CONTRACT AMENDMENT

DuPage County - Procurement Services Division

Contract Number: 23-065-PW

Contract Amendment No. 1

Effective June 25, 2024

This Contract is Amended as Follows:

Contract Number: 23-065-PW

Trenchless Rehabilitation and Maintenance of Pipeline Infrastructure

1) The addition of the following specifications/scope(s) of work by Insituform Technologies, LLC, for: Epoxy Lining of Water Mains, Cement Lining of Water Mains, Close Tolerance Pipe Slurrification, and Flexible Fabric Reinforced Pipe, as set forth in Exhibits A, B, C, D, and E (Pricing), attached hereto.

All other provisions of the contract not expressly changed herein shall remain the same in their entirety.

The parties represent and warrant to each other that each party has full power, authority and legal right to execute, deliver and perform this Amendment and the execution, delivery & performance hereof have been duly authorized by all necessary actions.

IN WITNESS, WHEREOF the undersigned duly authorized representative of the parties has executed this Amendment as of the date below written.

THE COUNTY OF DUPAGE, ILLINOIS	INSITUFORM TECHNOLOGIES, LLC.
By: [signature]	By: [signature]
SIGNATURE	SIGNATURE
Deborah A. Conroy	Patrizia H. Sordillo
PRINTED NAME	PRINTED NAME
DuPage County Chair	Contracting & Attesting Officer
PRINTED TITLE	PRINTED TITLE
7-17-2024	July 9, 2024
DATE	DATE

EXHIBIT A - SPRAY APPLIED EPOXY LININGS FOR WATER LINE REHABILITATION

PART 1 GENERAL

1.01. DESCRIPTION

A. Provide all labor, materials, equipment, and appliances required for the installation and testing of epoxy-based spray applied liner for the rehabilitation of water lines

B. Achieve curing through controlled chemical reaction that results in a hard, water tight coating of specified thickness with a uniformly smooth interior

C. Spray lining application method which uses centrifugal force to apply a plural component lining mixture to the interior of piping systems. The system shall be able to accommodate varying pipe diameters as well as be able to accommodate elbows and bends within the pipes, while applying an even, smooth lining throughout the entire length of pipe that is required within the specified scope of work.

D. Work shall include surface preparation, liner application, inspection of coated surfaces and corrective action required, protection of adjacent surfaces, cleanup and appurtenant work required for the proper coating of all surfaces to be coated.

E. Perform Work in strict accordance with manufacturer's published recommendations and instructions, unless the ENGINEER stipulates that deviations will be for the benefit of the project.

1.02. REFERENCE STANDARDS

A. American Water Works Association (AWWA) Manual of Water Supply Practices M28

B. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03. QUALITY ASSURANCE

A. Epoxy Lining

1. Comply with latest editions of AWWA C620 – "AWWA Standard for Spray-Applied In-Place Epoxy Lining of Water Pipelines, 3 In. (75 mm) and Larger"
2. Epoxy Manufacturer: Minimum of 10 years documented experience in the design, development, and production of products specified in this section.
3. Manufacturer shall have supplied the same specific epoxy product proposed for this project on other water main epoxy lining projects within the continental United States within the past two years, constituting a total of 20,000 linear feet of successfully applied epoxy liner, as supported by specific references (name, title, phone number) of water main OWNERs.

B. Spray Lining Equipment: Certified by Manufacturer to provide the necessary and appropriate equipment and monitoring devices to apply the Manufacturer's spray liner to the interior of water main pipe in accordance with the Manufacturer's requirements, as well as all standards referenced in these specifications. CONTRACTOR to provide the OWNER written proof that the machine has been serviced and calibrated once a year or any other times between.

C. Video Inspection

1. Provide video inspections for the following;
    a. After cleaning
    b. After coating application

1.04. SUBMITTALS

In accordance with the procedures and requirements set forth in Section 01 33 00 Submittal Procedures, submit the following:

A. Product Data
    a. Manufacture's literature, warranty, and Material Safety Data Sheets for each product
    b. Lining schedule identifying surface preparation and lining systems proposed
    c. Provide the name of the liner product manufacturer, and name, address, and telephone number of manufacturer's representative.
    d. NSF Standard 61 certificate for the lining system.
    e. Data for the minimum and maximum curing temperatures, minimum and maximum allowable installation pressures and speeds, application rates, curing times and curing procedures.
    f. Repair methods and equipment to be used to repair unacceptable liner defects and for removing failed liner.

