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Standard Practice for Close Tolerance Pipe Slurrification (CTPS) Method to Replace, Rehabilitate, and Repair Existing Buried Asbestos Cement (AC) Pipe Systems[1]

This standard is issued under the fixed designation F3632; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the requirements and test methods of an EPA-approved alternative work practice (AWP) for the replacing of an Asbestos Cement (AC) pipe by the Close Tolerance Pipe Slurrification Method in accordance with said EPA CTPS AWP issued on June 10, 2019. This process utilizes a patented method (US 10,557,587 B2)[2] and other specially designed tools designed to work with the EPA regulations surrounding AC pipe work. Specifically, the special (patented) back reaming tool (US 8,365,841 B2)[2] delivers the required bentonite-based fluid to maintain a wet cutting environment which is an important requirement for cutting Asbestos Cement Material (ACM). The sizing of the cutting head is set at 0.25 in. in diameter greater than the replacement pipe's outside diameter to facilitate the removal of the ACM. This close tolerance sizing creates a scenario where the new pipe, along with the injection of the drill fluid, will allow the slurry to flow and subsequently expel at pre-determined pit locations. The slurry containing the ACM is then removed from the site and properly disposed of. Any remaining trace amounts of asbestos fiber in the ground are encapsulated in a skim coat of the slurry remaining around the new pipe, the skim coat having the consistency of a lightweight concrete material commonly known as excavatable flowable fill.

1.2 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2657 Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

D3035 Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

F412 Terminology Relating to Plastic Piping Systems

F1417 Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

F2164 Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure

F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

2.2 *AWWA Standards:*

AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)

AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4IN. Through 65 IN. (100 MM Through 1,650 MM), for Waterworks

AWWA Manual of Practice M23 PVC Pipe – PVC Pipe - Design and Installation

2.3 *Plastic Pipe Institute (PPI):*

Plastic Pipe Institute's Handbook of PE Pipe Design of PE Piping Systems

[1] This test method is under the jurisdiction of ASTM Committee F36 on Technology and Underground Utilities and is the direct responsibility of Subcommittee F36.20 on Inspection and Renewal of Water and Wastewater Infrastructure.

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[2] The methods (created by Dimitroff, Ted R.) US 10,557,587 B2 and US 8,365,841 B2 are covered by a patent. Interested parties are invited to submit information regarding the identification of an alternative(s) to this patented item to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

2.4 *Environmental Protection Agency:*
EPA Notice of Final Approval Alternative Work Practice Standard for Asbestos Cement Pipe Replacement – EPA-HQ-OAR-2017-0427 : FRL-9994-29-OAR
40 CFR 61.145 Standard for demolition and renovation
40 CFR 61.150 Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations
40 CFR 61.154 Standard for active waste disposal sites
40 CFR 61.155 Standard for operations that convert asbestos-containing material into nonasbestos (asbestos-free) material
2.5 *OSHA Standards:*
29 CFR 1926.1101 Asbestos

3. Terminology

3.1 *Definitions:*

3.1.1 Unless otherwise indicated, definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *ACM, n*—Asbestos Containing Material: any material containing more than 1 % asbestos

3.2.2 *AC Pipe, n*—Asbestos Cement Pipe

3.2.3 *ACPRP, n*—Asbestos Cement Pipe Replacement Project

3.2.4 *competent person, n*—one who is capable of identifying existing asbestos hazards in the workplace, is capable of selecting the appropriate control strategy, and has the authority to take prompt corrective measures. Personnel must be trained to meet the criteria of the EPA Model Accreditation Plan for contractors/Supervisor/Workers for Class II work.

3.2.5 *drill fluid, n*—a bentonite-based lubricating fluid for the pipe reaming process that is pumped through the drilling stem/rod to create a wet cutting environment.

3.2.6 *friable asbestos material, n*—any material containing more than 1 % asbestos (ACM) that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

3.2.7 *Negative Exposure Assessment (NEA), n*—a demonstration by an employer that an employee's exposure during an operation is expected to be consistently below the Permissible Exposure Limit (PEL) and the Excursion Limit (EL). If the employer can demonstrate that employee exposures are below the PEL and EL by any of the following means, this is deemed a NEA.

3.2.7.1 Objective data,

3.2.7.2 Personal air sampling results collected from the previous 12 months,

3.2.7.3 Initial monitoring of the current project,

3.2.7.4 A Negative Exposure Assessment has been made, or

3.2.7.5 All employees in a regulated area are wearing supplied air respirators operated in the pressure demand mode, or other positive pressure mode respirator.

