

ASBESTOS CEMENT PIPE: WHAT IF IT NEEDS TO BE REPLACED?

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ABSTRACT: Asbestos cement (AC) pipe, also known as “transite,” was a popular choice of engineers for potable water, sanitary sewer, and storm drain pipelines during the 1940s, 1950s, and 1960s. AC pipe was touted for its light weight and ease of handling, low coefficient of friction (Manning’s “n” = 0.010), and corrosion resistant properties. An estimated 600,000 miles of AC pipe were installed in the U.S. and Canada.

Due to health concerns associated with the manufacturing process, production of AC pipe ceased in the United States in the early 1970s. The U.S. Environmental Protection Agency (EPA) issued a complete ban on all asbestos-containing products in 1979, but was defeated in the U.S. Fifth Circuit Court of Appeals and the ban was lifted. The Court did, however, reinforce the EPA’s responsibility to regulate asbestos.

Hundreds of thousands of miles of AC pipe are beyond or are approaching the end of their 50-year design lives. Two very effective technologies for replacing AC pipe are pipe bursting and pipe reaming. However, existing regulations limit the use of these trenchless construction methods.

Many public agency officials and engineers are not familiar with the regulations restricting pipe bursting and pipe reaming of AC pipe. Regulatory application is not consistent from one state to the next, or even within the same state in many instances. Enforcement is occurring much more frequently; however, and it is important for those in our industry to clearly understand the restrictions. This paper will examine the regulations on AC pipe rehabilitation and replacement, evaluate the impacts of the restrictions, and discuss the current position of the regulators.

INTRODUCTION

Asbestos cement (AC) pipe became a viable option for water, wastewater, and storm drainage systems beginning in the mid-1940s. The materials used to fabricate AC pipe included Portland cement, up to 12 percent asbestos fibers, water, and silica or silica-containing materials. The pipe was formed under pressure and heat cured in an autoclave. The presence of the asbestos fibers in lieu of reinforcing steel provided adequate strength with lower weight. In addition to its light unit weight, AC pipe was marketed as having very good resistance to the effects of hydrogen sulfide corrosion and soils that were aggressive to steel, and low operating costs because the smooth walls of the pipe provided low friction factors. The major U.S. manufacturers of AC pipe are shown in Table 1.

Table 1. Manufacturers of Asbestos Cement Pipe

Company Name	Headquarters Location
Cement-Asbestos Product Company	Woodward, Alabama
Certain-teed Products, Company	Ambler, Pennsylvania
Flintkote Company (Orangeburg Mfr. Div.)	Orangeburg, New York
Johns-Manville Company	New York, New York

AC pipe was manufactured in four different classes, for various applications. Each type of pipe was manufactured to specific ASTM standards. The individual characteristics for each material are shown in Table 2. Each section of pipe and each fitting were marked with the size and pipe class, manufacturer’s

name or trademark, and date of manufacture. Each rubber gasket was also marked with the manufacturer's trademark and date of manufacture.

Table 2. Characteristics of Asbestos Cement Pipe

Type of Pipe	Typical Use	ASTM Standard	Size Range (in.)	Crush Strength (lb/ft)	Pressure Class (psi)
Nonpressure	Sanitary sewers	C 428	4–42	1,500–7,000	--
Pressure	Local water mains, sewer force mains	C 296	4–18	4,100–17,400	100, 150, 200
Storm Drain	Storm drains	C 663	4–42	1,500–3,750	--
Transmission	Water mains	C 668	6–42	2,000–42,000	300–900

Due to its light unit weight, relatively low installation cost, superior corrosion resistance, and low friction factor (Manning's "n" = 0.010), AC pipe was very popular during the 1950s, 1960s, and early 1970s. Vitrified clay pipe provided a competitive alternative for use in sanitary sewer systems, but AC pipe soon became the pipe of choice for water and storm drainage systems. A survey conducted by the American Water Works Association (AWWA) in 2004 found that, on average, AC pipes constitute approximately 15–18 percent of the nation's water distribution and transmission systems. In North Carolina, AC pipe comprises nearly 5,000 miles of pipeline or approximately 6.5 percent of all water mains installed. The amount of AC pipe installed in various entities within North Carolina ranges from zero to ninety-eight (98) percent. This illustrates that there is a substantial quantity of AC pipe installed in North Carolina and is quite prevalent in some communities.

