

Steve Slusarenko (ProStar Geocorp Inc, Canada, Steve Soychak (SJKS Ventures, USA) and Layne Tucker (EchoRFID, USA) outline how RFID technology contributes to pipeline safety, regulatory compliance and the bottom line.

Reporting on the RFID SOLUTION

Today we are all very much aware of the increased visibility of the oil and gas industry in the news. Via printed media, television and the internet, the press reports every incident, making the public acutely aware of every negative event. As a result, the public has become very vocal and more involved in the regulatory approval process. More than ever, companies are reacting to this by dedicating more time and energy to regaining public trust. This heightened awareness, brought on by the pervasiveness of press reports and increased public scrutiny, has seen public relations departments working overtime to produce advertisements that promote the benefits that are brought about by the industry and to remind people of the safety record that the industry has and constantly strives to improve.

Public perception is not the only thing that keeps CEOs and directors awake at night. It is not just bad press that comes from an oil leak or gas explosion – it is the fear that the next incident may be a major catastrophic event that the public remembers for years. While public relations can help with mitigation after an event, as the old saying goes, ‘an ounce of prevention is worth a pound of cure’. This is where regulations and adherence to those regulations will



come into play to ensure that everyone, including the CEO, directors and public relations personnel can sleep peacefully. Providing information to ensure that risk events are prevented is where radio frequency identification (RFID) technology can really help.

What is RFID?

RFID is a wireless technology that transmits a unique identification number, using radio waves from a chip in an RFID tag, to a reader that uses this identifier to access the information stored on the chip, in a computer database or, in some cases, both. RFID is intended to reduce data entry time and improve data accuracy by removing the need for manual entry. Unlike barcode technology, there is no need for line of sight to read it; proximity requirements can range to 20 ft or more and the RFID reader can read many tags at once. This substantially reduces time to record multiple objects and eliminates the opportunity to accidentally miss one.

The unique identifier in the tag provides a key to allow access to specifications, maintenance records, installation information and the location (track and trace) history of the object that the tag is assigned to. Because the information is bound to the physical asset by the RFID tag, there are no concerns about associating the wrong records to the asset. Data held in the RFID tag could be used to auto-populate certain fields in forms and inspection reports to eliminate the chance of errors that are introduced by manual data entry. This is especially true in process workflows, where data captured in one form is required to populate data into subsequent forms and record value add activities.

Just as barcodes brought benefits to the retail and manufacturing industries 30 years ago, RFID provides real benefits to industry now. The technology used is constantly improving, with early adopters seeing major benefits that have lowered their costs greatly. For example, large automobile manufacturers have made major process improvements throughout their supply chains by utilising RFID. Moreover, they are continuing to embrace the technology further.

The oil and gas industry can also derive major benefits by using RFID, in much the same way as an automaker. We must ensure that we have the right parts, at the right time, in the right place. This is where RFID adds tremendous value. RFID can be used in every step of an asset's lifecycle, from its manufacture, through shipping, receipt, installation, maintenance, repair and ultimately its retirement and disposal. How EchoRFID is leveraging RFID technology to add value wherever possible in certain business event process chains is what this article focuses on.

The oil and gas pipeline industry – current state

Oil and gas pipeline companies have been established for over 150 years, with over 3.5 million km (2.2 million miles) of installed pipelines worldwide today. Considering that a good deal of this pipeline infrastructure has been in place for over 60 years, one can see that it is important to know what is in the ground, exactly where it is located, what conditions it operates under and what the current state of

repair is. To achieve and maintain this, understanding is a major undertaking. Prior to the information age, all records (if they existed) were paper-based and were easily lost or destroyed, or the source documents were lost. What is left of these are artifacts that cannot be proven to be accurate. Recent fines levied for poor record-keeping have been in the tens and even hundreds of millions of dollars. The Department of Transportation, through PHMSA, has issued a Notice of Proposed Rulemaking (NPRM) relating to revising pipeline safety regulations. This revision covers substantial changes to integrity management requirements and how pipeline data is collected, validated and integrated into the integrity management programme.

How does RFID technology help asset owners?

Many of the major energy companies and service providers have been utilising RFID technology to help manage the logistics for asset management, safety and personnel monitoring for offshore operations in the Gulf of Mexico and the North Sea.

