Alyeska Pipeline Video Script

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This is Valdez, Alaska, southern terminal of the 800-mile-long Trans Alaska Pipeline and the northern most ice-free port in the United States.

Just off the bay, beneath this expanse of terrain, lies a large diameter pipeline used to remove ocean ballast water from incoming tankers. It runs up to 40 feet deep and stretches more than 15-hundred feet through the glacier-formed terrain.

When the ballast water line was installed 10 years ago, it was internally coated with an epoxy having a life expectancy of 8 to 10 years because of the corrosive ballast water it would regularly carry. It was during a scheduled maintenance inspection that facility engineers determined the pipe would soon need to be repaired or replaced. However, to excavate the entire pipeline would require months to complete and cost millions of dollars.

There had to be a better way.

Many alternatives were considered. One by one each was ruled out – except for an exceptionally innovative pipeline reconstruction technique known as the Insituform Process.

Gelco Industries, Incorporated, a pipeline reconstruction company, was selected for the project. Richard Beck, Gelco Insituform vice president, explains why his company chose the Insituform process.

"We want to show you a spool piece that illustrates why we are using the Insituform Process to solve this problem. This was one of the original pieces of pipe installed in the system. That piece of pipe as you can see was coated with an epoxy coating previously. That epoxy coating where the pipe has been welded was failing due to the aggressive environment of the effluent on the interior of the pipe.

As you can see … in many cases the weld area is highly pitted due to the loss of the epoxy coating on the interior of the pipe. When we were originally contacted by the owner, we were asked to look at many alternative systems to solve this problem. We looked at polyethylene slip lining, we looked at spin mortar lining, and we looked at different types of epoxy coatings. We even evaluated total replacement of the system installing new carbon pipe with a new epoxy coating. But what we finally ended up with was the Insituform Process."

The Insituform Process is a technique of manufacturing a new pipe inside an old or damaged pipe – usually without the need for excavation. This results in a fast, convenient and cost-effective installation.

This newly created pipe within a pipe is made from an epoxy resin system. Selecting the proper epoxy resin system is critical to the success of the Insituform installation. Gelco chose Shell Chemical Company's Epon Resin 9215 and Epon Curing Agent 9270 Epoxy Resin System.

Shell's Epon Resin System provided the critical long-range benefit of resistance to corrosion and abrasion, and long-term pressure carrying capability necessary for a successful installation.

It also provided good strength, less shrinkage, and greater flexibility than other materials, which enabled the Insitutube to negotiate sharp bends and turns in the pipe, demonstrated good bonding to the original steel pipe, and was able to seal off all corroded or pitted areas of the pipe, especially pipe joints.

Briefly, here's how the process works. Later on, we'll go into more detail about the Alaskan project.

First, a synthetic fiber felt tube is custom made to the precise dimensions of the pipe to be reconstructed. Because the tube must meet exacting standards before it can be used in the process, Gelco Insituform technicians carefully examine it to ensure that it is the correct length, diameter and thickness.

They also examine it for pin holes or any other structural defects, and repair them as needed. Before the tube enters the pipe to be repaired, it is saturated with a prescribed amount of Epon Resin. A polyurethane film on the outside of the tube protects the uncured resin system from water, which is added later in the process. The term **Insitutube** is used to describe the resin impregnated felt tube before the resin hardens. **Insitupipe** is the term applied after the resin hardens.

A hydrostatic head forces the saturated tube into the damaged pipe, inverting it (or, turning it inside out) as it goes in. As a result of the inversion, the resin-saturated surface is pressed snugly against the pipe wall. When fully extended, heated water is circulated through the pipe, curing the resin and liner into a homogeneous, rock-hard composite pipe within the damaged pipe.

There are significant advantages to using an Epon Resin System and the Insituform Process.

The Insitupipe which is formed stops internal corrosion and seals leaks in damaged lines.

An epoxy Insitupipe has low shrinkage and high burst strengths.

The Insitupipe largely restores structural integrity to the original pipeline.

Compared to pipe replacement, the Insituform Process is a faster and more convenient means of pipe reconstruction since …

- Traffic need not be disrupted;
- The process can be used even where the damaged pipe is not accessible for excavation;
- And since the entire damaged pipe need not be excavated, the time required to repair the pipe is significantly reduced.

Because the cured Insitupipe has a smooth interior wall, it provides improved flow despite a minor loss in diameter due to the thickness of the Insitupipe.

And, finally, compared to pipe replacement, Insituform often has a cost advantage both in direct repair costs and in the amount of downtime involved. Where pipe access is available by means of manholes, or aboveground fittings, excavation is often eliminated altogether.

