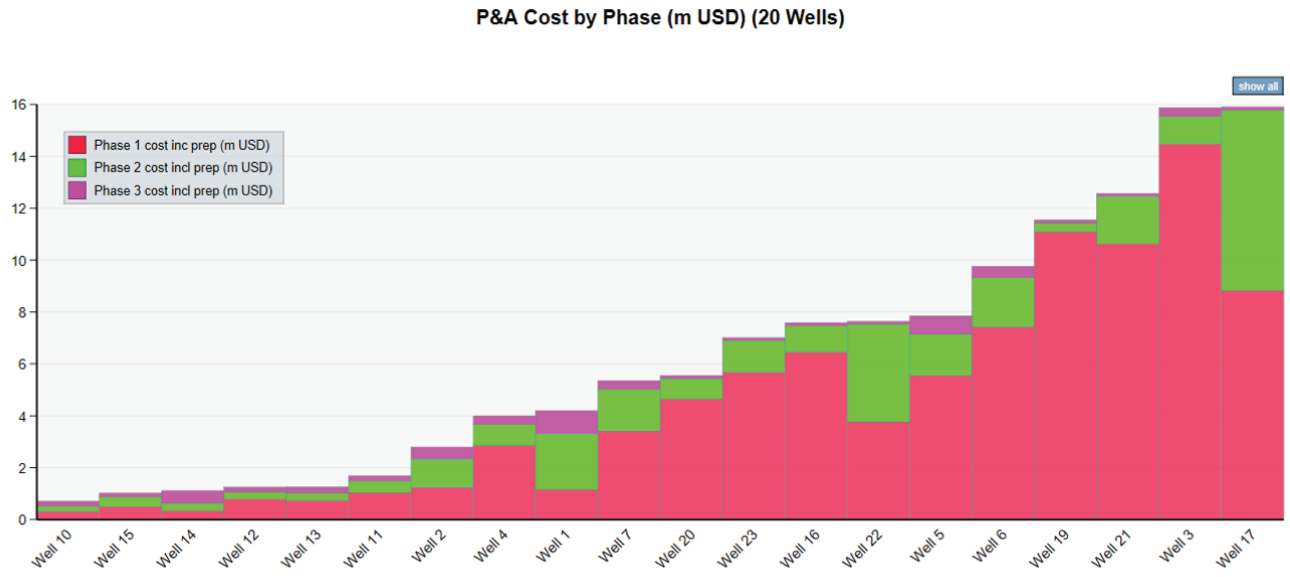

Figure 3 Total P&A Cost by Phase

In a more detailed exercise, the major NPT events can be investigated further and considered for inclusion in risk assessment activities. The NPT days can also be plotted to determine a median, mean, low case and high case (figure 4). An equivalent chart is available for waiting on weather time.
This information can be used to support the NPT and WOW assumptions submitted with the time and cost estimate.