The anticipated increased activity in both oil and gas producing basins when demand for hydrocarbons picks up will result in huge capital expenditures for tangible assets. RFID will be a great way to track assets in these expanding basins to help reduce theft, increase safety and manage tangible goods more efficiently, while also saving a tremendous amount of money. Experience has shown a tremendous amount of waste can occur during boom times. Incorporating RFID into the asset management process could prevent losses by materially improving visibility and management of asset data. RFID has the potential to expand to other areas in these operations in order to help manage frack water disposal and the movement of attendant pumps and lines.

Considering the linear asset construction process and the underlying process requirements driving it, one can reflect on the improvements that are attainable by leveraging RFID. The RFID icons in Figure 1 show where a tag is applied (blue icon) and activities that read/write information to the tag (red icon).



Figure 1. RFID tags.

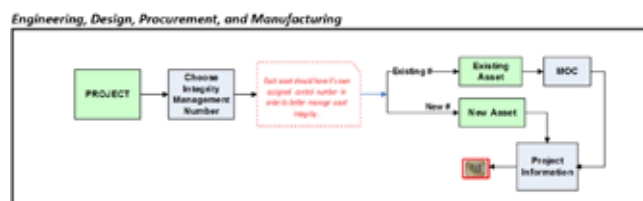


Figure 2. Project information including project, drawing number, specifications and tag number, is specified in the purchase order line item for inclusion in the material RFID tag upon manufacture.

RFID's ability to capture and record electronic information will ensure that when a material item is manufactured, the references to the project engineering drawings and specifications are captured in the material RFID tag. This same tag could contain links to information relating to the material test report (MTR), maintenance manuals, etc. When the item is a valve, for instance, the tag ID on the drawing can be entered into the RFID tag to ensure that the valve is uniquely identified to the location shown on the drawing. When the material item is loaded for shipment, an RFID reader at the loading dock can confirm that the item is shipped. Writing to the RFID tag will ensure that the materials are dedicated to the right project at the first available point of control, the plant floor.

When the material is received, RFID readers can register the load and confirm the contents as the truck or rail car arrives onsite. This same material receipt could create a materials receipt document such as a pipe tally. As each item is unloaded, an inspector will look for damage, confirm the condition of each joint and update the pipe tally with any comments required.

As part of the set-up for the project, standard forms can be used to push information that is captured in the database for the first time. RFID can help to populate subsequent forms with this data. By passing data from the source and making it read only on subsequent forms, the provenance of the data is maintained.

To further enhance the quality of the data available at this point, EchoRFID has selected Vintri Technologies, a leader in data integrity and material traceability through the supply

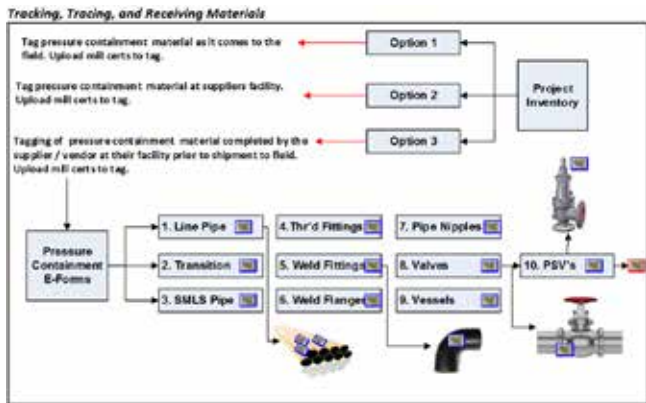


Figure 3. Writing and placing tags on material items – option 3 – is preferred.

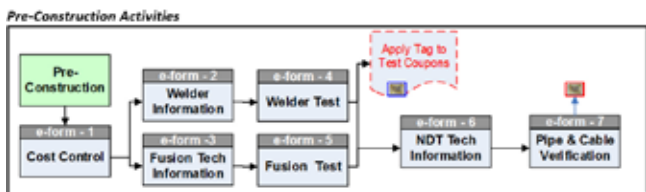


Figure 4. Pre-construction activities where read/write using RFID will help to ensure data integrity.

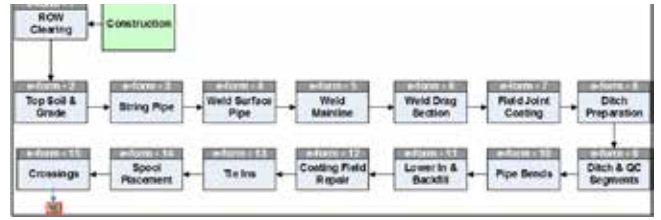


Figure 5. Inspection of construction activities can automatically read and populate information from the RFID tags, reducing the effort for inspection staff and the opportunity for error.

chain. This new partnership with Vintri will allow EchoRFID to introduce RFID in order to enhance its data management solution further. Together, the organisations are aligned to offer a complete cradle-to-grave electronic traceability solution for the oil and gas industry, with verified data.

