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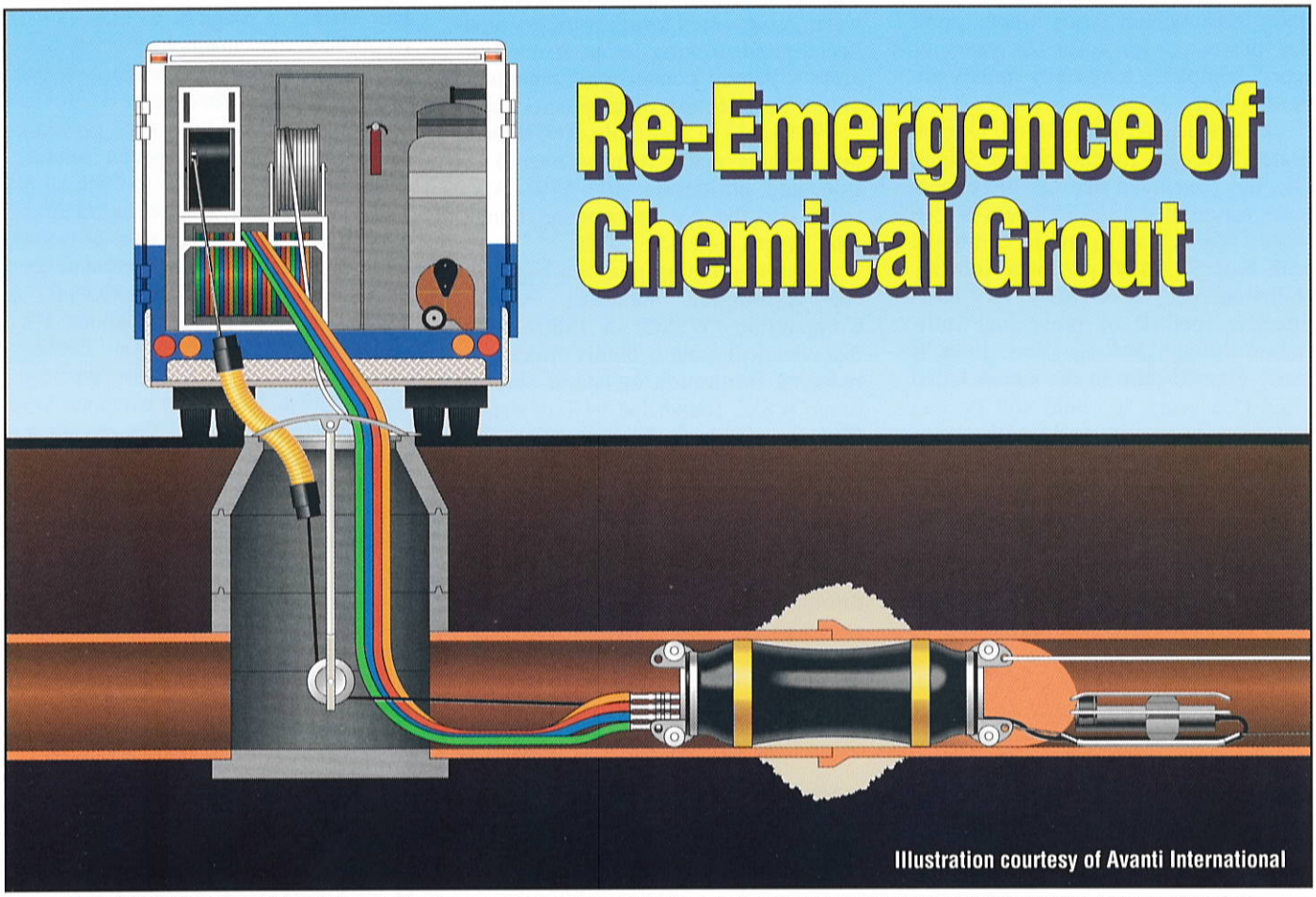
Update

Re-Emergence of Chemical Grout



■ SECTIONAL view of the TV/grout rig above ground and the TV inspection camera on a remote unit inside pipe in front of packer.

RECENT studies and over 40 years of experience indicate that America's first trenchless technology is still the best, most cost-effective, long-term defense against infiltration of groundwater into structurally sound sewer systems.

Chemical grout was first developed and applied in 1955 by American Cyanamid Company. That first product, an acrylamide monomer grout, has been used to stop leaks in sewers, dams, docks, missile silos, tunnels, and many other applications all over the world. Acrylamide is still considered by many professionals to be the best grout available, even though many other formulations have been developed in recent years.

Although chemical grouting has been used successfully for many years, some municipalities have not accepted it as a permanent pipeline rehabilitation technique. There are three reasons for this phenomenon: misunderstanding, poor record keeping, and misapplication.

Misunderstanding

Many people who could benefit from the proper use of chemical grouts do not use them because of misinformation. One such bit of misinformation is that chemical grouts are extremely dangerous. This does not appear to be true. None of the grouts currently being used are toxic in their gelled form and many are non-toxic in their pre-gelled form. Acrylamide is classified as toxic but, according to a 1991 OSHA report on this substance, exposure can be prevented with prudent workplace precautions. Acrylic resin grout, which has performance characteristics similar to acrylamide, is 10 times less toxic. Other chemical grouts are even less toxic and some are non-toxic. The relatively recent development of special grout application trucks has reduced exposure to toxic materials greatly. Now, applicators may sit in an air-conditioned control room while they inspect, test, and grout pipeline joints and laterals.

