WORLD PIPELINES®

Volume 18 Number 11 - November 2018

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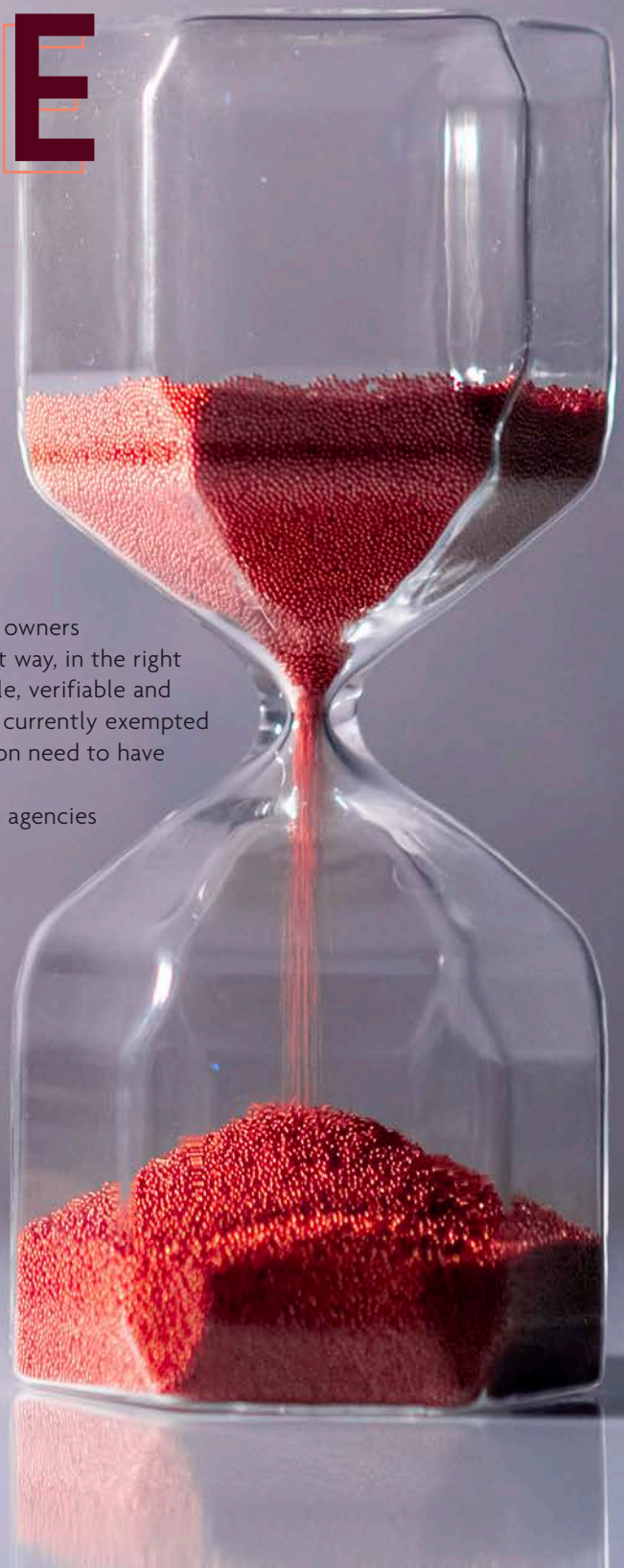
THE ONLY CONSTANT IS CHANGE

Steve Slusarenko, ProStar Geocorp Inc., USA, and Layne Tucker, EchoRFID LLC, USA, explain why RFID is a critical technology for the oil and gas industry.



The oil and gas business in the US is now aware of the proposed changes coming to the industry in the form of proposed legislation called the 'Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act' from the US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA).

The PIPES Act is intended to improve safety by ensuring that facility owners create records that show that the right materials were installed the right way, in the right place. Furthermore, the records that show this must be reliable, traceable, verifiable and complete. Notably, the onshore gathering and production lines that are currently exempted from reporting are potentially going to lose this exemption and may soon need to have processes in place to be compliant under the new legislation.

It is very likely that similar regulations will be adopted by regulatory agencies in other countries. While the main impetus behind the PIPES Act is the improvement of safety, the opportunities it provides to improve the financial bottom line should also be acknowledged.

The opportunity

Providing information to ensure compliance with regulatory agencies can do more than avoid civil and criminal charges: it can improve business operations as well.

By approaching this the right way, compliance with the regulations is ensured and costs reduced.

While the oil and gas business has been slow to embrace new technologies, it has seen many changes over the years. This is particularly evident in technologies now used in the field where a change was needed to solve a problem. Fracturing, directional drilling and 3D seismic surveys are examples where the need to change has resulted in substantial improvements in the industry.