Communities that experienced significant growth during the 1950s and 1960s, however, constructed their infrastructure systems when the use of AC pipe was prevalent. These cities have percentages of AC pipe that are much higher than the national average, especially if one or more AC pipe manufacturing facilities were located nearby. Through our research, we found that AC pipes comprised from 50-80% of typical storm drain systems in the western U. S. and Canada; water systems included 40-75% AC pipes; sewer systems included 10-25% AC pipe (mostly in force mains). Usage rates as found through our literature search for the various systems are shown in Figure 1. As a comparison, the AWWA survey of 50 responding communities (mainly large municipalities in the eastern U. S.) reported that 15% of infrastructure systems are comprised of AC pipe as a national average. Overall, it is estimated that more than 600,000 miles of AC pipe are in use throughout the U.S and Canada.

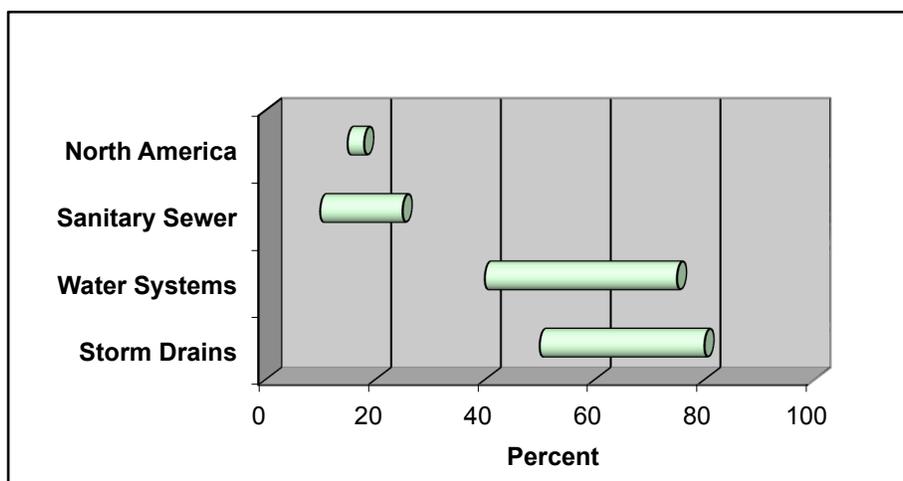


Figure 1. Asbestos cement pipe was used extensively in water and storm drainage systems built between 1950 and 1969

Under certain conditions, AC pipe has experienced failures at rates that are similar to other pipe types during their 50-year design lives. However, many public agencies have reported significantly higher failure rates for AC pipe than for other pipe materials. Ironically, the major factor in predicting failures of AC pipe appears to be aggressive soils—one of the conditions that AC pipe was supposed to protect against. Overall, however, studies have shown that the failure rate for AC pipe increases dramatically with age. After 50 years of use, AC pipe failure rates are about one per year per mile of pipe.

THE HISTORY OF ASBESTOS REGULATION

In 1973 the National Emissions Standards for Hazardous Air Pollutants (NESHAP) was implemented by the United States Environmental Protection Agency (EPA) when it was determined that asbestos was a leading contributor to asbestosis and certain forms of cancer. Through NESHAP, the EPA sought to protect the public by controlling exposure to asbestos during the milling, manufacture, common use, spraying, renovation, demolition, and disposal of more than 3,000 asbestos-containing products.

Effectively regulating such a large class of diverse products proved to be a daunting task. In 1979 the EPA announced its intent to ban all asbestos-containing materials. By 1986 the EPA proposed a rule to ban asbestos. The EPA's Asbestos Ban and Phaseout Rule was published in the Federal Register¹ in 1989, proposing to eliminate all asbestos-containing materials in three stages between 1990 and 1997.

The Asbestos Information Administration and the Asbestos Institute (with major funding from the government of Canada) conducted significant lobbying efforts against the Asbestos Ban and Phaseout Rule. One large manufacturer of asbestos-containing products, Corrosion-Proof Fittings, successfully sued the EPA to block implementation of the ban. The U.S. Fifth Circuit Court of Appeals ruled that the EPA had failed to present a compelling case for banning all asbestos-containing materials. The Court did, however, reinforce the EPA's responsibility to regulate asbestos, and new products containing asbestos were banned.

The impact on the asbestos pipe industry was uncertainty and fear. After 1973, the asbestos fiber content in AC pipe was reduced from 12 percent to less than 0.2 percent. By the 1980s the popularity of AC pipe had waned dramatically due to fears of liability and the availability of PVC pipe. Manufacturers stopped producing AC pipe in the United States; however, the machines were moved to other countries (including Mexico and Saudi Arabia), and AC pipe is still produced and available today.

ASTM Subcommittee C17.03 remains active and tasked with maintaining a series of ASTM specifications related to the manufacture, installation, and testing of AC pipe. Table 3 lists the ASTM specifications for AC pipe.