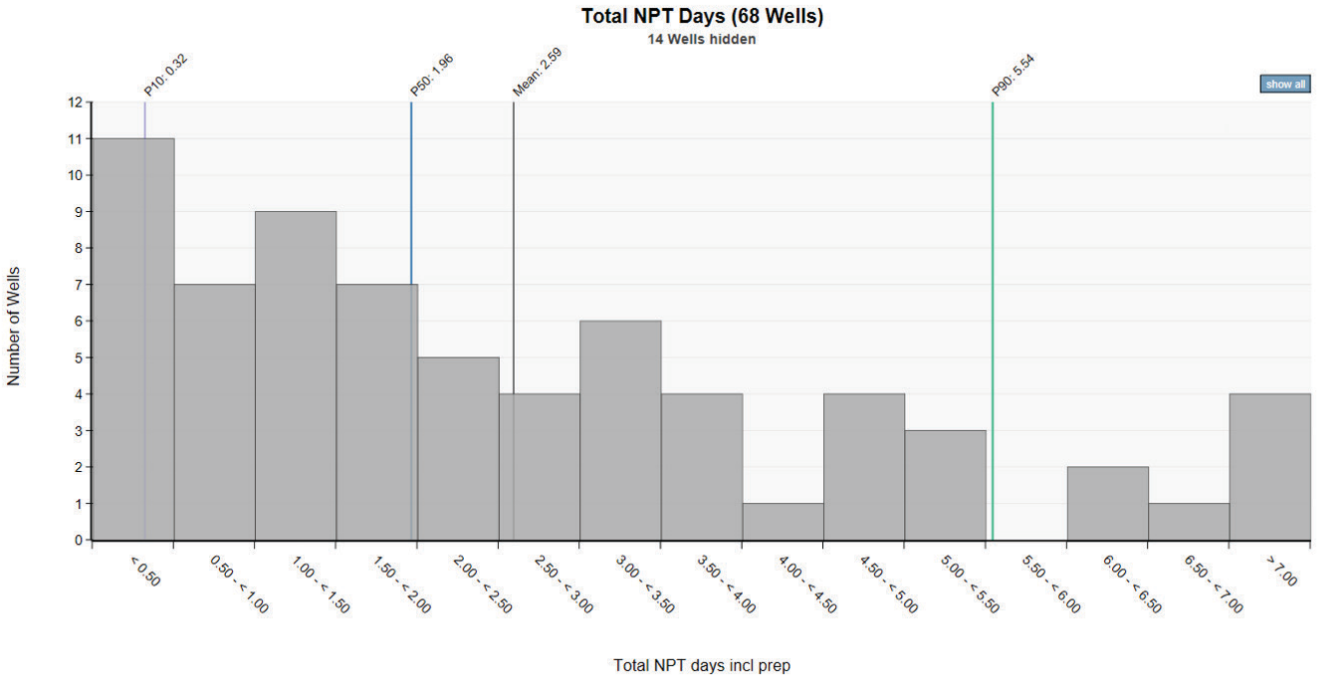

Figure 4 Histogram Total NPT Days

It is also possible to chart the time or cost performance by Operator, to determine the best in class (Figure 5). Participation in the APR opens the possibility of cross-Operator engagement. Lessons learned and best practices can be shared through the Rushmore co-ordinated workshops and webinars. Similarly, one to one sessions between Operators can be facilitated by Rushmore Reviews.

