



# Trenchless TECHNOLOGY.

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## 2018 Project of the Year Rehabilitation Winner: 36-in. CIPL Gas Main Rehabilitation Project 0

BY MIKE KEZDI ON OCTOBER 23, 2018

MARKETS, OIL & GAS, PIPE RELINING, PROJECT OF THE YEAR, REHABILITATION

Proximity to a NCAA Division I university, being situated beneath the main thoroughfare to a major recreation area and a tight deadline to avoid the late fall dips in temperature common to the Northeast, are just a few of the challenges associated with rehabbing a 36-in. gas main in South Orange, New Jersey.

These were some of the known challenges facing Public Service Electric and Gas (PSE&G) and Progressive Pipe Management (PPM), the utility's contractor partner. As is the case with any construction project, other obstacles came into play as work progressed.

Overcoming all of these challenges, without a major disruption of service, and the sheer size of this cured-in-place lining (CIPL) project made the "36-in. CIPL Gas Main Rehabilitation Project" stand out from the competition and earned it the 2018 Trenchless Technology Project of the Year – Rehabilitation honors.

Documented by PSE&G, PPM and Karl Weiss Technologies as a world-record relining of a critical high pressure gas distribution main using the Starline CIPL technology, the project took place in four segments beneath South Orange Avenue, a major county route between Newark and Morristown, New Jersey, and right on the doorstep of Seton Hall University.

The 36-in. high-pressure, cast-iron feeder main, installed in the 1950s, was a known problem for PSE&G at the time of the renewal in fall 2017. The main had 15 known joints with active leaks, elevating concerns regarding the safety

**Project Owner:** Public Service Electric & Gas (PSE&G)  
**Engineer:** George Ragula, PSE&G  
**Contractor:** Progressive Pipeline Management  
**Manufacturers/Suppliers:** Karl Weiss Technologies GmbH, ULC Robotics and QuakeWrap  
**Value of Trenchless Project (US\$):** \$6.2 million

of the line, and although some patches had been made, it was clear to PSE&G that a permanent fix was required.

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According to George Ragula, distribution technology manager for PSE&G, with the joints every 18 ft and at a depth of 4 ft, repairing the joints via excavation was not a feasible alternative. Ragula estimates that each excavation alone – not including repairing the joints – would range from \$40,000 to \$50,000. Ragula knew a trenchless solution was needed. PSE&G uses the sliplining process for many projects; however, the utility needed to maintain the 15 pounds per square inch gauge (psig) capacity on this main and thus was ruled out.

In addition to its proximity to the university and being a heavily-trafficked roadway, the feeder main shares a crowded subsurface space. This includes a telephone facility with tile ducts, water, two sewers, cable and a parallel 2-in. low pressure main,” Ragula says. “The only viable and cost-effective approach that would guarantee minimal disruption was trenchless renewal using CIPL.”

The CIPL main relining process is nothing new to Ragula, PSE&G and PPM. In the last 25 years PSE&G has relined several key sections of its distribution network throughout the Garden State using this technology winning Trenchless Technology Project of the Year honors in 2011, and tying a world record with a 30-in. Starline install three years ago.



*The Starline cured-in-place liner is guided from the truck to the inversion drum. The lining took place in four segments.*

George [Ragula] approached us and said that PSE&G had a 36-in. critical feed near Seton Hall that had leaks and they knew they could save some money with this method,” says David Wickersham, president and CEO of PPM. “We [PSE&G and PPM] approached Karl Weiss in Berlin, the patent holder of the Starline process, about what we would need to get it done.”

Though the overall project timeframe was a little more than two months – Sept. 5 to Nov. 19, 2017 – the planning and equipment procurement that went into this arduous project took more than half the year to plan.

PPM beefed up its vacuum capabilities – necessary to remove the sand-blasted grit and scale from inside the 2,000 ft stretch of pipe – and procured a larger inversion cone and pressure drum from Karl Weiss that was approximately the size of a 12-ft box truck.

From an operational perspective, everything we have learned in our 16 years did not give me any pause on designing this project and completing it successfully,” Wickersham says. “Based on our experience and based on the strong partnership with PSE&G and Karl Weiss, we really didn’t have any pause in going after this.”