B. Provide qualification of CONTRACTOR'S personnel

C. Provide a list of the type of equipment to be used for surface preparation and the lining system including calibration logs of the lining machine.

D. Field testing equipment and procedures for each type of material/process/product proposed:
    1. Adhesion testing
    2. Thickness testing

E. Pre-lining video inspection and post-lining video inspection in a video format acceptable to Engineer.

F. Post Lining Pipe Samples:
    1. Dip Cards: Submit beginning of lining run and end of lining run dip cards after curing.

1.05. COORDINATION

A. Coordinate Work of this Section with users connected to system.

1. Notify all residents and businesses at least 2 weeks in advance of expected disruption of water service via a door hanger provided by the OWNER.
2. Notify all residents and businesses at least 48 hours in advance of expected disruption of water service via a door hanger provided by the OWNER.
3. Limit disruption of service to individual properties to one-time occurrence for maximum of eight hours.
4. Do not disrupt customer service between hours of 5:00 PM and 8:00 AM without prior approval from ENGINEER/OWNER.
5. Provide and maintain temporary facilities, including piping and pumps, to meet requirements.

1.06. EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to application.

B. Existing Pipe Conditions:

C. Pipe material, size and condition may vary from the Drawings. Verify prior to application.

1.07. WARRANTY

A. All work shall be warranted/ guaranteed for one (1) year from date of installation against all defects in material, equipment and workmanship. Lining warranty shall include deterioration of liner or loss of adhesion of the lining to the pipe wall.

B. This warranty shall be voided by the following:

1. Welding or "hot" work performed on the pipe system around welded area.
2. Introduction of acids into the pipe system with concentrations in excess of (10%)
3. Obvious physical damage to the pipe or pipe system outside of the relined pipe
4. Disassembly or mechanical altering of the pipe system without first consulting with the applicator to ensure warranty compliance.
5. Damage to the pipe system due to natural causes (e.g. pipe bursting from internal expansion in freezing temperatures, earthquake or flooding damage.
6. Other stresses placed on the pipe or pipe system or its contents which are not considered normal to the original intended use or function of the pipe system.

C. Upon notification from the OWNER of any defect found, the CONTRACTOR shall promptly repair or adjust the necessary items required for the repair. The

CONTRACTOR shall be responsible for all expenses incurred as a result of warranty work.

PART 2 MATERIALS

2.01. SPRAY APPLIED LINER

A. Liner material – A sprayable resin-based 100% solids, solvent-free system used to form a monolithic liner covering all interior pipe surfaces. All materials shall be NSF 61 potable water certified.

B. Thickness:

1. Individual liner thicknesses is called out in the bid item list and shall be verified by the CONTRACTOR and submitted prior to the start of Work. CONTRACTOR may elect to design and install multiple thickness liners for various diameters/configurations/depths within a given pipe segment or install a uniform thickness within a given pipe based on the thickest required portion of the liner.

    a. Maximum internal pressure: 150 psi

    b. Minimum internal pressure: 0 psi

    c. Minimum safety factor: 2

    d. A minimum service life of 50 years under continuous service.

    e. Physical Properties requirements on (1/8" casting)

        1) Tensile Strength (ASTM D638-86): 7,000psi

        2) Flexural Strength (ASTM D790-86): 11,000psi

        3) Flexural Modulus @ 0.100" (ASTM D790-86): 500,000psi

        4) Compressive Strength (ASTM D695-85): 12,000psi

        5) Tensile Elongation at Break: 4.8%

C. Purchase liner product from an approved manufacturer. Ship in sealed containers each marked with a batch number, date manufactured, shelf life, mix ratio, storage temperature tolerance range, and instructions for storage and safe handling.

1. CONTRACTOR shall not use a product that has exceeded its shelf life.

D. Provide the same lining product for the entire project produced by the same manufacturer. Use only thinners approved by the manufacturer, and only within manufacturer's recommended limits.