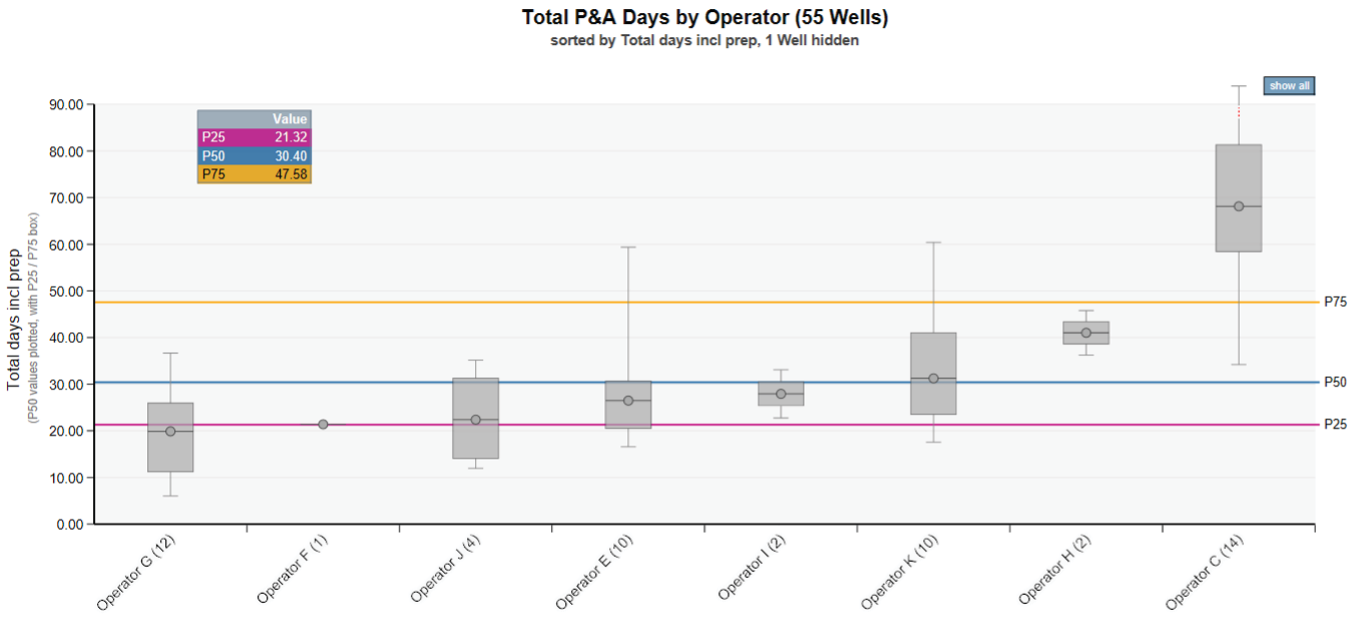

Figure 5 Total P&A Days by Operator

External benchmarking with the APR simplifies the process of well abandonment time and cost estimation. It provides engineers with a global database of complete and quality-controlled offset data to work with. The APR data is organised in such a way that a comparable set of offset wells can be found, using abandonments of comparable complexity, facilities and well conditions. The continual addition of wells to the database ensures that evolving regulatory requirements are considered. Similarly, performance improvements through advances in technology and best practices are captured.

The APR is suitable for generating time and cost data estimations at different levels of accuracy, as required by the user. Generic liability costs required as an estimate during field life are simple to deduce. Meanwhile more in-depth analysis is possible for cases where COP is imminent, or to benchmark and QC bottoms up AFE estimates.

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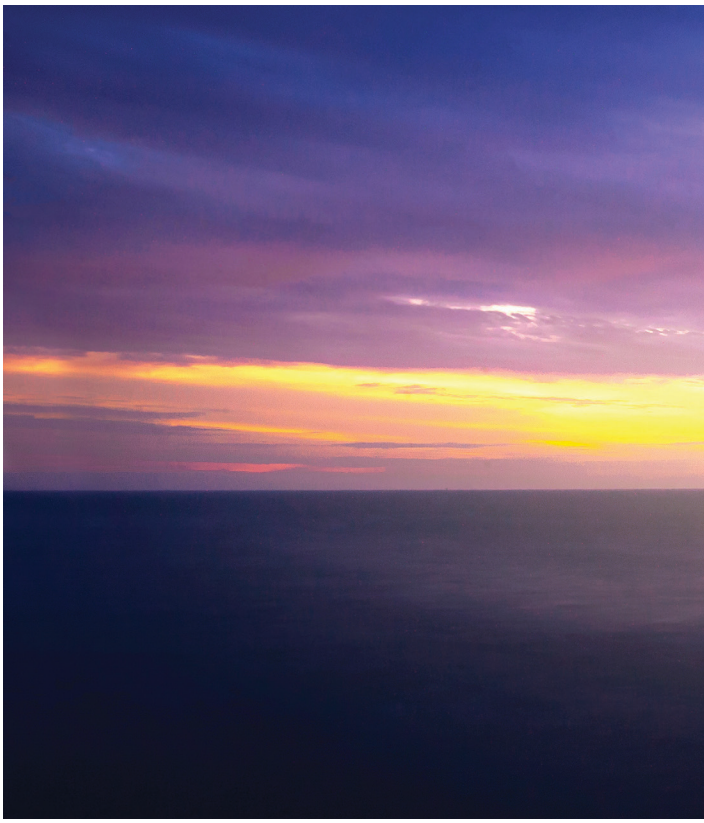

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