place. Though the operator would prefer not to utilise another party as a resource, in most cases they will eventually rely on the contractors to provide the missing pieces of their operation, a decision that invariably leads to mistakes and shortcomings. Weak project management that relies on the 'checkmark in the box' and hiring untold numbers of employees to fill a quota is very apparent to seasoned experts. These tell-tale signs become very apparent when a root cause failure analysis of pipeline incident is performed.

The supply of data and information needed to ensure integrity and compliance must be verified and thus allow an operator to know they have done all that is needed to continue operating safely, efficiently, and effectively. Though there is always a desire to cut costs, blindly relying on a system of 'checkmarks in the box' can invariably lead to disaster.

Procurement of pipe

Beginning with procurement, the pipe that is procured must satisfy project design and needs, which must be confirmed as well as verified repeatedly. Senior procurement personnel with a thorough working comprehension of project specifications, the ability to anticipate conformance vulnerabilities, and the know-how to create contractual provisions and utilise inspectors to prevent those vulnerabilities from being realised are must haves. Simply throwing a team together to travel halfway around the world to perform a preproduction meeting in a third-world nation to be able to put a 'checkmark in the box' indicating that the task is completed is not the answer.

When [illegible] million of pipe is procured, a coherent and focused team should be mobilised for the preproduction meeting. It is preferable that the members of the team be industry veterans who have actually been to a mill before and who understand the complexities of the project. Bringing in warm bodies who have little knowledge of the subject just so that they can put a 'checkmark in the box' is insufficient and irresponsible. A QC Coordinator from a refinery, for example, a QA representative with no background in pipelines, or a QA/QC specialist operating in an entirely different field, are not ideal candidates to be part of a cohesive, integrated team. Alternatively, a seasoned materials engineering team (with at least two members) that is prepared to scrutinise the inspection test plan and hire a 24/7 surveillance team to monitor each step of the mill production, which should include load-out inspection, is preferable.

The long-term success of a pipeline project begins with ensuring successful receipt of the expected pipe. As Donald Rumsfeld once said: "You get what you inspect, not what you expect."

In the past few years, untold miles of defective 'new' pipe anomalies have been identified in the US Pipeline and Hazardous Materials Safety Administration (PHMSA), a part of the US Department of Transportation.[1]

It is almost unbelievable how so much substandard pipe was procured, shipped, delivered and installed before it was identified as substandard. The claim that this issue is related to the placement of a 'check mark in the box' would not be unfounded.

Aerial surveillance

The pipeline operator cannot rely on an aerial surveillance company to put a 'check mark in the box'. An aerial surveillance company has no true understanding of a particular pipeline company has no true understanding of a particular pipeline operation and maintenance history or the technology the operator is using; this lack of comprehension will generally result in false and inaccurate interpretation of readings, which could set the stage for potentially catastrophic events.

Experience with pipeline operators indicates that they are, for the most part, overwhelmed with confusing and inaccurate reports. These reports are the result of contractors lacking sufficient pipeline engineering experience and knowledge of the industry to properly interpret findings. This, combined with rapidly advancing technologies and multiple service companies, has only increased overhead and frustration for the operators.

Subsequently, the risk of ineffectively managing the safety of a pipeline and protection of the adjacent environment will certainly be a challenge to explain, as even a single incident could potentially expose the operator to significant and expensive litigation in the future. Recent and highly publicised fines and settlement awards have proven that the cost of safety is cheaper than the alternatives. A company trying to cut costs with a 'check mark in the box' will quickly realise that taking such shortcuts can end up being very expensive.

In the summer of 20[illegible], Engineering Services LP, in co-operation with Helicopter Services Inc. located in Houston, Texas, put together a research team to investigate the issue. More recently, the company performed extensive field tests and studies of various gas release and monitoring methods. The methods tested were designed to simply detect methane gas leaks on gas transmission pipelines using aerial surveillance and various examples of gas detection equipment.

What was found was startling; it was another 'check mark in the box'. There was so much of this equipment that did not even come close to performing the job for which it was designed; it was hard to imagine how the equipment was ever incorporated into an inspection/surveillance programme by major pipeline companies.