E. Ensure compatibility of total coating system for each substrate.

F. Require that personnel perform work in strict accordance with the latest requirements of OSHA Safety and Health Standards for construction. Meet or exceed requirements of regulatory agencies having jurisdiction and the manufacturer's published instructions and recommendations. Maintain a copy of all Material Safety Data Sheets at the job site of each product being used prior to commencement of work. Provide and require that personnel use protective and safety equipment in or about the project site. Provide respiratory devices, eye and face protection, ventilation, ear protection, illumination and other safety devices required to provide a safe work environment

G. Acceptable manufacturers

1. Epoxy Structural Lining

a. Warren Environmental, Inc. 301-01

b. Approved equal.

2.02. APPLICATION EQUIPMENT

A. Spray Lining Equipment

1. The Pipe Lining Equipment will be controlled with a computer operated system control that will monitor the flow characteristics of the lining material as it flows through the machine for constant quality control. The system will have automatic alarms in place to allow the machine to abort lining should and abnormalities occur during the process.

2. Spray lining equipment shall be in accordance with the manufacturer's recommendations and maintained and calibrated regularly.

PART 3 EXECUTION

3.01. VIDEO INSPECTION

A. Pre-lining and post-lining video inspection is required.

1. Conduct all video inspections with Engineer present.

2. Provide video and output report to the Engineer for each pre-lining and post-lining video with pay application. The output shall include limits, such as address and or intersections with footages.

B. Pre-Lining Video:

1. Visually inspect pipeline after pipeline has been cleaned to ensure cleaning has adequately removed deposits and that the liner can adequately be installed.

2. If the pipeline has to be re-cleaned, re-inspect with video equipment.

C. Post-Lining Video:

1. Visually inspect pipeline after lining has fully cured according to the cure times submitted.

2. Clean and disinfect video inspection equipment.

3. If the liner has repairs, re-inspect with video equipment for final post-lining video submission.

4. Utilize rollers so that cables, rods, and wires do not come in direct contact with the cut pipe edge or excavation edge.

3.02. PIPE CLEANING AND SURFACE PREPARATION

A. Pipe Cleaning and Surface Preparation

1. An opening at both ends of the pipe for access is required to allow access and egress for cleaning equipment.
2. Surface preparation methods shall be based upon the conditions of the substrate and the requirements of the spray in place pipe lining system.
3. Upon completion of the cleaning process the pipe shall be showered with compressed air to remove any leftover debris.
4. Coordinate with the OWNER to close the necessary valves or as directed by OWNER to isolate sections scheduled for cleaning from water mains providing active service. Verify that all customer connections affected by this action are served by the temporary water system and verify that no water is leaking into the sections to be cleaned and lined.
5. Field verify length of water main sections; limit lengths of individual pipe sections for cleaning and lining to not greater than the maximum length that can be lined with lining in one continuous operation using the CONTRACTOR'S equipment.
6. Isolate air release valves, if present, from water main section.
7. Clean and abrade pipe to produce a sound substrate with adequate profile and porosity to provide a strong bond between the monolithic surfacing system and the substrate. Remove heavy build up and scale in the pipe via approved method.
8. Notify Engineer if tees, crosses, valves, or reducers are encountered, other obstructions in pipe are found, or if bends, pipe sleeves, or couplings are encountered that the cleaning equipment will not pass through safely, or will not pass through and meet the cleaning standard specified. These obstructions shall be noted on red line drawings submitted to Engineer.
9. Excavate to remove obstructions by installing obstruction pits at these locations when directed by ENGINEER
10. Pass a suitably sized mandrel or "prover" through the water main to ensure that there is adequate clearance without obstructions for passing the applicator head through the entire section of pipe during lining.
11. Remove and dispose of dirty water and materials from the cleaning operation; obtain necessary disposal permits as required by law. Take appropriate steps to minimize public view of the material removed from the water main. With the approval of the OWNER, CONTRACTOR may provide settling tanks to remove coarse debris from the cleaning wastewater and discharge decant to a sanitary sewer manhole

3.03. APPLICATION

A. The pipe matrix will be entered into the computer control system, mapping any abnormalities and or imperfection into the pipe. This will allow the controls of the system to apply more or less material at the particular points noted.