3.2.8 *NESHAP, n*—National Emission Standards for Hazardous Pollutants are stationary source standards for hazardous air pollutants. Hazardous air pollutants are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

3.2.9 *regulated area, n*—an area established by the contractor where Class II asbestos work is being conducted, along with any adjoining area where debris and waste accumulates. The requirements of a regulated area are: (*1*) It is clearly marked to minimize the number of persons therein while protecting persons outside the area; (*2*) access is limited to authorized personnel only; (*3*) eating, drinking, smoking, chewing, and the application of cosmetics are prohibited in this area; and (*4*) a competent person must supervise the work within the regulated area.

3.2.10 *skim coat, n*—the portion of the waste slurry that remains on the exterior of the new pipe.

3.2.11 *slurry, n*—the mixture composed of the drilling fluid, AC pipe, and soil.

4. Summary of Practice

4.1 Close Tolerance Pipe Slurrification is a trenchless method used to remove and replace an existing AC pipeline with a minimum amount of excavation. The CTPS method removes the existing AC pipe by pulling a rotating cutting head through the existing pipe while simultaneously injecting a bentonite-based lubricating fluid. The cutting head rotates at a sufficient speed to grind the existing pipe and surrounding soil, combining it with the bentonite-based lubricating fluid into a slurry. The accumulating slurry mixed with the ground up AC pipe is pushed down the existing pipe by the advancing replacement pipe and taken (vacuumed) out of the existing AC pipe through a series of vertical holes between the ground surface and the existing pipe at planned intervals or at the receiving pit. After completion of the CTPS process, the existing pipe will have been removed, the new pipe installed through the subsequent tight-fitting void, and the slurry containing the existing pipe fragments, soil, and bentonite fluid safely removed from the ground and properly disposed of at a landfill certified to receive ACM.

5. Significance and Use

5.1 This practice is for use by engineers, regulatory agencies, owners, and inspection organizations who are involved in the removal and replacement of AC pipes through the use of a method that is in compliance with the rules for removing and replacing AC pipe in accordance with NESHAP and OSHA requirements governing the handling, removal, and disposal of any ACM.

6. Materials

6.1 *Pipe:*

6.1.1 The pipe material used in the CTPS process shall conform to the requirements of Specification D3035 (or AWWA C906) for HDPE pipe, or AWWA C900 for PVC pipe.

6.1.2 The required wall thickness and hydrostatic design stress rating for HDPE piping shall be as determined by engineering design for the subject application using Chapter 6 – Design of PE Piping Systems in the Plastic Pipe Institute's Handbook of PE Pipe. The required wall thickness and

hydrostatic design basis for the PVC piping shall be determined by the engineering design for the subject application using the AWWA Manual of Practice M23, PVC Pipe—Design and Installation.

6.1.3 *Working Pressure*—For pressure pipe applications, the minimum working pressure for the design shall be the maximum average operating pressure, or MAOP, in accordance with the owner's operations documentation.

6.1.4 The inside diameter shall be equivalent to the existing pipe, or the new pipe size required to be used to comply with the EPA's CTPS AWP.

6.1.5 The new pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

6.1.6 The color of the pipe shall be coded based on the product to be carried by the new pipe.

6.2 *Pipe Joining and Fittings:*

6.2.1 Pipe joining of the new pipe shall be by butt fusion welding to provide for a leak-proof joint. Threaded or solvent cement joints and connections are not permitted.

6.2.2 *Pipe Joining:*

6.2.2.1 HDPE pipe and fittings shall be joined by the heat fusion joining practice in Practice F2620.

6.2.2.2 PVC pipe and fittings shall be joined by the heat fusion joining practice in Practice D2657.

6.2.2.3 Terminal sections of pipe that are joined within the insertion pit shall be connected with a mechanical joint fitting, a mechanical joint adapter, or both.

7. CTPS Process Requirements

7.1 *General:*

7.1.1 The contractor must handle all sections of the AC pipe in accordance with 40 CFR 61.145 and 40 CFR 61.150 of the Asbestos NESHAP.

7.1.2 The contractor must avoid to the extent feasible crumbling, pulverizing, or reducing to powder the AC pipe during the excavation of the vertical access or slurry relief points.

