In situ for improved integrity

Chad Carriere and Chad Allan, EnerClear Services Inc., Canada, describe the company's in situ internal cleaning and coating process.

In North America, particularly in Canada, access to markets is an ongoing challenge that will continue to dominate headlines throughout 2019. With increased scrutiny on the energy sector, depressed oil prices, government-imposed production cuts and pipeline projects being cancelled or put on hold indefinitely, it is becoming increasingly more difficult for Canadian producers to get oil to market. This is causing some companies to question whether extracting it even makes economical sense. Yet, with every challenge lies opportunity: often solutions can be found with targeted programmes focused on maximising existing assets and infrastructure.

Maintaining and extending the integrity of existing pipeline assets is one way that companies can work to weather the storm and find value in the marketplace, with a focused and diligent integrity plan for existing infrastructure. Regardless of local energy prices and circumstances, this is a global mindset that makes prudent economic and practical sense in any market cycle.

Attend one of the many pipeline trade shows and you will see that the energy industry is resilient and constantly pushing itself towards improved technologies and methodologies. The result is a plethora of options for producers to explore when it comes to maintaining, rehabilitating and protecting existing and new pipelines, such as cathodic protection, inline inspection programmes, pigging and chemical inhibition maintenance programmes, internal liners and internal coating. Often, these solutions can be used in conjunction with each other to create integrity programmes, as each system offers its own unique set of advantages and inherent challenges.

In the field of internal pipeline coatings, many advantages such as increased throughput and lowered friction, as well as debris and paraffin retardation, are offered with this solution. However, challenges arise when it

comes to longer pipelines, as more traditional methods see pipelines coated in a shop environment and then transferred to the location to be welded together. This can create issues in achieving uniform and homogenous dry film thickness coating coverage on the internal welds and joints of the pipeline. Potential solutions to this challenge can include touching up the weld locations manually after the pipeline has been welded together; using sleeves to protect the welds and joint locations; or, in some cases, leaving the weld locations untouched. Depending on the specific project parameters, all or some of these techniques can be applied, but sometimes to an economic or environmental disadvantage. A unique solution to the problem of weld and joint coating coverage is offered by EnerClear Services Inc., and its unique in situ internal cleaning and coating process.

Founded in 2005 in Alberta, EnerClear Services provides an innovative in situ pipeline epoxy coating process that provides a cost-effective solution for the prevention of corrosion in new pipelines or the rehabilitation of worn, corroded or scaled existing pipelines via its progressive pigging and multiple pass flood coating system.

Flood coating reduces owning and operating costs by extending asset life, reducing or eliminating the need for corrosive inhibitors, lowering friction and increasing line capacity vs conventional solutions (such as liners). This process can be used in the field (for new or existing pipelines), in plants and has applications in power generation, oil and gas, agriculture, civil, infrastructure, manufacturing, chemical, as well as offshore.

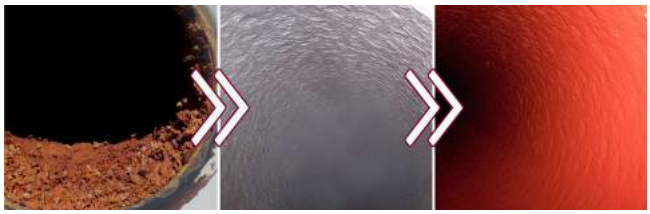


Figure 1. EnerClear Services uses a three stage process consisting of mechanical cleaning, chemical cleaning and coating to successfully rehabilitate existing pipelines and provide proactive internal protection for newly constructed pipelines.

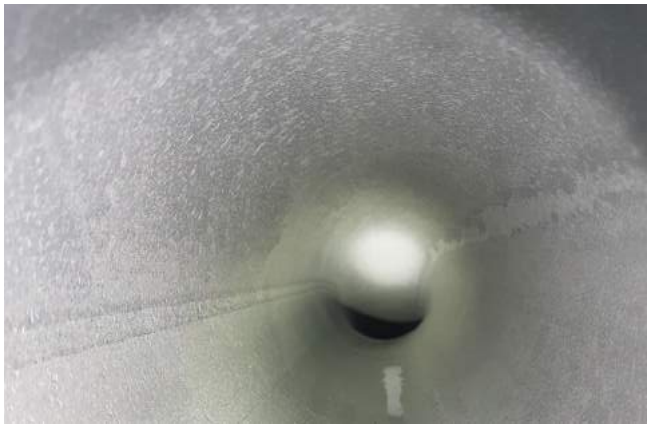


Figure 2. A pipeline after EnerClear Services' in situ mechanical and chemical cleaning process.