B. The lining head will be implemented in an enclosure at the exit of the pipe matrix.

The material flow and mix ratio will be checked for abnormalities as a final physical quality control measure prior to the lining heads entry.

C. The lining head is entered into the pipe matrix and is then left to automated controls of the coating machine. The computer control system is monitored by a pipe lining operator during the entire process. The system is monitored at the opening of the pipe as well as monitored from the pipe entrance.

D. During the lining process the Computer control system is required to print off a quality assurance report at a minimum of every 20 seconds. This report must include Current mix ratio of material, pressure at which the material is applied, temperature of material, flow rate of material, distance currently in pipe and thickness of material currently being applied to the pipe.

E. Use equipment approved by the lining manufacturer for application of spray lining.

F. Conduct spray-lining operations only when pipe temperature is within the manufacturer recommended limits.

G. Conduct pre-lining checks on the lining equipment and the liner material in accordance with manufacturer's recommendations. Verify pump output; mix ratio, and material temperatures. CONTRACTOR to give a paper copy of the print out from lining machine that includes pre-lining checks and lining report at minimum every 15 seconds to Inspector to verify thickness and mix ratio per manufacturer specifications.

H. Pump and re-circulate both components until each component reach and maintain the temperature range recommended by the manufacturer. The equipment shall not allow the application of any lining material unless the specific conditions set by the manufacturer are met. When all necessary conditions are met the lining equipment shall be capable of autonomous operation monitored by failsafe protocols that will stop the application of material if the manufacturer's conditions for correct application are no longer met, or if an error or equipment failure is detected.

I. When end of hose assembly has been pulled to the second access pit, connect static mixer and application head to end of hose assembly and check for proper operation. Test spray the mixed epoxy into a container outside the pipeline; observe and record color of wet film. Typical spin up time of 60 to 90 seconds as needed to get the mix ratio right before lining. Begin spraying epoxy on pipe only after, all the manufacturers lining requirements are met by the equipment and operator.

J. Apply epoxy at a constant rate while winching the hose assembly back toward the lining equipment at a fixed speed, in accordance with manufacturer's instructions, to produce a smooth finished lining of the pipe to a minimum of

K. Dispose of all excess epoxy and cleaning agents in accordance with applicable federal, state, and local laws and regulations.

3.04. FIELD QUALITY CONTROL

A. The CONTRACTOR to preform adhesion testing at the end of the pipe to check the adhesion of coating to the existing host pipe. Test results to be submitted to the OWNER for approval.

B. Dip cards shall be taken at the beginning of the pipe lining and at the end of the pipe lining. Tag and allow dip cards to cure.

C. Upon completion of water main lining, the CONTRACTOR will conduct closed circuit television inspection of the line, as specified under 'Video Inspection'. Defective sections shall be repaired at no cost to the OWNER.

3.05. TESTING, CHLORINATION, AND RETURN TO SERVICE

A. Pressure testing

1. Prior to putting line back in service, the line must pass water quality and pressure testing. Pressurize the line to normal operating pressure.

END OF SECTION

EXHIBIT B - CEMENT LINING OF WATER MAINS

PART 1 General

1.01 Section Includes

A. Lining of water mains.

1.02 Related Sections

A. Section XXXX - Trenching

B. Section XXXXX - Cleaning of Water Mains

1.03 Unit Price – Measurement of Payment

A. Cleaning and Lining:

1. Basis of Measurement: By the linear foot cleaned and lined, and accepted by the Engineer, measured along the pipe centerline at ground elevation. No payment shall be made for lining installed within water main replacement areas.

2. Basis of Payment: Includes clearing and grubbing, excavating, shoring, cutting pipe, furnishing and installing temporary bulkheads and connections, cleaning, clearing side street connections and services, proving, dewatering, lining, blowing back services, curing, furnishing and installing pipe, fittings, couplings, bedding, concrete thrust blocks, temporary air releases, blow-off installations, caps for abandoned main, pressure testing, flushing, disinfecting, health sampling and backfilling with native soil.

B. Video of Water Mains:

1. Basis of Measurement: By the linear foot of video recording, measured along the pipe centerline at ground elevation.

2. Basis of Payment: Includes removing water from the mains, running tag lines, furnishing all video equipment necessary for recording, recording the interior of the main and turning the video over to the Owner.

