Advanced pipe renewal without disruption

The Spray-In-Place pipe (SIPP) rehabilitation method provides a new tool to extend the life of water mains. By **Chad Atcheson**

As a community's water infrastructure ages, its many buried pipes approach the end of their useful life, and the incidence of leaks and water main breaks escalates. This results in an increase in water loss and costly repairs, causing disruption to consumers and the local economy.

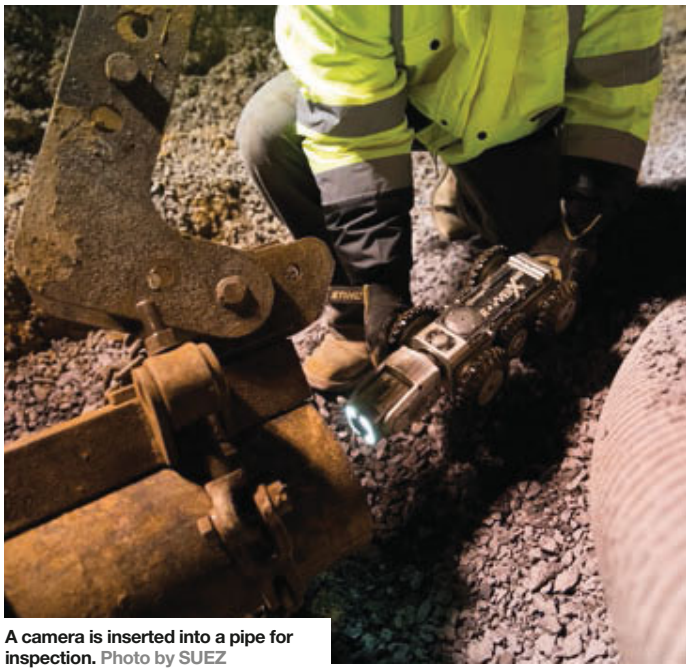
In fact, problems with aging infrastructure cost municipalities hundreds of millions of dollars each year in maintenance, repair, and replacement costs, and shutdowns. In addition, deterioration of pipes cause water quality issues, such as lead leaching from soldered joints, copper and steel pipe corrosion, and the buildup of biological material.

Maintaining infrastructure assets, such as water mains in fit-for-purpose condition, is a critical aspect of utility management. Today, pipeline asset management programs, which help communities optimize these assets as well as their annual pipe renewal budget, have become increasingly important. Advanced solutions such as SIPP provide a new tool to extend the life of existing underground pipes while creating an alternative to traditional dig-and-replace pipe or direct replacement. With SIPP – which is part of the pipeline asset management program offered by SUEZ, a world leader in water and wastewater management solutions – no major road or sidewalk tear-ups are necessary.

How SIPP works

SIPP is an innovative, efficient, and long-lasting pipe rehabilitation solution that scrubs underground pipes clean and then uses a state-of-the-art, computer-controlled robotic spray to apply an internal epoxy pipe lining in situ. Once cured, the epoxy lining seals the pipe, preventing leaks and water contamination, extending the pipes' service life, minimizing future maintenance costs, and increasing the flow capacity for greater system efficiency.

Because it is a trenchless technology application, SIPP requires only two access points: the first point where the equipment is inserted, and the second at the other end of the pipe segment where equipment is, in essence, attached and pulled through. Only very small access points are required, therefore disruption is minimal. There is no need to dig up the whole length of the road. Because of this, SIPP is especially suited for applications underneath railroads, interstates, highways, buildings, and so forth.



A camera is inserted into a pipe for inspection. Photo by SUEZ

This rehabilitation technology works on pipes made of different materials and ranging from approximately 10 centimeters (cm) (4 inches [in]) to 91 cm (36 in) in diameter – both vertical and horizontal.

SIPP benefits

Once the lining is cured, it creates an internal seal that prevents leaks and helps protect against future corrosion and biological buildup. Because the epoxy coating bonds with the pipes, it also seals cracks and protects against the formation of future infiltration. The newly applied coating, which is highly elastic, means that the lining is flexible and moves with the pipe, reducing the risk of leaks caused by infrastructure settling. Additionally, the epoxy lining may eliminate leaching of lead from soldered joints and the corrosion of copper and steel pipe – significantly improving water quality.