Challenges arising from bends, risers, operational infrastructure and other onsite barriers are mitigated by EnerClear's process, and the small onsite footprint has minimal impact on operations. Under the correct circumstances, EnerClear's process is capable of cleaning and coating lines up to 20 km in length and from 3 - 24 in. ID with just one small launching and small receiving station. For IDs from 24 - 60 in., an internal coating robotic process can be utilised. EnerClear's compact system can be mobilised around the world to coat or rehabilitate a broad range of assets including produced water, boiler feed and potable water lines; natural gas, CO_2 and sour gas lines; and oil and emulsion lines.

The process

EnerClear Services utilises a unique, progressive pigging multiple pass flood coat system, which is a new iteration of a proven technology developed in the 1970s in North America. The process uses specially designed pigs propelled with dried compressed air, where the pipeline is mechanically and chemically cleaned to a NACE 1 or 2 white metal finish, then dried. Every cleaning pass includes detailed quality control monitoring the cleanliness of the pipeline.

Once a white metal finish and a sufficient surface profile for coating adherence has been achieved via the company's acid etching programme, the next step is to apply a two-part epoxy coating that is batched between two pigs and sent down the line in a slug or a pill at a controlled rate of speed via EnerClear's 'Progressive Pigging Multiple Pass Flood Coat System'. The coating is deposited in a squeegee-like effect through the multiple pass flood coat system, which results in homogenous coating over weld joints, all bends, pitting, and any weld or minor corrosion defects. Every pass includes detailed quality control to measure dry film thickness. The final product results in a thin coating application evenly applied throughout the entire pipeline (including welds) that provides a lower coefficient of friction than bare steel pipe, maintains pipe ID and throughput and helps lower operating costs of the pipeline.

Epoxy pipeline coating offers the following advantages:

- Minimally invasive, low cost process that maintains throughput.
- Extends asset service life, reducing the need for costly inhibitor programmes and pigging maintenance programmes.
- Uniform coating coverage throughout the entire line, including welds.
- Combats wax and paraffin deposition.
- Eliminates scaling, internal corrosion and significantly reduces the process of erosion.

With existing pipelines, the process allows the company to economically rehabilitate its asset and extend the service life, in order to maximise return on the pipeline. When it comes to new pipeline construction, in many cases the process can allow companies to think economically by considering constructing a smaller diameter line utilising this coating method (due to its

thin application of coating) as opposed to constructing a larger diameter line and then pulling a liner through it, which can reduce the final throughput capacity.

Additional cost savings can be passed along when multiple lines are located in a similar area, allowing EnerClear to employ its process on a number of lines as part of one mobilisation. Under the right circumstances, EnerClear can also review the lines and look for ways to join them together (via temporary piping) to create a longer continuous section which reduces cost and scheduled timeline.

Figure 3. A typical EnerClear Services set-up. Footprint shows launcher/receiver tent with temporary pipefitting (20 - 25 ft run-out spools) extending out (to 90°) to a convenient location.

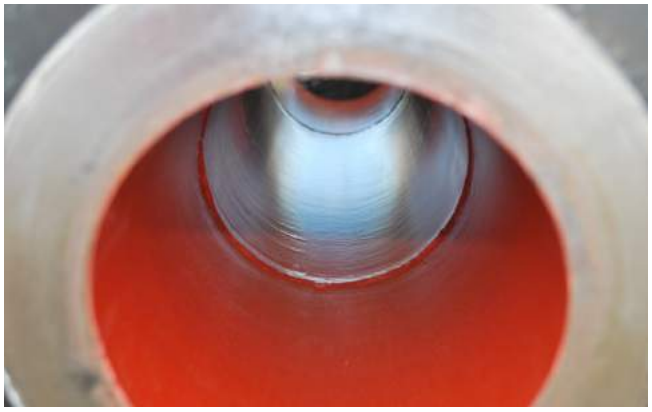


Figure 4. Uniform thin film coating coverage (including welds) maintains majority of pipe ID and throughput.

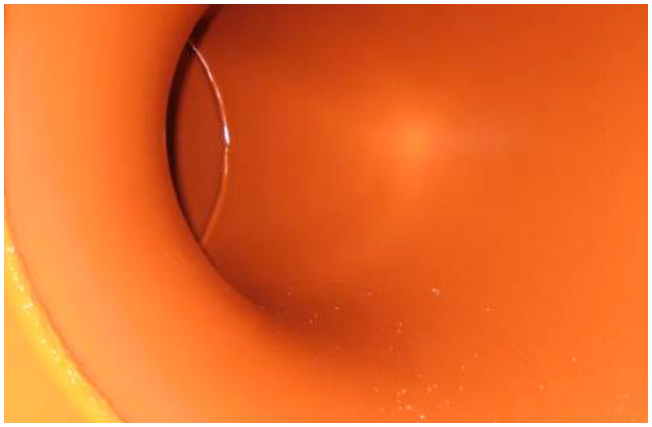


Figure 5. In situ coating provides full homogenous coverage throughout the entire line, including all bends (ie: 45s and 90s), providing a solution for pipe racks and difficult to access lines.