Inspections to ensure that work conforms to the engineering and design specifications and that the job is properly documented are critical elements of any project. The use of RFID will provide the opportunity to have the data validated in real time so that there are no inconsistencies. For example, if a radiography report is associated with the weld through RFID, there is no opportunity for an NDT tech to transpose a weld number or reuse a number that has already been recorded because each electronic entry can be validated by the system in real time. Each feature with a RFID tag can contain information that provides a link to the relevant reports and ensure the history of each value added activity is maintained. Hot bends can be tracked from receipt to final installation to ensure that they are in the correct location. Bore pipe, heavy wall pipe, casings, valves, etc. can all be verified and have installation records linked to each feature using a RFID tag. Imagine every feature on this newly constructed facility with a RFID tag that contains all of the basic data, including exactly what the feature is, who installed it, when it was installed and where it is geospatially to within a few inches. The use of RFID will ensure that the entire history of the feature and that the provenance of the information is maintained. The RFID tag provides a unique identifier which is used as a reference to access the back-end database where voluminous information in the form of certificates, reports, manuals and history making all of these available to the person needing the information.

Post-construction activities are rife with opportunities for businesses to benefit from the use of RFID. Not only are there obvious uses, such as recording the link from the pigging report to the receiving barrel, or the position and photos of the installed signage to the final right-of-way (ROW) clean-up and punch list report. There are also other uses that will make project management much easier. Surplus materials can be automatically captured as they leave the site and can be returned back to the warehouse or disposed of through a sale as surplus materials. Of special note here is that surplus materials without their attendant MTRs are of little value. But, if they have their documentation retained via RFID, they are very saleable.

Operations and maintenance history

When facilities are commissioned and turned over to operations, RFID provides some major opportunities. Imagine walking up to a valve and by reviewing the information in the RFID tag, you have access to the entire history of that valve, from the date of manufacture at the factory to present day, while also being able to access the maintenance history, parts diagrams and maintenance manuals in real time, on your tablet.

Management of personnel, tools, material and equipment

The use of RFID in personnel, asset, material and equipment management are other areas with exciting possibilities. One potential use of RFID that is being considered is the ability to produce a compliance report relating to pipeline ROW signs at road crossing locations, by placing a reader in a vehicle that drives a prescribed route each year. As each sign is driven past, the RFID reader collects the data and automatically triggers a photograph of each. If you had 65 000 signs to report on, this would prove to be an onerous task if done manually.

Personnel

Imagine a worker arriving on the jobsite and a RFID tag on his badge logs him in for the day in real time upon entering. Particularly in a plant environment, if there was a safety incident, you would be able to see how many people were checked in, how many checked out and how many are at each of the muster stations. Therefore, you can be made aware of anyone that was unaccounted for, may be at risk and, potentially, where they were last located inside the plant.

Tools, supplies and materials

Imagine this worker is going to a tool-shack and picking up a torque wrench. The tool is automatically checked out under his name when he leaves and automatically checked in when it is returned. The worker goes to the warehouse and is issued materials and supplies to be used for the job. A goods issue is automatically generated when they leave the warehouse that charges the materials to the appropriate work order or project. If the items are brought back, the job is automatically credited for the materials. If the work order relates to work where the materials are specifically for sour gas service, when he goes past the scanner, a real time warning can be issued to say that one or more of the items that he has is not suitable for the work identified in the work order. Subsequent inspection in the QA/QC process would also pick this up if the RFID tag identified the valve as sweet gas service. However, checking the RFID tag at the time of goods issue prevents what may be a costly delay. One only needs to identify the requirement and build the business rules into the software application.

Equipment

Managing equipment is a full-time job in itself. Here is one area where RFID can be used effectively. Imagine knowing not only the usage and maintenance history of all mobile equipment, but also knowing where that equipment is in the plant, on the job site, or whether it is on the premises

at all. By placing RFID readers at strategic locations, you can determine the general location of your equipment in real time. For equipment-intensive operations, knowing whether your equipment is in your yard, shop, in transit or on a particular jobsite would bring major value to an equipment manager, especially when mobilising and demobilising equipment on multiple jobs. While heavy equipment may have GPS for this, specialty tools and smaller equipment are not viable for GPS installation. RFID provides a cost effective solution to tracking and tracing mobile equipment.