C. Lining Verification Test Nipples:

1. Basis of Measurement: When lining thickness of test nipple meets or exceeds the specified thickness, payment shall be made per cubic yard of excavated material. When lining thickness does not meet the specified thickness, no payment shall be made.

2. Basis of Payment: Includes excavating, shoring, cutting pipe, furnishing and installing new ductile iron pipe and couplings, backfilling and restoration.

1.04 References

A. ANSI/AWWA C602 - Cement-Mortar Lining of Water Pipelines - 4 inches and Larger- In Place.

B. AWWA M28 - Cleaning and Lining Water Mains.

C. ASTM C-40- Test for Organic Impurities in Fine Aggregates for Concrete.

1.05 Delivery, Storage and Handling

A. Deliver, store, protect and handle products under provisions of the General Conditions.

PART2 Products

2.01 Portland Cement

A. Standards

1. ASTM C-150, Specification for Portland Cement.

2. All materials in contact with potable water shall be NSF-61 certified.

B. Requirements

1. **TYPE I/II OR TYPE IL**

2. Aged such that abnormal heat is not present between sacks of cement.

3. Handled and stored such that no hard lumps are present.

2.02 Sand

A. Standards

1. ASTM C-40, Test for Organic Impurities in Fine Aggregates for Concrete.

B. Requirements

1. Consist of inert, granular material with strong, durable and uncoated grains.

2. Well-graded with 100% passing a No. 16 mesh screen and not more than 5% passing a No.100 sieve.

3. Free from dust, clay, lumps, shale, soft or flaky particles, mica, loam, oil, alkali and other deleterious materials.

   a. "Free" shall mean that the total weight of the above materials shall not equal or exceed 3% of the total weight of sand and the above.

   b. Additionally, computed as above, the weight of shale shall not exceed 1% of the total weight; the weight of clay lumps shall not exceed 1% of the total weight; and the weight of mica and all other deleterious materials (excluding shale and clay) shall not exceed 2% of the total weight.

4. Sand color shall not be darker than the "reference standard color solution" prepared as required in ASTM C-40.

2.03 Water

A. Use potable water only for mixing mortar for lining.

2.04 Lining Machine

A. Requirements

1. Capable of traveling through the pipe and centrifugally distributing the mortar uniformly across the full section of the pipe and bends.

2. Shall not mark the applied mortar.
3. Capable of placing densely packed mortar without rebound.

4. Capable of pulling a trowel.

5. Capable of placing lining that is only slightly dimpled on the surface (in the event of untrowelled lining) without ridges or buildups.

6. Used only for potable water construction projects in previous applications.

2.05 Lining Trowel

A. Requirements

1. Capable of being adjusted in the field to the required diameter.

2. Shall apply continuous uniform pressure to the lining.

3. Shall produce a continuous, smooth regular finish free of dimples, pock marks, honeycomb, scrapes or spiral shoulders.

4. Capable of passing over irregularities in the pipe, such as protruding corporations, without damaging adjacent lining.

5. Used only for potable water construction projects in previous applications.

2.06 Lining Winch

A. Requirements

1. Capable of providing a smooth, continuous pull to the lining machine such that the mortar lining is applied without variations in thickness due to variations in the rate of travel of the machine.

2. Capable of being adjusted during the lining process.

2.07 Lining Pump

A. Requirements

1. Capable of providing smooth, continuous feed of cement to lining machine and being adjusted during the lining process.

PART 3 Execution

3.01 Examination

A. Verify existing conditions under provisions of the General Conditions.

B. Verify that pipe section to be lined is no longer than 650 feet, measured along the pipe centerline at ground elevation.

3.02 Preparation

A. Prove section of pipe to be lined. Proving shall consist of demonstrating prior to lining pipe that lining machine and trowel are capable of being pulled through pipe without catching, momentarily or longer, on an obstruction.

B. Excavate and remove anything which blocks passage of cleaner or prover.

  1. Payment for this work shall be made under the appropriate contingency item of the Bid.

  2. No payment shall be made when lining machine hangs up.

C. Remove all dirt, debris and water from main to be lined. Remove water immediately prior to lining.

D. When water cannot be prevented from entering the pipe, notify the Engineer immediately.

  1. The Engineer shall determine whether pipe can be lined without a trowel or if leaking section must be excavated.

  2. Payment for excavating and repairing leaking valves and curb stops shall be made under the appropriate item of the Bid.