Global positioning systems (GPS) and radio frequency identification (RFID) coupled to a cloud-enabled mobile software solution provide yet another use of technology to resolve business issues. This article addresses two key issues facing the industry today: ensuring compliance with newly proposed regulations regarding information about the source, use, and modification of materials used in pipelines; and preventing delays and interruptions caused by the lack of visibility or actual loss of tools, equipment and materials.

Figure 1. Field inventory can be created with RFID handheld or gate readers and audited using drones.

Figure 2. Registering the location when stringing pipe using RFID coupled to GPS.

Figure 3. RFID tag is captured in the weld log to ensure data integrity.

As the former US Secretary of Defense, Donald Rumsfeld, once said: "You get what you inspect, not what you expect." The key to effective inspection is provided by inspection staff using RFID technology coupled with a material management system.

For example, EchoRFID has designed a patented system to reduce the impact of lost, stolen or late materials by tracking their location using RFID and GPS transponders. This ensures that the material documentation for any material item is retained in the database and linked to the associated item via the RFID tag. Cost reductions and data integrity are achieved by creating electronic records to eliminate the use of paper and all additional costs and risk of loss of documentation associated with paper processes.

The research and development performed over the past 15 years by EchoRFID and ProStar Geocorp has resulted in the issuance of 18 patents and four pending patents that cover the collection, aggregation, management and display of data relating to pipeline and facility projects.

Tracking pipeline materials

As any seasoned project manager knows, all too often projects experience delays and additional costs due to late, incorrect or missing materials. Ensuring that the correct materials are available when they are required is a critical function that requires personnel, equipment and established processes to manage effectively. Using RFID and GPS technology, material tracking – including the management of the material documentation – is undertaken for the complete lifespan of the material. Optimally, one should start to employ the system as early in the process as possible, although it can be employed at any point in the process where it adds value.

The following outlines the process for tracking project materials including piping, valves, fittings and fabricated assemblies:

- When a customer places an order with the manufacturer, the manufacturer will record the details and create a production order for the material items. Each item manufactured will then be assigned a unique number and have a combination barcode/RFID tag attached. The heat number, item number (such as joint number in the case of pipe), PO number, grade, length and wall thickness will then be stencilled on the pipe and entered into the database, along with the RFID tag number. When the material is loaded at the manufacturer's plant, the RFID tags can be read and the load manifest created. An RFID gate reader can record each individual item in the load as it leaves the plant on the transport vehicle. Note that while barcode is a somewhat dated technology and easily damaged, it still has benefits – especially when the barcode/QR code that is readable with a smart phone is printed onto an RFID tag (such as those available from Omni-ID), so that an RFID reader is not always required.
- During shipment, each mode of transport can be tracked using a low cost GPS transponder, such as that

employed by Globalstar, which is used to send the current location of the shipment at pre-set intervals. At each plant, port or storage location, the RFID tags can be automatically read by a gate reader or by a person with a handheld reader when the load enters or leaves the facility. This allows each material item, especially any critical items, to be tracked during shipment to ensure that they can be expedited if necessary.

- At the coating plant, the RFID tags can be read upon entering the gate. The database is reviewed to determine the specified coating type, and then updated once each joint is coated. Once the pipe is inspected, it is ready to ship to the customer. Again, when loading out the pipe the RFID tag can be used to create the load manifest and record when each joint is shipped from the plant.

- When the shipment arrives at the customer warehouse or laydown yard, as it is being inspected an electronic pipe tally can be created in the Pipetalker™ mobile application. The pipe tally is automatically populated with the pipe attributes that are in the database file provided by the supplier, so the inspector need only make a note of any damage to a joint in the pipe tally. This same information can be used to generate a goods receipt document to confirm that the material was received in good order and allow the supplier to be paid. Similarly, for valves, fittings and fabricated assemblies, a materials receiving report can be automatically created to generate a field inventory so that their current location is known.

- As each pipe joint, valve or fabricated assembly leaves the laydown yard to be installed, the inventory is decremented and the location of the material item can be recorded in the mobile device when it is strung in the field.

- For all projects, valves, appurtenances and pre-fabricated items such as pipe spools, the same process can be followed to show precisely where they are located in the laydown area. This would be a major benefit for large facility projects such as LNG plants or refineries, where there may be upwards of 20 000 pipe spools and finding their location to co-ordinate deliveries for installation could be an issue. Performing a search in the Pipetalker application will find the item in the search report. Additionally, when the user selects 'MapIt', the exact location of the item is shown on the map so that it can be picked up. By implementing the Pipetalker system, an international EPC firm that had identified the cost of finding lost spools at over €460 000 per project estimated that they could eliminate this cost entirely.