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The project included four lining segments – segment one, 650 ft; segment two, 565 ft; segment three, 450 ft and segment four, 260 ft – and one small open-cut segment to replace several critical valves. Based on a flow analysis, PSE&G knew they had a tight window of time for this project before cold weather natural gas demands would require the 2,000 ft segment to be gassed-in.



*The 36-in. CIPL liner was inverted above the lining pit and transferred to the host pipe via a transport tube. This setup led to some initial challenges for the crew, including liner chafing and liftoff.*

## **Challenges Faced, Challenges Met**

We knew from our 30-in. experience that we needed to beef up our vacuum capabilities and we created a Venturi system to improve suction,” Ragula says. “We also planned to internally reinforce a portion of the line to bridge a 4-in. tap instead of using full encirclement so we had the ability to line right a way.”

The tap was reinforced using a four-layer prefabricated patch of PipeMedic by QuakeWrap, a fiber reinforced polymer (FRP) that PPM and PSE&G have used on previous CIPL projects.

When the project was under way, crews faced four major challenges that their 30-in. experience did not prepare them for.

## Grit

As with other CIP relining work, the host pipe needs to be as clean as possible for the liner to adhere. PPM crews sandblasted the pipeline to an almost virgin white pipe to meet a NACE 2 visual standard. To remove the grit, crews used several vacuum trucks combined with a Venturi system to optimize air flow. Even with this modified system, in segment two they found a long section of grit remaining. They tried several options to no avail.

With input from its partners at Karl Weiss, PPM created a special pig that would be pulled through the segment, increasing the airflow velocity by narrowing the internal diameter of the pipe. This allowed crews to remove the grit with the vacuum equipment they had on the project. While this process took place, the team moved ahead with lining segments three and four.

## Liftoff and Chafing

In its previous CIPL work, the inversion took place in the lining pit but due to the size of this liner with related equipment and the planned excavation pits, all of this had to take place above ground. This led to non-optimal entry angles for the liner into the host pipe.

After the liner was cured in three of the segments, it was discovered that there was slight liner liftoff, also known as delamination, that occurred near where the liner entered the host pipe. After the discovery, repairs were made with epoxy and specially fabricated retention bands to hold the liner in place while curing.

In segment one, and also due to the entry angles, the liner chafed and caused minor leaks due to the size of the 8-in. retention belt used to guide the liner into place. The leaks were fortunately outside of the pipe and in the remaining segments the retention belt switched to 4 in. and the lubrication was doubled resulting in no further chafing or leaks occurring.



*PSE&G and Progressive Pipeline Management devised a series of vacuum trucks to create a Venturi system to remove the silt and grit from the pipe cleaning process in advance of the relining.*

## Major Tear

Segment two, a 565-ft stretch, took 28 days to complete, first, because this is the segment in which the aforementioned grit was stuck, and second, because, after three successfully completed segments, the liner suffered a major tear when one of four tail bolts failed. Luckily for the team the three remaining bolts were still secure and they were immediately able to remove the liner over a 24-hour stint. Unfortunately, this happened as the colder late-October weather started rearing its head and the mandated November gas-in was fast approaching.

Lead time for liners is typically four to six weeks, but for larger liners like this we can see up to 12 weeks because it is coming from Germany," Wickersham says. "Karl Weiss really jumped on board and worked around the clock to get the liner to us within two weeks and we were able to reline the section and get it done on time."

After facing these in-field challenges, Ragula says that on future large diameter projects – more 30-in. and possibly a 42-in. is on the horizon – the team will opt for a longer excavation area for the lining pit to accommodate the larger inversion cone and transport hose from the pressure drum.

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Segment two was successfully installed on Nov. 14, 2017, and a final CCTV of the entire 2,000 lf pipeline took place Nov. 19. This record-breaking renewed section of PSE&G's mainline was gassed-in on Nov. 20 just in time for the record-breaking cold winter that befell much of North America.

A lot of experience came together to make this project happen. It was very much a team effort between PSE&G, PPM and Karl Weiss," Ragula says. "The takeaway for all of this big stuff is that there are three things that you must do. Plan, plan and over plan and if you do those three things that can help you react to the unexpected that occurs, which almost always occurs in pipeline rehab and renewal work. It is just the nature of this business."

**Mike Kezdi is associate editor of *Trenchless Technology*.**

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