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This two-component, 100-percent solid epoxy system exceeds ANSI and NSF 61 standards, which are performance-based standards that evaluate the amount of contaminants that leach from products into drinking water. The epoxy is a zero volatile organic compounds (VOC) material with certified zero fish kill.

SIPP technology can yield an estimated cost saving of 20 to 30 percent when compared to direct replacement, where it is necessary to dig up and replace the entire length of the pipe that needs attention. With this comes another benefit that transcends cost: the ability

The SIPP rehabilitation process consists of five steps for most piping infrastructure

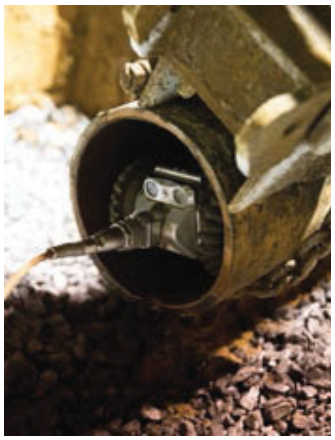
Step 1: Conduct system analysis that includes mapping the system, using closed-caption television (CCTV) to evaluate digitally recorded findings and then diagnose and identify a restoration plan.

Step 2: Prepare the pipe interior by drag-scraping, power-boring, and/or hydro-jetting to create a clean, smooth dry surface. This is followed by a second CCTV inspection to determine if there are any leaks, infiltration, or repairs that are needed outside of the SIPP scope of work.

Step 3: Repair of any current piping issues without the need for additional excavation and then prep for the epoxy coating.

Step 4: Complete the epoxy lining and reassembly.

Step 5: Conduct a final inspection and system analysis, including thorough inspection of the epoxy lining and chlorination/disinfection before system restoration.



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Left: Close-up view of camera in pipe. Photo by SUEZ

to minimize inconvenience to consumers by relining water pipes rather than digging them up and replacing them.

SIPP in Wyandotte

A look at the program used by the city of Wyandotte in southeastern Michigan provides insights into how SIPP works.

Wyandotte is located approximately 17.7 kilometers (km) (11 miles [mi]) south of the well-known city of Detroit. Wyandotte is situated on its water source, the Detroit River, and is part of the collection of communities known as Downriver.

Today, Wyandotte is the only Downriver community that owns and operates a potable water filtration plant. The Wyandotte Municipal Water Plant serves more than 12,000 customers and can produce up to approximately 57 million liters (15 million gallons) of water per day. Its distribution system consists of 177.028 km (110 mi) of water mains ranging from 10 cm (4 in) to 76 cm (30 in) in diameter. Fire protection is provided through 850 fire hydrants throughout the community. The water system has a 1.9-million-liter (500,000-gallon) elevated storage tank and 17 million liters (4.5 million gallons) of ground level storage for peak demand periods such as fighting fires or other emergencies. The utility has annual revenues of over US$3.5 million and sells more than 5.7 billion liters (1.5 billion gallons) of water annually.

According to Bill Weirich, superintendent of the Wyandotte Water Department, the utility's traditional method of maintaining the water mains was open cut and direct replacement, which entails trenching the entire length of pipe to be repaired or replaced and laying down new pipe in the trench. The downsides of this method are the high cost, the lengthy time involved in the process, and the disruption and inconvenience that customers encounter.

Another difficulty with the open cut and direct replacement method was the presence of underground utilities. "Having all the other utilities underground makes it almost impossible to relocate your mains without running into gas and electric, and we also have underground cable," Weirich explained.

However, Weirich heard about the SIPP process offered by SUEZ – which Wyandotte already contracted to provide water tower maintenance through its Asset Management Program. "We started looking into SIPP and decided to give it a try on small areas and see what happened," he said.