7.1.3 Appropriate measures must be taken to prevent the slurry from coming into direct contact with the surrounding soils of the terminal ends access and intermediate vertical access (slurry removal) holes. In accordance with EPA recommendations, this can be accomplished by using plastic sheathing or other type of impermeable barrier material placed on the walls of the vertical access (slurry removal) holes and the bottom and sides of the terminal access holes to prevent the slurry from contacting the surrounding soils.

7.1.4 To achieve the required close tolerance and to minimize the thickness of the skim coat, the CTPS process must use a certified AWP tool train reamer with a slightly larger diameter (approximately ¼ in.) than the new pipe.

7.1.5 The guide head must fit closely to the I.D. of the old pipe and the cutting head must be drawn around the existing pipe and must grind the old AC pipe to a fine material using the liquid delivery system. To adequately grind the existing AC pipe to a fine material, the minimum cutting head rotation speed shall be 240 RPM along with a minimum rotational torque of 4000 in-lb. to properly grind the AC pipe and soil in the slurry mixture into a fine enough material to be removed by vacuum excavation from the service excavations and vertical slurry removal holes or shafts.

7.1.6 The location of the insertion pits and number of vertical slurry removal access shafts shall be such as to minimize the total number while assuring that no significant pressure will be developed in the advancing slurry in the existing pipe being replaced, and that the footage of pipe installed in a single run is maximized. Use excavations at point repair locations and service connections for insertion pits where possible.

7.1.7 Excavate entry and exit pits or vertical shafts to access the interior of the existing AC pipe. Hand excavate and remove AC pipe sections without creating any visible emissions of asbestos fibers. No dry cutting or grinding will be allowed. Bag and remove ACM in compliance with NESHAP requirements. Location of pits shall minimize quantity of pits and disruption to the public.

7.1.8 Drill stem shall be pushed through existing pipe from one pit to another where the guide head, reamer, and new product pipe shall be inserted.

7.1.9 Drill fluid shall be pumped through drill stem and released in such a manner that would lubricate the pipe, collect AC pipe debris, suppress AC dust, and collect AC fibers. No visible emissions will be allowed.

7.1.10 Reamer shall be sized no more than 0.25 in. in diameter greater than the outside diameter of the of the new pipe being installed so that the majority of the drill slurry (containing soil, AC pipe debris, and AC fibers) will be forced into pit excavations, service excavations, and relief holes.

7.1.11 The pipe pulling cap shall be sized to match the diameter of the reamer.

7.1.12 The slurry shall be removed from the pit, relief holes, and service excavations and disposed of in a manner that is compliant with NESHAP requirements for ACM.

7.1.13 ACM shall be disposed of at a landfill approved to receive ACM by the county, state, and federal environmental agencies.

7.2 *Lubrication:*

7.2.1 The drilling fluid used for the pipe Slurrification process is the responsibility of the contractor who shall follow the drilling fluid recipe guidance given on p. 19 in the *Guidelines for Replacing Asbestos Cement Pipe by Close Tolerance Slurrification* (06/11/2021) developed by the CTPS process patent holder regarding the Bentonite-based fluid mixture with adjustments as needed for the groundwater conditions present on the project site. The drilling fluid recipe must consist of a lubrication fluid, hole sealing material (bentonite), and a material suspension fluid.

7.2.2 The contractor is required to ensure that the slurry (including the slurry that remains as a skim coat) is a homogenous mixture comprised of the finely ground AC pipe, drilling fluid, bentonite clay, and other materials suspended in solution that, when cured, hardens so that it meets the required sample friability test (7.3.7).

7.2.3 The contractor must ensure that the CTPS train pulls the replacement pipe behind it along with a locating wire or other durable tracking material for future locating of the new

pipe. The new pipe must be sealed to ensure no ACM contacts the inside of the new pipe.

7.2.4 The slurry must meet the no visible emissions requirements of 40 CFR 61.145 and 40 CFR 61.150.

7.3 *NESHAP-Approved Alternative Work Practice Standards for AC Pipe Replacement:*

7.3.1 *Notification:*

7.3.1.1 The pipe owner or operator shall be advised as to when the work will start so that the state and federal EPA can be notified ten days prior to the disturbing of the AC pipe.

7.3.1.2 Notification shall include the location using the latitude and longitude (to six digits) coordinates of the AC pipe.

7.3.2 *Pre-Work Inspection:*

7.3.2.1 Prior to using the CTPS process for an ACPRP, the owner or operator will have conducted an underground pipe inspection which shall identify, locate, and construct an underground utility map of the area with all identified potential areas of malfunctions such as changes in pipe type, drops in the line, broken and off-center points.