  3. Payment for other leaks shall be made under the appropriate contingency item of the Bid.

E. When fittings or appurtenances make the use of a trowel impossible, notify the Engineer immediately.

  1. The Engineer shall determine whether pipe section can be lined without a trowel or if the fitting or appurtenance must be excavated and removed.

  2. Payment for excavating, removing and replacing fittings or appurtenances as approved by the Engineer shall be paid for under the appropriate contingency item of the Bid.

F. Four-inch pipe may be lined without a trowel when approved by Engineer.

G. When un-troweled lining is approved, the section of pipe to be lined shall not exceed 100 feet unless approved in advance by the Engineer or the pipe is four-inch diameter.

3.03 Installation

A. Prepare cement mortar consisting of a 1 to 1 volume ratio of cement to sand.

1. Add the least amount of water required to produce a workable mixture.

2. Slump shall not exceed 5 inches when tested immediately prior to being pumped to the lining head.

3. Slump testing shall be in accordance with ASTM C143.

B. Install mortar by machine prior to mortar attaining initial set.

1. Mortar lining shall be 1/8 inch thick for 6 and 8-inch nominal diameter pipe.

2. Mortar lining shall be 3/16 thick for 12–24 inch nominal diameter pipe.

3. Mortar lining shall be 1/4 inch thick for all pipes with nominal diameter greater than 24 inches.

4. There shall be no minus tolerance, and the plus tolerance shall be 1/8 inch.

C. Prevent cable from scoring or damaging pipe.

D. When hand placement of mortar lining is necessary, the mortar shall be the same as that used for placing by machine.

1. Dampen edges of machine-placed cement adjacent to location requiring hand placement.

2. Trowel hand-placed mortar and smooth the edges to blend with the machine-placed mortar.

3. Place all hand-placed mortar within 24 hours of placement of machine-placed mortar.

E. Clear all services, pito taps, blow-offs, existing hydrants, air or pressure relief valves and sideline main connections on the mortared pipe section using water blowback within 5 hours of placing the mortar lining.

1. Air blowbacks shall not be used unless a water blowback has been unsuccessful.

2. When a water blowback is unsuccessful, use of air must be approved by the Engineer.

3. Use curb stops, unless defective, to conduct clearing operations.

F. Remove mortar lining disapproved by Engineer immediately upon rejection.

1. Introduce water into main during removal process.

2. Flush all services and sideline connections during removal process to remove all mortar.

3.04 Curing

A. Seal section of pipe immediately upon completion of placing and inspecting mortar lining such that air is prevented from circulating through the pipe.

B. When mortar lining has attained initial set, introduce potable water to pipe section and maintain a minimum of 12 hours.

3.05 Inspection

A. No pipe shall be lined unless Engineer is present.

B. Provide Engineer with the opportunity to visually inspect both ends of each completed lining run.

C. Video cement mortar-lined pipe prior to closing up pipe using a color camera with self-contained lighting and remote focus.

1. Video inspection shall be in .mpg, .wmv, or .mov format and provided on a USB drive.

2. Record footage in ten-foot intervals visibly on video.

3. Record on audio footage location of all visible appurtenances such as taps or sideline connections.

4. Inspection videos shall become property of Owner.

D. Do all video of a street in order, starting at one end of street and proceeding to other end.

1. Video all runs on same street with camera pulled in same direction on each run.

2. Reference location of each end of run to a house number.

3. Write on poster board and visually record run number and location. Record this information on audibly on video.

E. Set counter to zero at beginning of each video, and provide list indicating "counter location" of each run and street name.

G. Payment for above shall be made under appropriate video item in the Bid.

END OF SECTION "

EXHIBIT C - CLOSE TOLERANCE PIPE SLURRIFICATION WITH FUSIBLE AWWA C900 PVC PIPE

PART 1. GENERAL

1.01 SCOPE

A. The Work to be performed herein shall consist of replacing Asbestos Cement (AC) water mains and forcemains by the Close Tolerance Pipe Slurrification (CTPS) Method. Removing and replacing Asbestos Cement pipe has the additional burdens of complying with NESHAP and OSHA requirements which govern the handling, removal, and disposal of any material containing asbestos.

