



LDC'S LONG SEARCH FOR APPROVED REHABILITATION TECHNOLOGIES FOR CAST IRON PIPE

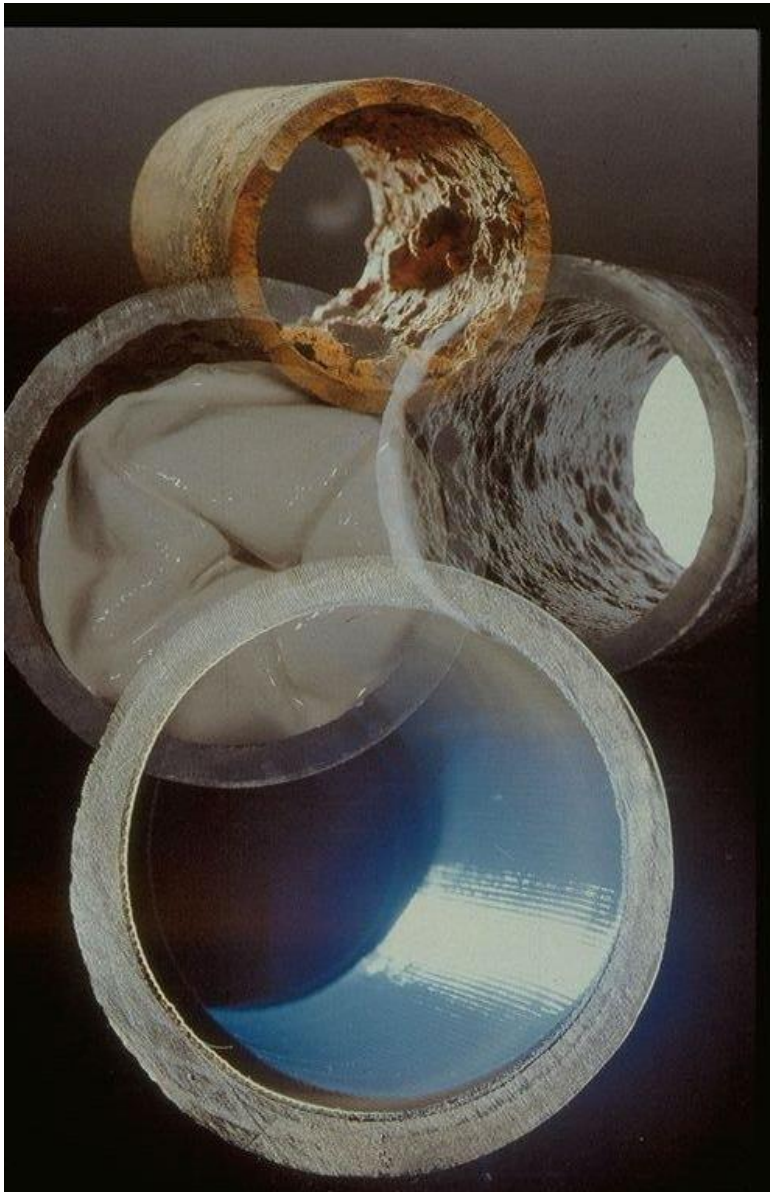
ARPA-E WORKSHOP
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ASPECTS OF CAST IRON REHABILITATION NEEDED IN LDC SECTOR

- Typical Areas where Cast Iron Rehabilitation is needed
 - Difficult-to-access areas
 - Highways, Railroads, Bridges
 - Areas include multiple bends
- Need to maintain flow capacity; due to age and location; many CI and steel lines are also major feeds that distribution system relies on
- Many times CI pipes are in areas where there is dense subsurface conditions; no space for additional 'clear lane'
- Sizes of CI pipe determine applicability of technology
 - Larger than 12" diameter – Replacement is NOT an option – more than 1000 miles still in U.S.
 - No available clear lane
 - Larger diameter CI has significant wall thickness and does not break; leaking joints are the issue
 - Geometric inconsistencies (e.g. 16" CI on ID, need to upsize to 16" OD for steel replacement)
 - Larger diameter facilities up to 48" are part of rehabilitation requirement; additional problems emerge – deeper depths; some in areas with wall-to-wall paving; conventional replacement techniques very costly





