It is important that a comprehensive overall crack management programme is in place to support validation of each ILI run. Emerging non-traditional (NT) in-line inspection (ILI) technologies are providing new solutions for pipeline operators to inspect and gather critical-asset data at pipeline locations not previously accessible by internal inspection tools. These methods and tools have proven useful to complete integrity management inspections at targeted locations, and for identifying and pinpointing internal pipeline features in support of in-situ hydrostatic tests and asset-knowledge requirements. Successful NT ILI projects require a detailed understanding of the unique project constraints, the selection of the appropriate execution method and NT ILI tool, and meticulous planning and coordination.
PIGGING

Use of aerial imagery is employed to identify potential entry points for tool insertion and other excavations required for project execution. Multiple locations, preferably both upstream and downstream from the target area, should be identified, taking account of the ability to safely execute the project, and the lead time necessary to secure approvals for the access point through land negotiations, permitting, and agreements required to meet the project deadline. Consideration should be given to the impacts on local residents, construction logistics, traffic control, workspace constraints, gas blow-down, and other construction noise related to the activities at each site.

Pipeline geometry must be evaluated for diameter, wall thickness, inspection length, bends, and internal features that will affect the viability of various NT ILI execution methods and tools. This information must be considered in relation to the target inspection area in addition to the identified tool insertion point(s).

Pipeline and system conditions must be evaluated and take into account the feasibility and requirements to perform a pipeline shutdown. In addition, an evaluation is performed to determine the potential for liquid and debris in the pipeline that have the potential to affect the performance of the NT ILI tools.

Based on evaluation of the data gathered, potentially viable NT ILI methods can be identified, and the appropriate vendors contacted to confirm the project’s feasibility and the tool availability for the scheduled project window.

Execution methods

There are multiple methods of conducting NT ILI projects, with no single method being suitable for every project scenario. Each of the NDE technologies has specific considerations that must be taken into account when deploying them. Types of NDE sensors deployed or considered for the projects which serve as the basis for this report include MFL, EMAT, eddy current, laser deflection, and ultrasonic. In addition, high-resolution cameras have been used effectively to pinpoint pipeline features in combination with the ability of tools to record the distance travelled to the feature location. There are multiple delivery platforms available that deploy the tools through the pipeline, including tethered robotic, untethered robotic, tethered MFL (tethered pig), and the use of traditional free-swimming tools deployed at targeted locations. All methods have unique requirements that must be considered during project planning. Tools launched from a single entry point may be deployed in both directions in order to maximise inspection coverage and avoid the capability of the tools to traverse the pipeline segment.

Untethered robotic tools can also be launched from a single entry point, and can be deployed in a pressurised pipeline through a pressure-controlled fitting (PCF), or in a depressurised pipeline through a cut-out. These tools use on-board batteries for power, and antennas for tool communication and data transmission. Tethered MFL tools, also referred to as tethered pigs, can be used in either a bi-directional or uni-directional manner. In a bi-directional operation, the tool is launched and retrieved from a single entry point via a cut-out, propelled away from the launch point with compressed air, and then pulled back via its tether and a winch. In a uni-directional operation, the tool is pulled between two cut-outs. The feasibility of these types of projects is generally dictated by bend radius, bend degree, and total bend quantity within the project scope.

In some cases, using traditional free-swimming ILI tools deployed via a temporary launcher and receiver installed in the field to inspect targeted locations offers the most viable option. This method is more resource-intensive than methods that use a single entry point; however, the method may offer greater schedule flexibility given the larger number of vendors and tools available than with robotic tools, in particular in the smaller diameters (6-8 inches). Advances are being made by robotic vendors to improve the capabilities of robotic tools within this range.

Project planning and coordination

Given the complexity of conducting NT ILI projects, meticulous planning, coordination, and communication is required to ensure project success. A comprehensive project team will include project management, ILI engineering, design engineering, construction (excavation, welding, ILI vendor support), permitting, land/environmental, gas system planning, gas outage planning and customer and governmental relations, and discussions with the other stakeholders identified in the project plan.

Detailed site planning, including a site walk, is essential to confirm the assumptions made during the initial project scoping in order to identify excavation and workspace locations, and outline permitting requirements for each site. Planning for each location must consider what activities are required during the various phases of the project’s execution.

In addition to establishing a schedule, a detailed task list is important to capture all the critical project details, assign roles and responsibilities, and drive key tasks to ensure the project schedule is met. With multiple support groups involved and advanced NT ILI technologies mobilised to the project site from across the country or internationally, ensuring that all the details are meticulously planned, and the necessary tasks completed, is of paramount importance to a successful project execution.

Project risks should be identified and contingency plans established during the planning phase. Common risks such as emergency tool extraction, an incomplete inspection, or discovering an unexpected condition requiring a rapid repair response, must be built in to the project plan. Contingencies are developed for each scenario, agreed upon by the team, and communicated to stakeholders in advance in case a contingency condition is encountered.

Project execution

A detailed project plan is essential to ensure clear understanding among the execution team, given that it is composed of multiple groups. The project plan includes the project description and summary schedule of key milestones, a team roster with roles and contact information, the contingency plan, and a detailed sequence of operations. The sequence of operations covers daily site activities, details of individual tasks, details of responsible personnel, arrival times, identification of what equipment and materials are to be supplied and by whom, as well as key safety details.

Key project team members, including the ILI engineer and the project manager, should be scheduled to be on site in the event changes to the project plan are necessary based on site conditions, and in order to ensure that any of the changes that are made take account of the overarching project goals and project requirements.

Conclusions and outlook for future use

NT ILI has proven to be a valuable tool in completing inspections and gathering key pipeline data in challenging pipeline locations where previous methods have proved ineffective or impractical.

Given the multitude of potential project scenarios and unique conditions and constraints, no single NT ILI tool or execution method is universally applicable. Each project must be thoroughly analysed to ensure that project conditions are identified and matched with the method and tool that can provide the optimum solution.

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