In some cases, the equipment provided erroneous results outside of the stated capabilities of the instruments and apparatus used. Furthermore, the equipment's limitations have resulted in helicopter flight operations being compromised as the contractor tries to overcome these limitations. The helicopter pilot understood the helicopter, and the service technician operating the detection equipment understood his equipment; unfortunately, neither fully understood the needs or abilities of the other, resulting in lost time and wasted resources.

The results revealed a very serious risk to every pipeline operator when they rely on personnel and equipment that do not even marginally perform the job that they claim. This time a 'check mark in the box' may put someone in jail when they try to justify an inspection programme that just flat does not work.

Incidents certainly do not have to occur; indeed, pipeline operators pay a great deal of money to ensure the pipeline's integrity. As in this case, the operator thought he had done so through a leak survey, but another 'check mark in the box' meant that it was a job not well done.

Conclusion

Before the incident occurred, the pipeline operator seemed confident in the work done and the data collected. It all seemed very impressive (the recommendations even seemed somewhat conservative), but, after all, there was a lot of data; as such, the operator's confidence continued to grow when the recommendations of the contractor were followed with good results. All seemed right in the world of pipeline operations – up until the incident occurred. But there was a 'check mark in the box'.

Figure 4. Verifying installation and operation of pipeline inspection equipment, immediately prior to take-off.

Figure 5. Preproduction meeting /ITP at pipe mill in Italy.

References

1. PHMSA reports on substandard pipe in the US can be found at: http://phmsa.dot.gov/pipeline.

Choosing the linear method

Lorne Duncan, Linear Project Americas, Canada, explores linear planning methodology and presents a tool that has great value in the planning and execution of pipeline projects.

Planning a pipeline pro□ect is ne□er an easy process. □ight of way □□□□ □selection□ land ac□uisition□en□ironmental constraints□ crossings□access to the □□□ and seasonal considerations all come into play when trying to optimise the construction e□ecution plan and strategy. □he traditional approach has been to incorporate all this into a critical path methodology □CPM□planning tool□such as Prima□era™□or M□Pro□ect™□in order to de□elop a □antt chart representation of the e□ecution se□uence of the pro□ect and then progress against this plan. □nfortunately□these typical planning tools do not gi□e a pro□ect team any indication of where or what the ma□or challenges are and when the wor□was completed in a specific area. □ften□it is left to the Construction Manager to □eep trac□of completed sections by mar□ing alignment sheets.

Traditional Gantt based tools cannot describe issues that can occur and potentially lead to claims. The majority of stakeholders have very little comprehension of the nuances of a lengthy and expansive Gantt chart representation. As a result, TILOS can be used as an effective collaborative planning tool to visually represent all the HSE and stakeholder concerns that are typical of a pipeline project.

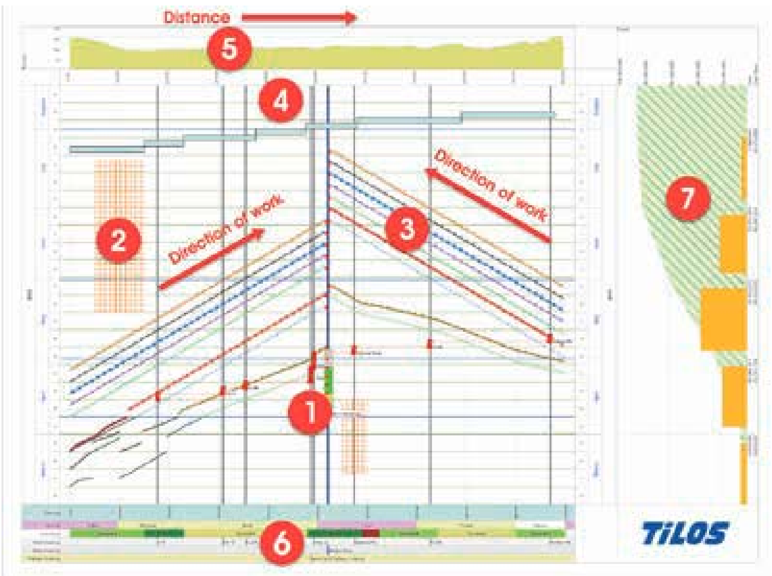

Figure 1. Sample pipeline plan.

