



## Making Pipe Repairs More Affordable, Quicker and Easier

In the trenchless pipe repair market, cure-in-place pipe (CIPP) systems are a popular choice. **Huntsman's VITROX® resin is potentially the world's first polyurethane-based pipe repair resin.** VITROX resin provides a longer handling window, faster curing time and superior high temperature resistance properties compared to existing technologies.

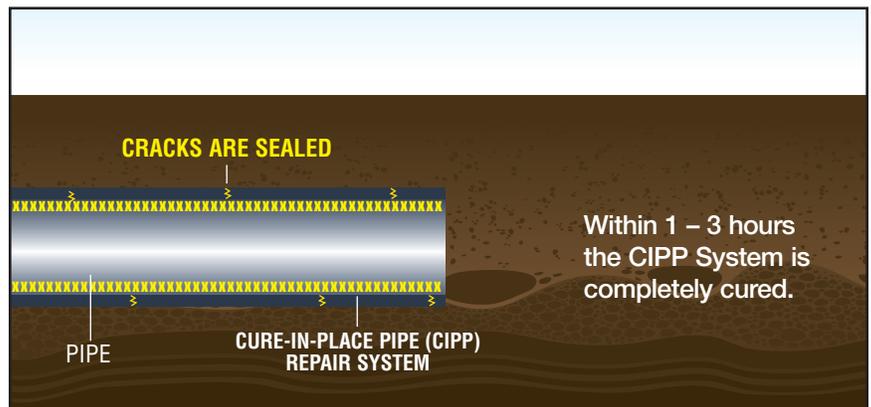
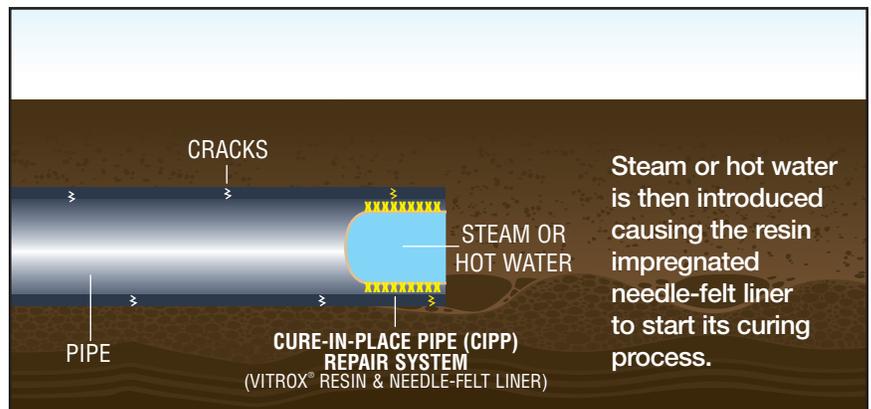
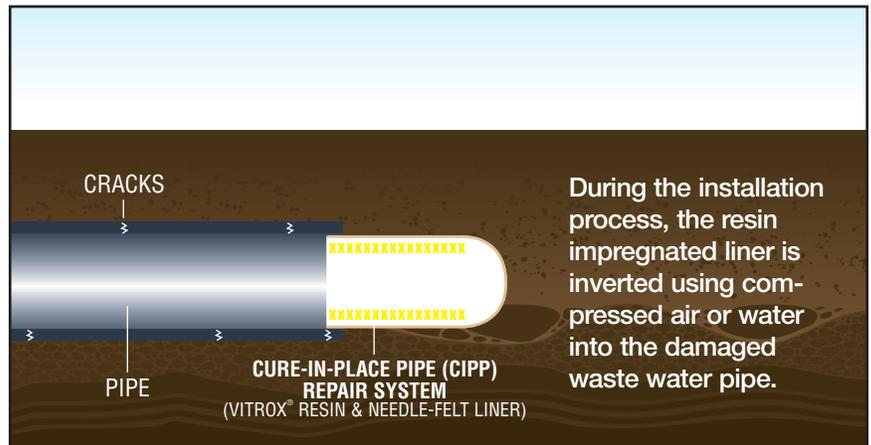
### Innovation Uniqueness

In the cure-in-place pipe (CIPP) process, a resin-saturated felt liner made of polyester is inverted into a damaged pipe using compressed air or water. Steam or hot water is then applied to the saturated liner, aiding the resin to cure and sealing the damaged pipe. Less digging makes the CIPP process more affordable, less disruptive and more environmentally-friendly compared to traditional "dig and replace" pipe rehabilitation methods.

Traditionally, epoxy or unsaturated polyester resins (UPRs) are combined

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### How The VITROX® Resins Work





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with felt liners to create a durable, impenetrable CIPP solution. Epoxies have a short pot life and have to be mixed just a few hours before installation. UPRs offer longer pot life's - however, they have long cure periods, and potential health risks. VITROX resin is based on a novel isocyanate chemistry with an adjustable pot life and snap cure capabilities.

**The patented VITROX resin system offers the ideal resin properties – a long pot life, which enables repair of long pipelines, as well as short cure times, which reduces the repair period.** The significant scientific challenge to develop a polyurethane resin suitable for the CIPP process was tackled by the Huntsman technology team using fundamental chemistry know-how, and demonstrated in-field in partnership with I.S.T. (Innovative Sewer Technologies GmbH).

According to I.S.T.'s press release, "Using VITROX® resins, far more time is available between resin application and installation. As a result, liners can be prepared off-site, the day before application, at a suitable indoor location. This reduces the risk of mixing faults, which can occur on outdoor sites because of inclement weather conditions. It also means actual repair work can start onsite as soon as the team arrives each day." This allows significant time and cost-savings in the repair of broken sewer pipes.

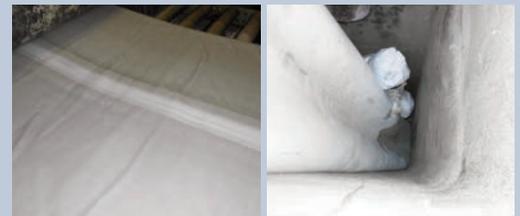


Enriching lives through innovation

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*The VITROX resin system being installed in a sewage system in Lleida, Spain.*

### Industry and Marketplace Benefits

According to the 2002 EPA "Gap Analysis," by 2020 approximately 45% of the 600,000 miles of sewer pipes within the United States will be in need of immediate repair. Lack of renovations can be attributed to the high costs, and difficulty making the repairs underground, i.e., digging up and shutting down roads for an extended period during the renovation process. CIPP systems featuring VITROX resin can make sewer renovations/ repairs more affordable, quicker and easier to manage on-site.

Currently over 12 million ft. of pipelines are being renovated annually in North America using the cured-in-place pipe (CIPP) process. (Source: *Trenchless International Magazine*). VITROX resin is currently being used in a number of sewer repair applications throughout Europe. According to Dave Burge, Huntsman Polyurethanes Business Development Manager, "in the future, the product will see broader applications on a global basis in a variety of markets, including the water, and oil and gas industries."