PHMSA DEFINITION OF RE-CONDITIONED CAST IRON DISTRIBUTION PIPE

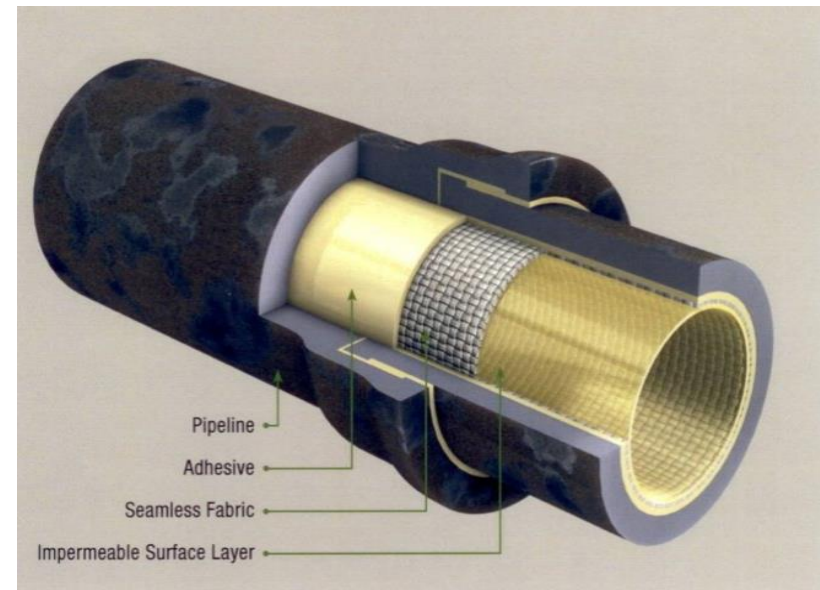
PIPE THAT HAS BEEN LINED INTERNALLY TO ENSURE SAME OPERATION AT A MAXIMUM ALLOWABLE OPERATING PRESSURE (MAOP) AND THAT DOES NOT EXCEED THE PREVIOUSLY ESTABLISHED MAOP

SEPARATE REPORTING CATEGORY FOR PHMSA REPORTS

*ASTM Standard F22070-06 governs rehabilitation of pipelines

LONG HISTORY OF SUCCESSFUL TESTING & USE OF CURED-IN-PLACE PIPE LINERS

- As of 2015, over 500,000 feet installed in U.S. (750,000' worldwide); over \$20 million spent on technology testing
- Testing over two decades (several projects – NYGAS, GRI, individual LDCs)
 - Life cycle testing
 - Aged pipe/post-mortem testing for pipe extracted after (10) years of use
 - Several long-term R & D programs at Cornell
 - Sample 6-minute video with details from 2014 Cornell testing (several types) https://www.nysearch.org/news-info_062215.php
 - Example test result – 6” Starline liner can withstand (50) yrs of combined expansion and contraction. That’s 2 million cycles of vertical displacements and rotations that correspond to heavy traffic loading!
- Products: Starline 2000, AMEX 2000, Paltem



SUMMARY

- NYSEARCH/NGA and previously NYGAS (pre-2001) have several members with cast iron pipe of all sizes that is costly and difficult to replace
- LDCs have made considerable investment in a rehabilitation technique using CIPP that they need to be deemed equivalent to replacement; to date- regulators are still deeming it 're-conditioned pipe'
- Given the environmental movement to reduce use of NG, LDCs need an economical means of making the pipe safe and no longer prone to leaks without replacing it
- Opportunities and challenges exist for particularly larger diameter cast iron pipe – new solutions needed
 - There are some LDC SMEs with extensive experience in rehabilitation of CI pipe that can provide advisory input for work on new solutions