Materials

We are all likely to have stories of materials that were surplus to a job and either forgotten about or the required documentation was lost or misplaced. RFID can be used to ensure that the MTRs and other documentation is available for high value items. Therefore, if they are surplus to the job, on disposal, they are properly credited to the project and their full value is realised. RFID brings value in other areas, such as commodity items. For example, RFID can be used to register tubulars as they come onsite, how many trips they made downhole and if they have left the site, are in use or stored onsite.

Integrity and risk management

However you look at it, we use systems to optimise the value of assets to investors. We optimise productivity to ensure that we move product from the ground, to the consumer as efficiently as possible. We manage maintenance to ensure that we reduce downtime, which will impact operations. We manage risk by ensuring that our assets are not damaged by external forces. To achieve this holistic view of all aspects of operations, we need to capture data and provide it to those who need it, when and how they want it, so that they can make informed decisions. Given the systems that are available today, which provide us with unprecedented access to information, we must use them to our best advantage. The use of RFID in risk management and damage prevention will become an integral part of the evaluation of risk, particularly because it relates to how accurate and complete your records are. We can all give examples of where poor record keeping has resulted in incidents, some causing loss of lives, millions of dollars in damages and tens or hundreds of millions of dollars in fines. Companies looking at acquisitions as part of their due diligence will look at the integrity of the records, placing a value on them. The value of a company that is being acquired may have a 10 - 20% premium if it has excellent records. Conversely, not being able to produce records on request may result in a healthy discount due to the risks and costs associated with taking on these assets.

The regulatory construct

Regulators have legislation in place to provide the basic framework for governing oil and gas and utility operations. They continually provide opportunities for the public to intervene and demand that their safety and environmental needs are met. We have recently seen the impact of some major incidents, which have caused the public to take far

more notice of pipeline operations. Loss of goodwill, caused by these incidents, has been substantial and the public is demanding that regulators respond by creating legislation and enacting laws to make the standards of care relating to operations and record-keeping mandatory. This will have an immediate and profound effect on oil and gas operators and we need to be ready to embrace new technology such as RFID to ensure that those standards can be met.

Current RFID partners and research

EchoRFID is working with several technology firms and research organisations to consistently improve the system that is currently in place.

- Layne Tucker, CEO of EchoRFID, is working with the University of Denver and Michigan State University where research, funded by the DOT through PHMSA, is being performed to expand the capabilities of RFID and support an intelligent RFID-based pipeline management system. This research initiative is looking at long range (greater than 5 ft underground) interrogation of buried RFID tags and embedding these tags into plastic pipe during manufacture.
- Omni-ID is providing RFID tags to allow Echo RFID to determine the optimal configuration for the harsh conditions found in the oil and gas industry.
- ecom is providing the Ident-Ex® 01 RFID reader and its Tab-Ex® 01 tablets to provide an intrinsically safe solution.
- EchoRFID is using ProStar Geocorp's Transparent Earth geospatial intelligence SaaS solution to provide the

backend to the EchoRFID Pipetalker application and ensure that the data is shared using Open Geospatial Consortium (OGC) compliant formats and Pipeline Open Data Standards (PODS) data models.

- BlueStar GPS provides a real time sub-metre GPS to record the installed location of the tagged feature.
- Tucker is also working with Monument Oil Technologies in Grand Junction (Colorado) to incorporate their fibre optic continuous leak, corrosion detection and ROW encroachment pipeline monitoring system, which sends alerts on impact events, seismic activity and small leaks to the Pipetalker solution within three seconds.
- Vintri Technologies is providing their data audit solution to standardise and verify electronic data at the manufacturing plant/supplier level.

Conclusion

Advances in RFID and mobile technology have presented to the oil and gas industry a new set of tools to provide improved data management and access to critical information. The ability to share this information with internal personnel and external stakeholders in real time helps to ensure safe operations and regulatory compliance. The reduction of manual data entry and the ability to review data that is entered in real time makes the information more timely, accurate, reliable and trustworthy. The adoption of RFID has already provided major benefits to oil and gas companies. Further adoption will continue to improve safety, ensure compliance and add significant value to the bottom line... 