- For each material item, any value add activities such as bending, welding, coating or as-builting are recorded in an electronic report and linked to the material. Electronic forms are used to not only capture new information, but to auto-populate subsequent forms with data that have already been captured to eliminate manual entry and the consequent opportunity for duplication and/or errors. Electronic forms have the added benefit of being shared in real-time and are immediately available for quality assurance checks to ensure that they are being completed correctly. The majority of the location-based information is provided in the inspector's electronic reports. This can reduce the load on the survey crew and ensure that they are able to keep the as-builting up to speed and prevent delay claims from the contractor – such as those caused by waiting on the as-built survey crew so that the ditch can be backfilled.

- During construction, the precise location and orientation of existing pipelines and any crossings can be registered in the system and compared to historical

Figure 4. Confirming the data prior to backfilling by reading the RFID tag.

Figure 5. GPS, RFID and GIS provide precise material locations.

data to ensure that the records are accurate. This alone can substantially reduce liabilities by ensuring that the geographic information system (GIS) records are accurate and complete.

- Opportunities also exist for tracking and tracing critical equipment, specialty tools and personnel using RFID. To improve safety, some jobs now use RFID tags on employees to ensure that everyone has been accounted for in a muster area during an emergency. In some offshore jobs, virtually all assets are tracked with RFID.
- At the end of construction, any materials that are excess to the project can be returned to inventory as spares, returned for use on another project or for disposition. In all cases, the RFID tag that is attached to the pipe will provide a link to the electronic material records, thereby meeting the regulatory requirement to ensure that the material has reliable, traceable, verifiable and complete documentation so that the material is fit for use and retains its value.

Tracking tubular goods

Certain elements of the process to track pipeline materials can be used to manage drill pipe, casing and tubing commonly known in the industry as oil country tubular goods (OCTG). Similar to piping materials, tubular goods can be tracked from their original supplier, to the warehouse and to the well site. During or at the end of the job, any tubular goods that leave the site can be recorded by a gate reader to ensure that the materials are properly tracked. The added benefit of using RFID on tubulars is that any items that are reused can also have their usage recorded. If, for example, an RFID reader is installed on the rig floor, the number of trips and downhole time for each joint of drill pipe can be tracked. In addition, at the end of the well project, the condition of each joint of drill pipe can be recorded and then sent either physically or electronically back to inventory so that the quantity, location and condition of tubulars is known at all times. This allows improved inventory management and co-ordination of logistics.

The benefits

The best outcomes are achieved when everyone wins. When the owner is able to easily demonstrate the availability, completeness, accuracy and provenance of its records, auditors will appreciate the clarity and accuracy of the records and shareholders will see increased profits.

In a white paper from Lloyd's Register, Chris Wilber relates how copies of all data and records verifying compliance "should be required by every lending institution, board of directors and insurer."[1] A relatively small investment up front in a proper material management system may be returned tenfold over the life of the asset. Additionally, the resulting good record-keeping may increase the value of the company by 10% or more because of the reduced liability associated with incomplete or inaccurate records.

For the owner, the ability to have access to location-based information will benefit designers, engineers, expediters, project managers and construction and maintenance personnel. As more precise data is collected in the field, older GIS records can be updated, providing better records for design work.

For project managers and material co-ordinators, access to material status and locations will provide them with the ability to ensure that there are no late or missing materials, thereby reducing or eliminating material related delay claims. For construction crews, the use of electronic forms will: eliminate the use of paper forms; end the need for duplicate entry; and substantially reduce the cost and time to capture project information. For maintenance personnel, better records and improved access will provide safer operations and ensure that they have all of the information that they need to efficiently perform their work.

With RFID tags on critical items, such as valves, the tag can provide a link to ensure that the correct maintenance manuals, operating procedures, parts books and maintenance orders are accessed by the user when working on that item.

Conclusion

Oil and gas companies understand the value of tracking and managing materials, personnel and equipment, especially in environments such as offshore work where logistics provide major challenges and mistakes can be very costly. RFID ensures that operators are able to track and manage the resources at their disposal and receive what they expect. EchoRFID is currently working on incorporating elements of the Pipeline Open Data Standard (PODS) model into the available user memory on Generation 2 RFID tags. The use of the PODS ensures seamless data exchange is supported when sharing information with other parties.

Within the last decade, the industry has seen regulatory agencies levy fines of hundreds of millions of dollars or more against oil and gas companies for compliance violations. With today's technology and its ability to support the creation, management, storage and recovery of records to prove compliance, there is no excuse for poor record-keeping.

Companies that continue with paper-based manual processes are taking on undue risk from potential government indictments for non-compliance or even negligence. For those that embrace change and use it to their advantage, the net result is that the operational cost savings and increased asset valuation can be many times greater than the cost of the system. Even without factoring in the reduced exposure to liabilities, the benefits of employing an integrated electronic data collection and management system can transform businesses by ensuring safety, integrity and improved profitability. WP

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