As indicated earlier, the resin system is an important consideration in the performance of the Insituform Process. Because not all reconstruction situations have the same performance requirements, careful selection of the proper resin system is needed. This will match the Insitupipe with the physical and chemical properties to perform its designated function within the atmosphere present inside and outside the pipeline.

Let's now look at the Alaskan Insituform Process in more detail …

One of the first steps was to gain access to the pipeline. This was done by excavating both ends of the pipe to be reconstructed and removing a short section of pipe called a spool piece. The entire length of pipe was then cleaned out thoroughly.

Scaffolding and a platform were erected over the excavation from which the Gelco crew would direct the inversion.

Later, technicians set up the Insitutube at the installation site and prepared for the inversion process.

Since this was the longest continuous Insituform installation to date, it required an exceptionally large volume of material. Therefore, the resin and curing agent were delivered in tank trucks. In previous projects, which required considerably less resin and curing agent, the material was supplied in drums. The use of the tank trucks also allowed the use of a specially-designed static mixer.

To start the repair job, Epon Resin and curing agent were mixed. But unlike mixers used in the past, which generated heat that shortened the pot life of the resin and curing agent after they were mixed, Gelco Insituform used a static mixer especially designed for this process. This extended the pot life of the resin/curing agent mixture from 10 hours to 17 and a half hours, preventing the material from hardening too early. Although the actual wet-out process took 25 hours – which was longer than the extended pot life – resin and curing agent batches were mixed as needed, thus enabling Gelco Insituform to compensate for the extra time needed for the wet-out of the Insitutube. The static mixer was monitored throughout the process to ensure it mixed the materials in the proper ratio. While the mixing was going on, a crew laid out the Insitutube along a handling conveyer.

The wet-out process began by pumping the resin/curing agent mixture slowly through an access port into the tube, forming a resin slug. Additional access ports were cut into the tube periodically to introduce more resin/curing agent mixture. After each resin injection, the access port was patched.

The crew meticulously followed the resin slug along the tube, manually helping to work the resin into the felt when necessary. Special vacuum hoses were used to remove air in the tube to facilitate total saturation of the tube. Complete saturation of the felt was critical to the success of the Insituform Process.

As the resin slug worked its way through the felt, the saturated tube was fed through nip rollers to maintain a specified and consistent thickness.

The open-ended Insitutube was hoisted to the top of the scaffolding and fed down into an inversion tube. At the bottom of the inversion tube, the Insitutube was doubled back on itself and clamped securely around a metal elbow which would direct the inverted tube into the pipe being repaired. Now the inversion could begin.

You'll recall that the inversion is just a matter of turning the Insitutube inside out. When this happens, the resin-saturated polyester felt is pressed against the walls of the pipe, and the polyurethane film which started on the outside of the Insitutube, now becomes the inside. During the inversion, this polyurethane film acts to protect the uncured resin from the water now inside the tube.

Thirty-eight degree mountain stream water was introduced at the top of the inversion tube and used as the driving force to turn the Insitutube inside out, while at the same time moving it inside the pipe to be repaired. The water helped keep the resin/curing agent mixture cool and prevented early hardening. As the Insitutube became full, increasing water pressure began to move it through the original pipe.

When half of the inversion was completed, hold-back ropes and two blue lay-flat hoses were secured to the end of the Insitutube. The speed at which this inversion continued was controlled by the hold-back ropes and by adjusting the flow of water as needed.

Once the inversion was complete, and with the Insitutube held snugly against the interior wall of the original pipe, water from the top of the inversion tube was circulated through special heat exchangers and returned to the far end of the Insitutube through the blue lay-flat hoses.

This, in turn, slowly heated the water inside the Insitutube to 140 degrees Fahrenheit for several hours until a complete cure was achieved. Special hydraulic pumps also were used to provide sufficient velocity in the line to make sure the temperature remained the curing process. Constant monitoring of the resin and water temperatures took place with the aid of thermocouples attached both inside and outside the Insitutube.

When the hardening process was complete … the water was allowed to cool slowly. Then the sealed end of the Insitupipe was removed using a saw and the water was drained, leaving the newly formed Insitupipe ready for inspection.

With what you have just seen we're sure you can now appreciate the many situations in which the Insituform Process and Shell's Epon Resin Systems can be put to use.

The nationwide need for pipe rehabilitation, especially those in inaccessible or critical locations, such as under city streets, buildings or manufacturing facilities, is providing the true test of the Insituform technology. It's a test that we know demands the performance which the Shell Epon Resin Systems can deliver.

While the anticipated potential for Insituform is high, it takes more than just the ability to manufacture resins and curing agents to realize this potential. It takes a commitment from a company like Shell which has the resources and the desire to provide:

- Strong research and development;
- In-depth knowledge of resin chemistry and technology;
- Experienced engineering backup; and
- Years of pipeline experience.