Figure 2. TILOS Gantt chart representation of sample pipeline project.

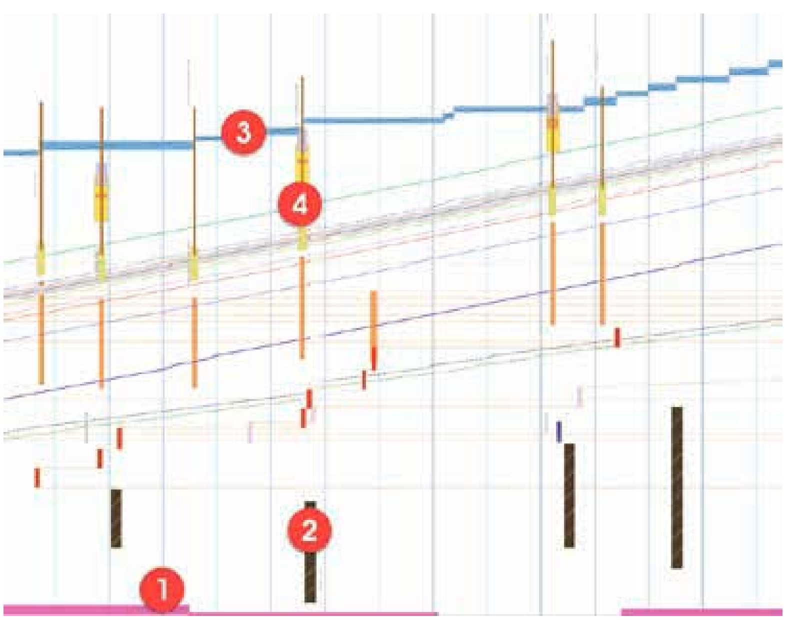

Figure 3. Example TILOS pipeline project showing key elements.

Linear planning made easy

The inherent advantage enabled by linear planning is the ability to incorporate as much or as little detail as required. TILOS is a layer based system that allows a user to finely control what is shown by only displaying specific layers, certain activities (such as welding) via the building of a filter, or by changing the time and distance dimensions to show multiple years, a single spread or all the spreads of a pipeline project.

Figure 1 is a simple representation of a pipeline project that shows some of the fundamental features available to the user. All stakeholders, regardless of planning experience, can visually see how key construction challenges impact the construction execution plan.

First of all, a major river crossing (horizontal directional drill (HDD)) is located about the middle of the view (1). Access to the HDD, combined with the major crossing, has resulted in the work starting at either end of the spread and working towards the river, as indicated by the arrows. The two environmental restrictions are indicated by the orange rectangular shapes (2) and it is evident that none of the planned work encroaches on these restricted areas. All mainline crews are represented by a series of lines (3) on either side of the river crossing. The planning methodology lends itself to a leaner schedule because, while each crew can be represented by several segments (due to skips, reverse lays, HDD access), this is considered to be a single activity. A CPM approach would see each segment as a different activity, which inflates the number of activities in the plan.

Other features of the execution plan that are displayed in the view include the hydro test plan, represented by a series of blue rectangles (4), and the DEM elevation that was imported from LiDAR data (Excel file provided by the survey company) (5). Foreign crossings, road bores, and other crossings (typically those that do not involve an HDD) are usually added to the distance scale (6) as a point of reference, but not included directly in the time distance chart.

If the activities are resource and cost loaded, then it is very easy to develop a spend profile (7), a manpower curve (to calculate camp requirements) or other time related curves and histograms.

In parallel to the creation of the time distance view, the software is also creating a Gantt chart representation of the execution plan (Figure 2). Stakeholders can easily switch between any number of views depending on their requirements.

The following example represents one spread of a multi-spread project. As with the previous

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HFW LINE PIPE

SPECIFICATIONS

Diameter	8 5/8" – 20"
Length	28' to 80'
Wall Thickness	4mm to 14mm (0.157" to 0.551")

COATING	Fusion bond epoxy and abrasion resistant overcoat
GRADES	API 5L (Grade B up to X80), API 5CT (Grade H40, J55 & K55), CSA Z245.1, ASTM, ISO, DNV(OS F101) Specific International / National Standards and Specifications

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