At Weirich's suggestion, Wyandotte elected to use this system for pipe maintenance in the older part of the township. With aging cast iron pipes that dated back to the 1930s through 1950s, this area had experienced numerous water main breaks and faced the potential for more. Wyandotte intended to remediate the aging infrastructure through SIPP with the goal of extending the life of the pipes by another 50-75 years.

"We took some main on which we had about 10 to 15 repair clamps. We did three parts of the system – a 4-inch pipe (10-cm) and two 6-inch (15-cm) pipes. With the SIPP program, we were able to open up three holes to remediate the pipes rather than open cut the whole area and replace the main," he said.

After locating the pipe next to a valve on each end, SUEZ inserted a receiving pit for the robotic device that applied the epoxy coating. After one section was done, the valve was replaced, and spraying of the lining continued down the line to the next valve, and so on.

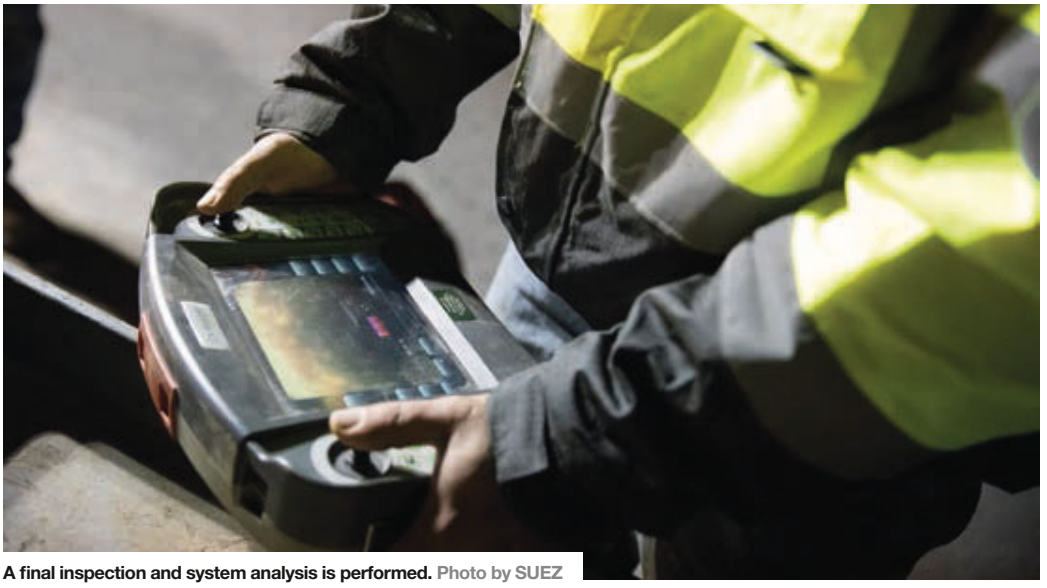
Weirich noted that, "In essence, we were lining the pipe and putting in two new operational, more up-to-date valves to replace the older ones that dated back to the 1950s. This gives us a more reliable way to shut the system down. And by sealing the inside of the pipes, I think we've greatly reduced the likelihood of main breaks in that area."

According to Weirich, the SIPP program has yielded numerous benefits. Within one month, and with little disruption to the community, Wyandotte rehabbed approximately 1,067 meters (3,500 feet) of main with the SIPP method. The traditional method would have taken all summer and only achieved approximately 457 meters (1,500-2,000 feet) of main for the same amount of money.

"I believe we were the first water department in Michigan to use SIPP. That's why we started small, so we could make sure that the process was going to work. We took a worst-case scenario to see how this would work," Weirich said. "Going forward, we're going to expand on where we started and begin expanding out to the whole system from those three points."

Author's Note

Chad Atcheson is responsible for managing the network asset management line of business for SUEZ. With nine years' experience in the piping industry, he specializes in pipe rehabilitation, conditions assessments, and trenchless technology. He holds a masters degree in civil engineering with a focus on environmental engineering from Auburn University.



A final inspection and system analysis is performed. Photo by SUEZ