Table 3. Asbestos Cement Pipe ASTM Specifications

Specification Number	Subject
C296	Pressure Pipe
C428	Non-pressure Sewer Pipe
C458	Organic Fiber Content
C500	Test Methods for AC Pipe
C663	Storm Drain Pipe
C668	Transmission Pipe
C966	Installing AC Non-pressure Pipe
D1869	Rubber Rings for AC Pipe

Table 4 shows the AC pipe standards promulgated by the American Water Works Association (AWWA). In November 2008, the AWWA withdrew its AC pipe standards.

Table 4. Asbestos Cement Pipe AWWA Specifications

Specification Number	Subject
C400	Pressure Pipe, 4"-16"
C401	AC Pipe Selection, 4"-16"
C402	Pressure Pipe, 18"-42"
C403	AC Pipe Selection, 18"-42"

REGULATIONS FOR AC PIPE

In most states, public agencies are *not* required to remove and replace AC pipe. Studies have indicated that, in normal use, AC pipe does not pose a threat to public health; however, certain activities—including tapping, cutting, crushing/removing, and disposing—are regulated.

Contrary to common belief, in many states specially licensed contractors are not required when working with AC pipe. Many states have developed programs to train individual employees in safe practices involving the regulated AC pipe practices. These training programs provide an employer exemption for registration requirements. In addition, guidelines have been established for licensing of course providers in order to extend the available training resources while maintaining consistency in content and message.

The EPA has addressed replacement of AC pipe using the pipe bursting method. In a letter issued July 17, 1991, the EPA stated its position that “the crushing of asbestos cement pipe with mechanical equipment would cause this material to become ‘regulated asbestos containing material’ (RACM)” and “. . . the crushed asbestos cement pipe in place would cause these locations to be considered active waste disposal sites and therefore, subject to the requirements of §61.154 (NESHAP).” Furthermore, in this same letter, the EPA goes on to advise that “In order to avoid the creation of a waste disposal site which is subject to the Asbestos NESHAP, the owners or operators of the pipe may want to consider other options for dealing with the abandoned pipe.” Since the EPA’s letter did not specifically identify pipe bursting, interpretation of the intent was inconsistent throughout the industry.

260-foot Exclusion: NESHAP includes an important exclusion for pipeline replacements. This exclusion allows single renovations of up to 260 linear feet or within a calendar year for nonscheduled operations. Although the exclusion was likely intended to allow some flexibility for small replacement projects, the exclusion also provides us with the opportunity to pilot test rehabilitation methods for AC pipe and test the impacts of construction.

CURRENT EPA ACTIVITIES

Key EPA staff members continue to survey the industry to learn about pipe bursting, pipe reaming, and AC pipe. They are trying to gain an in-depth understanding of the rehabilitation techniques in order to determine the extent to which pipe bursting or pipe reaming of AC pipes constitutes a threat to public health. They are also trying to determine whether existing restrictions are reasonable (either too much or too little).

Currently, the EPA staff has expressed a preference for pipe reaming over pipe bursting because reaming can remove a portion of the asbestos pipe fragments through the downstream receiving pit. Pipe bursting, on the other hand, leaves all of the broken pieces of pipe entombed in the soil surrounding the new pipe. Concerns seem to be centered on possible exposures during future excavations.

A pair of Florida contractors have recently (separately) approached the EPA in Washington D.C. to request issuance of a perpetual notification determination that would allow pipe bursting of AC pipe in the

State of Florida. EPA, through their lawyers and biologists, wanted to know what studies had been done to guarantee that the asbestos fibers wouldn't migrate up through the soil, groundwater and pavement to become airborne. Based on the meetings to date, EPA is willing to allow pipe bursting on a case-by-case basis, but it will not issue a unilateral exemption from notification of the potential impacts inherent to this type of project.

Independently, organizations such as the Government Regulations Subcommittee of the International Pipe Bursters Association (IPBA) are trying to develop a science-based argument with which to approach the EPA. The goal is to convince the EPA to modify the AC pipe regulations to specifically address the public health impacts of replacement by pipe bursting or pipe reaming. In the meantime, the EPA and local air quality boards are aggressively enforcing current restrictions.

SPECIFIC STATE REGULATIONS

The EPA has delegated administration and enforcement of asbestos regulations to many of the individual states. Program administration often falls to a statewide department that enforces many environmental policies. In North Carolina, enforcement of the NESHAP regulations is managed by the Health Hazards Control Unit of the Division of Public Health of the North Carolina Department of Health and Human Services. There are also three local programs in the State of North Carolina responsible for enforcing the NESHAP regulations within their jurisdiction. These three programs are the WNC Regional Air Pollution Control Agency of Buncombe County, the Environmental Affairs Department of Forsyth County, and the Department of Environmental Protection of Mecklenburg County.