B.

On June 10th, 2019, the EPA approved a request for an alternative work practice (AWP) called Close Tolerance Pipe Slurrification (CTPS) to replace, rehabilitate, and repair existing buried Asbestos Cement (AC) pipe systems. Subsequently, the EPA has determined that Close Tolerance Pipe Slurrification (CTPS) is an <u>equivalent work practice to open cut pipe replacement</u> for replacing, rehabilitating, and repairing Asbestos Cement (AC) pipe. Consequently, <u>any AC pipe replaced in accordance with the CTPS AWP</u> would not be required to meet the NESHAP requirements regarding Active and Inactive Waste Disposal Sites, as would be the case with the pipe bursting method.

Close Tolerance Pipe Slurrification (CTPS) is a proven "Trenchless Technology" method used to remove and replace an existing pipe line with minimum amounts of excavation. The CTPS method removes the existing pipe by pulling a rotating head through the existing pipe while simultaneously injecting a bentonite-based lubricating fluid. The cutting head rotates at sufficient speed to grind the existing pipe, surrounding soil, and bentonite-based lubricating fluid into a slurry. This slurry is squeegeed or forced out of the ground into a receiving pit by the new pipe that is being pulled in behind the cutting head. After completion of the CTPS process, the existing pipe is removed, the new pipe is installed through the subsequent tight-fitting void, and the slurry containing the existing pipe fragments, soil, and bentonite-fluid is removed from the ground.

When the patented CTPS process is used to remove and replace Asbestos Cement pipe systems, there are several important components of the process that work extremely well with regulations surrounding AC pipe work. First, the patented process requires the injection of bentonite-based fluid at critical points. This fluid maintains a wet-cutting environment, which is an important requirement for cutting Asbestos Containing Material (ACM). Second, the "Close Tolerance" sizing of the cutting head, in relation to the new pipe being pulled into place, facilitates the removal of the Asbestos Containing Material (ACM) from the ground. This "Close Tolerance" sizing creates a scenario where the new product pipe, along with the injection of additional drill fluid, will pressurize the slurry, which is expelled at excavations. The slurry containing the ACM is then removed from the site. Third, any remaining trace amounts of asbestos fiber are encapsulated in the skim coat of slurry remaining around the pipe. This skim coat has the consistency of a light-weight concrete material commonly known as "excavatable flowable fill".

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society for Testing and Materials (ASTM) and American Water Works Association (AWWA):
      a. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
      b. ASTM D1784, Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
      c. AWWA C900, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN. Through 60 IN. (100 MM Through 1,500 MM)

1.03 DEFINITIONS

A. **AC Pipe: Asbestos Cement Pipe**
B. **ACM: Asbestos Containing Material**: any material containing more than 1% asbestos
C. **ACPRP: Asbestos Cement Pipe Replacement Project**
D. **Category II Nonfriable ACM**: any material that does not include asbestos containing packaging, gaskets, resilient floor coverings, or asphalt roofing products that contains more than 1% asbestos, that, when dry cannot be crumbled, pulverized or reduced to powder by hand pressure.
E. **CCTV: Closed-circuit television.**
F. **Competent Person**: one who is capable of identifying existing asbestos hazards in the workplace, capable of selecting the appropriate control strategy, and having the authority to take prompt corrective measures. Personnel must be trained by to meet the criteria of EPA Model Accreditation Plan for Contractors/Supervisor/Workers for Class II work.
G. **DR: Dimension Ratio**
H. **DVD: Digital Video Disc**
I. **Friable Asbestos Material**: any material containing more than 1% asbestos (ACM) that, when dry can be crumbled, pulverized, or reduced to powder by hand pressure.
J. **FPVC Fusible Polyvinyl Chloride.**
K. **Initial Monitoring**: an assessment of airborne concentrations of asbestos prior to the initiation of work activities conducted by a competent person.
L. **NEA - Negative Exposure Assessment:** 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 or EL by any of the following means, this is deemed a Negative Exposure Assessment (NEA):

1 Objective Data, or
2 Personal Air Sampling results collected from the previous 12 months, or Initial Monitoring of the current project

M. **NESHAP: National Emissions Standard for Hazardous Air -** National Emission Standards for Hazardous Air Pollutants (**NESHAP**) are stationary source standards for hazardous air pollutants. Hazardous air pollutants (HAPs) 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.