The safety issue concerning grout began in 1978 when the EPA recommended testing acrylamide to define the health risks of its use. EPA has now spent 17 years and likely millions of dollars attempting to regulate a product which presents no known environmental risk and is used by only a minuscule workforce. Even though EPA's action appears to be a good example of pollution control gone astray, it has had a devastating effect on the image of chemical grout and the marketability of a viable, effective product.

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Another misconception is that chemical grout is a short-term "patch," not a permanent repair, and therefore, not a cost-effective rehabilitation technique. The basis of this misconception may relate more to poor record keeping and misapplication than to fact. While there are many documented cases where grout has prevented leaks for 25 years or more, complete, long-term studies are hard to find.

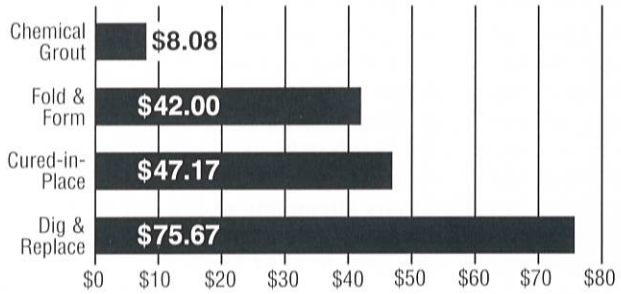
One study, conducted by Oregon State University for the city of Salem, OR, has concluded that the life expectancy for grouted joints in Salem is 15.6 years. When that figure is combined with Salem's $4.06 per-linear-foot installation cost, it reveals a very cost-effective method of preventing infiltration through leaking joints. Even if every grouted joint in the nation failed after 15.6 years, it would still be less expensive to prevent leaks with chemical grout for 50 years than to use a full-length liner or complete replacement (which have 50-year design lives) one time.

Salem's costs are lower than the rehabilitation bids shown in the following table for two reasons. First, the city of Salem used an average of all its grouting costs for several years, and second, the work was done by city crews, not independent contractors.

Rehabilitation Bids from Contractors by Area ($/lf)
(8" main, 1,000 lf, typical 40-year-old neighborhood)

	Chicago	Denver	Houston	Miami	Nashville	Washington DC
Grout	8	9	8	8.50	7.50	7.50
Fold & Form	38	48	46	39	36	45
Cured-in-Place	43	48	46	44	42	60
Dig & Replace	55	104	67	53	50	125

Average Costs Based on Table Aabove ($/lf)



50 years ÷ 15.6 years = 3.2 grout applications
3.2 grout applications X $8.08 per foot = $25.86 for 50 years

Grout Stops Leaks Through Lateral Connections

Groundwater migration has also contributed to the misconception that sewer rehabilitation does not stop leaks. It has recently become clear that when groundwater is prevented from entering a pipeline through leaking joints, it may migrate to lateral connections, manholes, or the next section of unrepaired pipe. A 1991 study in Nashville, TN, showed that relining mains reduced overall inflow and infiltration (I/I) 57%. After laterals in the test basin were relined, total I/I was reduced by 77%.

A lateral grouting program begun by the Washington Suburban Sanitary Commission (WSSC) in 1980, shows that chemical grout is highly effective in reducing infiltration at lateral connections. WSSC found that 94% of the infiltration visible at the connections and 50% of the lateral leakage was stopped by grouting the connection with the main and the first six feet of the lateral. WSSC has determined that leaks cost them $3.04 per gallon (calculated through a 20-year Present Worth analysis) for transportation and treatment of the groundwater. It costs them $1.33 per gallon to stop the leaks with chemical grout.

As awareness of the importance of grouting lateral connections has spread, many municipalities have begun to require that lining contractors grout all lateral connections. The experience of WSSC, Miami-Dade Water and Sewer Department, Metro Nashville Water Services and others, indicates that approximately 75% of the groundwater which infiltrates through laterals enters within 6 feet of the main. As a result, some of these cities require contractors to grout both the connections and the first 4 to 6 feet of the lateral.

Grout Stops Manhole Leaks

WSSC has also used chemical grout successfully to reduce infiltration through manholes. During the early 1980s, WSSC found that manholes were contributing significantly to their total I/I. As a result, they started a program to identify and rehabilitate the manholes which were leaking the most. Their primary rehabilitation technology for leakage control has been chemical grout. This has proven to be a cost-effective, long-term solution. Early in the study, 19% to 28% of all manholes inspected were found to be leaking. During the last 2 years of record, only 1% of the manholes inspected have been found to be leaking sufficiently to warrant repairs. Philip M. Hannan, P.E., Maintenance Reconstruction Division Manager, WSSC, says the lower percentages show that the worst manholes have been repaired, and that the repairs are holding up. To date, WSSC has used chemical grout to rehabilitate 2,557 manholes and eliminated over 2.6 mgd of infiltration in the process.

Misapplication

Misapplication has also tarnished the image of grout. Luis Aguiar, Director, Miami-Dade Water and Sewer Department, Miami, FL, points out that in the past, grout was the only trenchless rehabilitation process and, as a result, users were tempted to apply it to every problem they encountered. As these misapplications failed, grout was judged to have failed, too. As noted at the beginning of this article, chemical grout is not a structural repair. Its purpose is to stop leaks through joints and cracks in structures which are otherwise sound.

Contrary to expectations, the use of chemical grout has not diminished with the introduction of other trenchless technologies. In fact, its use has grown significantly. David Magill, president of Avanti International, points out that the volume of grout sales has almost doubled in the last 5 years. He expects this growth to continue as the true value of grout is re-established.

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