

Bentley[®]
Advancing Infrastructure



Project Summary

Organization

Vedanta Limited – Cairn Oil and Gas

Solution

Utilities and Industrial Asset Performance

Location

Rajasthan, Andhra Pradesh, and Gujarat, India

Project Objectives

- To develop a smart well integrity and flow assurance management system that automates manual well monitoring and corrective action processes.
- To establish a connected digital environment to integrate disparate data and streamline workflows.

Products Used

AssetWise[®]

Fast Facts

- Cairn operates more than 850 oil and gas wells in India that are aging and harbor risk factors affecting well performance.
- The company established a connected data environment and implemented a web-based smart well integrity and flow assurance management system.
- AssetWise digitalized and automated monitoring and management of Cairn's entire well stock.

ROI

- Using AssetWise, Cairn generated a comprehensive central well database that optimized preventive maintenance and corrective action, and increasing productive well time by 10%.
- Automating cumulative cost-performance plots to evaluate cost benefits improved well productivity by eliminating ineffective operations.
- Leveraging AssetWise reduced the potential for uncontrolled fluid release and improved flow assurance management, saving around \$1.2 million per year.

Cairn Implements Smart Well Integrity and Flow Assurance Management System

Bentley's AssetWise Provides a Connected Data Environment to Streamline Asset Monitoring and Data Analysis

Committed to Operational Excellence

Approximately 35% of global well inventory suffers from well integrity issues related to corrosion, erosion, and poor-quality cement behind the casing adversely affecting the down-hole well completions and surface pipelines. This situation results in flow assurance issues, asset failure, and subsequent downtime that costs millions of dollars. In addition, oil and gas companies must mitigate risks and safeguard against uncontrolled release of hydrocarbons to protect the environment. As a result, well integrity and flow assurance management have become critical to oil and gas operations. To monitor and control stimulation chemical usage, reduce tubular and pipe corrosion, improve flow assurance, and optimize well integrity, the industry requires continuous visibility into asset reliability, well performance, cost, and environmental impact.

Cairn Oil and Gas, Vedanta Limited is the largest private-sector crude oil producer in India. It operates over 850 wells in the Barmer, Ravva, and Cambay areas. With time, well productivity was affected by wax, scaling, corrosion, and increase annuli pressure issues. As manual, error-prone processes fail to provide optimal insight into well integrity management, Cairn explored ways to automate and streamline workflows, and integrate disparate data. The organization sought to implement a smart well integrity and flow assurance management system (SWIM) to efficiently manage associated risks, optimize cost and well performance, and limit environmental impact. "To ensure that the wells are operating optimally, it is very critical that various parameters affecting the performance of the wells are monitored robustly, hence the need for a smart well integrity and flow assurance management system," said Utkarsh Vijayvargia, senior petroleum engineer at Cairn.

A Connected Digital Solution

Well integrity and flow assurance management involve a multidiscipline approach, requiring engineers to interact on a regular basis to assess the status of well barriers and safe operating envelopes, as well as manage risks associated with maintaining flow. The sheer number of associated risks



Fig. 1 – Each well can be monitored to analyze each component's performance and alert engineers to any possible issues via notifications.

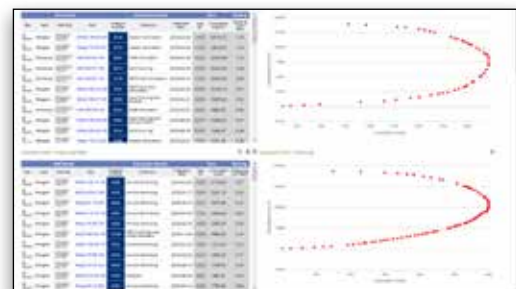


Fig. 2 – In order to maintain flow, Cairn monitors cost benefit analysis of individual stimulation treatments of all wells to identify underperforming assets.

usually entails numerous stakeholders, voluminous data, and multiple interfaces. With data dispersed among various interfaces and disparate sources, Cairn faced a lack of data visibility and accuracy, which are crucial for decision-making. To implement its SWIM, Cairn relied on Bentley's AssetWise to establish a connected data environment. The single platform streamlined workflows and converted all processes to a digital format. The interoperability of AssetWise provided a digital solution that interfaced with Cairn's internal, web-based portal and integrated data from different sources within Cairn.

Working in a connected data environment facilitates real-time data accessibility, allowing users to visualize data from wells and run individual queries to produce specified results, including summary data aggregated through the business up to the top level of the asset structure. Bentley's asset

“Successful SWIM implementation has reduced the probability of personnel missing potential well integrity issues, thereby enabling a proactive approach toward integrity management to eliminate possible failures or rectifying them as soon as possible.”