As the title of this paper poses, if a segment of asbestos cement pipe needs to be replaced, what are the requirements? Under the North Carolina rules, individual asbestos removals where 160 square feet, 260 linear feet, or 35 cubic feet or greater of RACM is to be demolished or renovated, a permit application is required.

Policies in other states are different. In South Carolina, a project license for the work to be performed must be obtained before beginning work and any person or contractor engaged in this activity must be RACM licensed. In Arizona and New Mexico, AC pipes can be replaced by pipe bursting or pipe reaming following filing of a notice of intent. In Oregon, specially licensed abatement contractors are required to remove and dispose of AC pipe. Oregon is also the only state that requires all AC pipe to be removed if it is exposed for any reason. In Nevada, New Jersey, and New York, specially licensed contractors are required for any work (including taps) performed on AC pipe.

PIPE BURSTING VS. PIPE REAMING FOR AC PIPE

Pipe bursting is a construction method that allows an existing pipe to be replaced with a new pipe of the same or larger diameter with limited excavation. Several different types of equipment, including static, pneumatic, or hydraulic equipment, are available to break the host pipe and pull or push a new pipe into the open cavity. As recently as 2010, the EPA cited pipe bursting as an effective means for rehabilitating force mains² and wastewater collection systems³.

Pipe reaming is similar to pipe bursting in that it is a process to replace an existing pipe with a new pipe of the same or larger diameter; however, the equipment used to create the cavity involves modified horizontal directional drilling equipment. Whereas in pipe bursting, the host pipe is broken into fragments and pushed into the surrounding soil, in pipe reaming, the host pipe is ground into smaller fragments.

During pipe reaming, drilling fluid is pumped into the borehole to flush pipe fragments and soil to the downstream receiving pit. The mixture of mud, soil, and pipe fragments can be collected for disposal. When the host pipe is AC, the collected mixture must be containerized and disposed of at an appropriate landfill site. This ability to contain and appropriately dispose of the AC pipe fragments is the primary reason that the EPA favors pipe reaming. To date, no studies have been done to quantify how much of the pipe is recovered during reaming, but an EPA staff member was quoted in offering an opinion that up to 90% of the pipe fragments may be removed.

Whereas pipe reaming is a patented process, the patent on pipe bursting has expired. There are far more contractors who are experienced pipe bursters. The number of projects completed by pipe bursting is much greater than pipe reaming. Only a few projects resulting in installation of pipes over 18 inches have been performed by pipe reaming. Pipe bursting can be used to install pipe up to 48 inches in diameter. The unit cost of pipe bursting is less than pipe reaming.

Certain EPA staff members are of the opinion that matters such as number of contractors, installation size range, and cost are market driven. If there is more demand for pipe reaming, then more contractors will become licensed and experienced, resulting in a wider installation range and more competition (leading to lower costs).

THE FUTURE OF AC PIPE REPLACEMENT

Hundreds of thousands of miles of AC pipe are reaching the end of their 50-year useful lives and will need to be replaced soon. Each engineer, contractor, and public official responsible for replacing AC pipe should be aware of the policies in place in the area where they work.

Since the EPA is soliciting input from the industry prior to revising existing regulations regarding replacement of AC pipe, now is an excellent time to contact the EPA to offer the benefit of your knowledge and to voice your opinions. These revisions are critical to our industry and it is important that the EPA have all of the available information in order to make prudent decisions.

The Water Research Foundation is currently leading a study to establish tools to predict the long term performance of AC pipes. Additional research is underway to develop bentonite lubricants that solidify after pipe installation to form a conglomerate with the pipe fragments, similar to a controlled low-strength material used for backfill. Such a product could substantially reduce the risk of future exposure to friable material.

Administrative procedures need to be developed to ensure that AC pipes replaced by either pipe bursting or pipe reaming are adequately marked so that maintenance activities can be properly planned and safely performed. Using the 260-foot exclusion, testing should be conducted to definitely determine the condition of pipe fragments remaining in the soil and the extent of pipe fragment removal accomplished.

REFERENCES

1. Federal Register, Volume 59, pg 41027, August 10, 1994.
2. State of Technology Report for Force Main Rehabilitation United States Environmental Protection Agency, Office of Research and Development, EPA/600/R-10/044, March 2010.
3. State of Technology for Rehabilitation of Wastewater Collection Systems, United States Environmental Protection Agency, Office of Research and Development, EPA/600/R-10/078, July 2010.