7.3.2.2 The owner/operator of any ACPRP must save the video recording of the inspection and make it available at the ACPRP work site for reference by inspectors, owners, and the contractor during the ACPRP work.

7.3.3 *Slurry Removal, Containment, Labeling, and Transportation Requirements:*

7.3.3.1 The slurry is to be removed at the vertical access points using a vacuum attached to a tank or vacuum truck.

7.3.3.2 The contractor is required to ensure that the slurry remains in an adequately wet state during the slurrification process and in containment through removal, transportation, and disposal processes meeting the requirements of 40 CFR 61.145 and 40 CFR 61.150.

7.3.3.3 All slurry produced as a result of the ACPRP must be labeled and transported in accordance with the corresponding requirements of 40 CFR 61.145 and 40 CFR 61.150 in Asbestos NESHAP. The only slurry material that may remain is the skim coat on the new pipe and is not subject to the removal disposal requirements provided it is confirmed as non-friable and left undisturbed in the ground.

7.3.4 *Disposal Requirements:*

7.3.4.1 NESHAP requires that all ACM waste be disposed of at a waste disposal site operated in accordance with the provisions of NESHAP regulation Section 61.155.

7.3.4.2 The slurry must be disposed of in a slurry form and placed in leak-tight containers in a landfill authorized to accept ACWM and meeting the requirements of 40 CFR 61.154.

7.3.4.3 Waste Shipment Records (WSR) must be maintained for a period of two years by the generator (contractor). The WSR must include the following information:

(1) Name, address, and telephone number of the waste generator.

(2) Name and address of the local, state, or EPA regional agency responsible for administering the asbestos NESHAP program.

(3) The quantity of asbestos containing waste material in cubic yards (or cubic meters).

(4) The name and telephone number of the disposal site operator.

(5) Name and physical site location of the disposal site.

(6) Date transported.

(7) Name, address, and telephone number of transporter(s).

(8) Certification that the waste was properly classified, packed, marked, labeled, and transported.

7.3.4.4 In accordance with the Asbestos NESHAP, the slurry must be disposed of as soon as is practical.

7.3.5 *Equipment Decontamination or Disposal:*

7.3.5.1 The equipment used for conducting the ACPRP may be either decontaminated or disposed of so that no ACM remains within or on the equipment after each ACPRP. Disposable lining/containers that prevent the slurry from coming into direct contact with the machinery may be used.

7.3.5.2 Water used in the decontaminating is recommended to be contained and filtered before being released.

7.3.6 *Testing—Watertightness Testing of the New Pipe:*

7.3.6.1 Testing of the new pipe for watertightness shall be in accordance with the service requirements and in accordance with local standards.

7.3.6.2 Gravity pipe applications shall be tested using Practice F1417 using low pressure air and the constant pressure method therein.

7.3.6.3 For pressure pipe applications, watertightness shall be determined using Practice F2164 for HDPE piping and AWWA C605 Section 10.3.5 for PVC piping. The test pressure shall be 1.5 times the maximum average operating pressure of the system.

7.3.7 *Slurry Friability Testing—Sample Collection:*

7.3.7.1 After the slurry has been pumped from the vertical access points, but before disposal, the contractor shall collect a minimum of three 2 in., roughly spherical, wet samples of the slurry using a commercially available ball mold.

7.3.7.2 Samples must be collected for each project discharging into a single enclosed tank.

7.3.7.3 The contractor must seal the sample in a leak tight container and allow the sample to harden and dry in a storage container that will not expose it to freezing temperatures or rapid drying.

7.3.8 *Sample Friability Testing and Certification:*

7.3.8.1 When the sample is hardened and dry, the contractor shall attempt to crush the sample by hand.

(1) If the sample cannot be crushed, crumbled, or reduced to powder by hand pressure, the contractor shall certify the sample as non-friable.

(2) If the sample can be crushed, crumbled, or reduced to powder by hand pressure, the contractor will be required to follow the hardening malfunction reporting requirements for the friable ACM.

(3) If a hardening malfunction occurs with the first sample, the backup balls shall be tested to confirm that indeed a friable ACM has been left along the new pipe. Any friable ACM must be retrieved and properly disposed of, or the site must be treated as an active asbestos waste disposal site and appropriate actions taken.

7.3.8.2 After testing, the contractor must ensure that the sample is packaged in a leak-tight container for storage and