– Utkarsh Vijayvargia, Senior Petroleum Engineer, Cairn

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Contact Bentley

1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

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performance and management application allows Cairn to implement SWIM throughout the lifecycle of its entire well stock by facilitating consistent and accurate data visibility required for well integrity management and production optimization. It also enables Cairn to analyze stimulation recipes relative to the established formations to determine and optimize the volume and types of chemicals needed. With a centralized view of real-time information easily accessible within the connected data environment, Cairn has standardized risk management and can monitor corrosion rates and chemical usage to drive well performance. Bentley's digital solution allows engineers to evaluate and manage flow assurance and well integrity from a single location, minimizing data inconsistencies and errors associated with manual processes.

Automated Monitoring and Management Processes

To optimize well performance and reduce well downtime, Cairn relies on continuous monitoring and management of all well data. Using AssetWise as the foundation for its SWIM system, Cairn automated well performance affecting parameters, safety critical parameters, and well-stimulation pre- and post-job data, enabling timely corrective actions and preventive maintenance to improve well integrity and stimulation operations. The company developed a well failure action matrix and alarm methodology using Bentley software, which automatically alerts personnel when well parameters exceed safe operating limits. This capability helps prevent potential spillage of well fluids.

Additionally, Cairn used AssetWise to automate cumulative cost performance charts that facilitate cost benefit analysis of individual stimulation treatments, resulting in abandoning ineffective treatments, improving well productivity, and increasing production from its wells at reduced costs. Bentley's flexible application provides Cairn with visibility on an automated, scheduled basis at the field and organizational level to assess stimulation effectiveness, corrosion data, asset reliability, and overall well performance. The software automatically converts raw data into analytical data for diagnostics and decision-making, which facilitates a proactive approach to operations and maintenance, prevents uncontrolled release of fluids and ensures optimal well production.

AssetWise Delivers Benefits

AssetWise provided the foundation for Cairn's effective SWIM system implementation leading to enhanced decision-making based on accurate data insights. "Successful SWIM implementation has reduced the probability of personnel missing potential well integrity issues, thereby enabling a proactive approach toward integrity management to eliminate possible failures or rectifying them as soon as possible," said Utkarsh Vijayvargia, senior petroleum engineer at Cairn. The AssetWise-based program displays live integrity

status of the entire Cairn well stock at any point in time. The application helped Cairn generate a comprehensive central database for all wells within a connected data environment that eliminates time spent searching for data from disparate sources, ensuring accurate, consistent data accessible to all stakeholders. Customized data entry forms accelerated entry of daily operational data into the system, while reusable templates streamlined creation of asset structure for quick well deployment.

AssetWise increased system visibility and enhanced data management, which effectively reduced associated costs and liabilities. Incorporating automated cumulative cost-performance plots allows Cairn to evaluate the cost benefit of individual stimulation treatments for cost-effective, optimal chemical management, enhancing well productivity and ensuring that ineffective treatments are abandoned. AssetWise monitors safe well parameters and stimulation jobs and utilizes a risk-based inspection approach that optimized preventive maintenance and corrective action, reducing unproductive well time by 10%. With a web-enabled, real-time system for lifecycle integrity and flow assurance management of the company's entire well stock, Cairn can also retain full asset failure and flow assurance histories to manage spare assets, ensure safety, maintain production plateaus, and provide insight for successful well operations in the future.

Digitalization Drives Industry Sustainability

Replacing traditional monitoring and management methods with digital models and automated workflows using AssetWise has helped Cairn optimize production across all its fields. The digital data for each physical asset within the SWIM system presents a real-time picture of well performance, facilitating a proactive approach to safety, reduced risk, and preventative maintenance. These technologies will provide valuable insight about asset performance, operation, and profitability that will enable Cairn to identify the problem before failure occurs, preventing downtime and enhancing predictability.

Cairn has successfully created a sustainable technology platform by integrating data from different systems to provide a single source of information for its wells. The organization plans to extend the advanced diagnostic features in AssetWise to predict potential failures and generate compliance reports providing clear visibility on status to reduce instances of overdue compliance. Leveraging the interoperability of AssetWise with digital monitoring devices and artificial intelligence, Cairn can apply predictive analytics and machine learning for early detection of issues to avoid asset failure. Cairn's success and continued commitment to data and process digitalization helped establish guidelines to automate and streamline asset management for optimal well performance and production, driving sustainability across the company, as well as the entire oil and gas industry.