The EnerClear Services process often achieves significant savings and operational benefits for pipeline companies, because the coating is applied in one continuous pass (per section) from start to finish after the field joints are welded. The benefits are as follows:

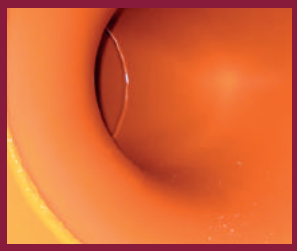
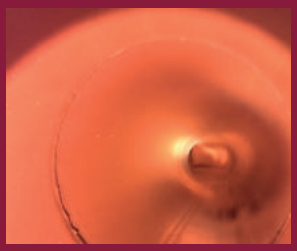
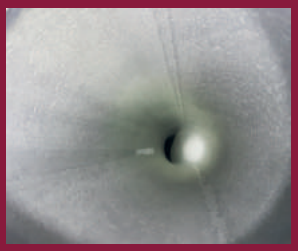
- Lower capital cost and improved coating integrity compared with shop coating the line pipe and manually coating the field joints after welding.
- Reduced timeline when compared to shop coating the line pipe and manually coating the field joints after welding.
- Improved flow efficiency.
- The proactively coated lines are less susceptible to corrosion should the inhibitor programme or system fail.
- Provides thin coating application vs traditional corrosion protection measures, such as liners.
- In situ coating process results in homogenous coating over weld joints, all bends, pitting, and any weld or minor corrosion defects.
- Complete internal coating for pipelines from 3 - 60 in. ID, and from 100 m to 20 km in length.

Conclusion

EnerClear is committed to executing projects in a safe and environmentally conscious manner throughout execution of the in situ pipeline coating system. At every stage of the process, extensive safety and quality control measures are carefully employed to ensure a successful and safe project execution as part of the turnkey project offerings. Unique footprints are available to access even the most challenging of pipeline settings, including offshore set-ups. With the proper planning and information obtained, a variety of pipeline environments can be successfully executed.

As the global sentiment towards energy ebbs and flows through its various geographical market cycles, solutions such as in situ internal cleaning and coating should be given serious consideration for its many benefits. This process can be achieved in any steel pipeline environment and has been considered and used in other industries in addition to oil and gas and energy.

As with any system or technology, the parameters and challenges of every project are defined by its own unique circumstances such as diameter, distance, location, access points, existing media/cargo and other factors. However, under the right circumstances EnerClear Services' unique in situ internal cleaning and coating process can be an effective way to combat internal pipeline issues on existing pipelines, which can significantly extend the life of the asset. It is also a proactive option for new pipeline protection of assets around the world in a variety of different industries.

Global Leaders in Insitu Pipeline Cleaning & Coating

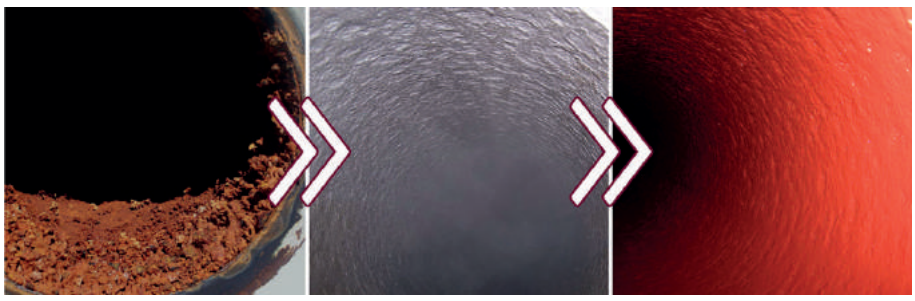
EnerClear Services provides an innovative insitu pipeline epoxy coating process that provides a cost-effective solution for the prevention of corrosion in new pipelines, or the rehabilitation of worn, corroded or scaled existing pipelines in diameters 3" and up. For IDs from 24" to 60", an internal coating robotic process can be utilized. EnerClear's compact system can be mobilized around the world to coat or rehabilitate a broad range of assets including produced water, boiler feed and potable water lines; natural gas, CO_2 and sour gas lines; oil and emulsion lines, and more!

EnerClear's Insitu Pipeline Coating System will significantly extend the life of your pipeline and is a proactive option for new and existing pipeline protection.

Benefits:

- Minimally invasive, low cost process with reduced impact on existing infrastructure and operations.
- Maintains pipe ID and throughput.
- Lowers operating cost.
- Flow efficiencies.
- Extends service life and reduces need for costly corrosion inhibitor programs and pigging maintenance programs.
- Combats wax and paraffin deposition.
- Eliminates scaling and internal erosion, and significantly reduces the process of erosion.
- Ability to coat multiples miles/kms in single sections, bends and difficult to access pipelines.
- Insitu coating process results in homogenous coating over weld joints, all bends (ie: 45's and 90's), pitting, and any weld or minor corrosion defects.

Take Your Pipeline From This...To This!



EnerClear SERVICES
PIPELINE REHABILITATION

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