N. **OSHA: Occupational Safety and Health Administration -** The Occupational Safety and Health Administration is a large regulatory agency of the United States Department of Labor that originally had federal visitorial powers to inspect and examine workplaces.

O. **Periodic Monitoring**: periodic air monitoring is required to be conducted daily within the regulated area for Class II work, unless;
1. Negative Exposure Assessment has been made, or
2. All employees in a regulated area wear supplied air respirators operated in the pressure demand mode, or other positive pressure mode respirator.

P. **Permissible Exposure Levels**
1 Permissible Exposure Limit (PEL) = .01 fibers per cubic centimeter (f/cc); Time Weighted Average (TWA). TWA means an exposure concentration averaged over an 8-hour period.
2 Excursion Limit (EL) = 1.0 f/cc as averaged over a sampling period of 30 minutes.

Q. **RACM: Regulated Asbestos Containing Material:** Category II Nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized or reduced to powder by forces expected to act on the material in the course of demolition or renovation operations. <u>Removing and replacing AC pipe by excavation in the same trench and by "Trenchless Technology" methods is generally considered to be RACM</u>.

R. **Regulated Area**: is an area established by the employer where Class II asbestos work is being conducted, and any adjoining area where debris and waste accumulate. Only authorized personnel may enter regulated areas. The following requirements apply to a regulated area;
1 Mark the area to minimize the number of persons within the regulated area and to protect person outside the area;
2 Limit access to authorized personnel only;
3 Prohibit eating, drinking, smoking, chewing, and the application of cosmetics in the regulated area;
4 Competent Person must supervise work within the regulated area.

S. **SDR: Standard Dimension Ratio.**

T. **Visible Emissions:** The most imperative regulation for removing and replacing AC pipe is the No Visible Emission (VE) rule. Under no circumstances shall Visible Emissions (VE) be released into the atmosphere while performing AC pipe removal.

Visible Emissions are dust clouds containing AC fibers that can be seen with the naked eye while cutting, grinding, breaking or removing Asbestos Containing Material (ACM). Visible Emissions are avoided by choosing engineered control methods that do not create dust or are controlled with spraying amended water over the work area. Once construction begins, NESHAP requires that no visible emission to the outside air be allowed during the collection, processing, packaging, or transporting of any Asbestos Containing Material (ACM).

1.04 SUBMITTALS

A. Action Submittals:
   1. Catalog cuts and specifications:
      a. Pipe.
      .
      c. Joining, including alignment jig, equipment.
   2. Dimensioned layout drawings including installation details.
   3. Samples: Trial field fusion welds, when requested by the OWNER.

B. Informational Submittals:
   1. Contractors Experience Submittals:
      a. CONTRACTOR Certifications:
         1) Installer: Certifications of experience installing pipe by the CTPS method of at least 5,000 LF.
         2) Asbestos Supervisor:
            a. Asbestos Supervisor Certification at approved EPA facility for supervising work relating to removal and disposal of Asbestos Containing Material (ACM).
            b. OSHA Competent Person Training relating to Asbestos Work & Excavation.
         3) Asbestos Work: Asbestos Worker Certification at approved EPA facility for work relating to removal and disposal of Asbestos Containing Material (ACM).
         4) Fusion Equipment Operator: The FPVC pipe fusion operator shall be qualified by the pipe supplier to join fusible polyvinyl chloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

   2. Installation Plan and Sequencing Submittals:
      a. Detailed Construction Methods & Procedures Comply with NESHAP and OSHA Standards When Working with and Disposing of Asbestos Cement (AC) Pipe.
         1) EPA Notification 10 days prior to start of construction.
         2) No Visible Emmisions
            A. Adequately wet ACM by

1. Mix control device asbestos waste to form a slurry; adequately wet other asbestos containing waste material. and
2. Discharge no visible emissions to the outside air from collection, mixing, wetting, and handling operations, and
3. After wetting, seal all ACM waste in leak-tight containers while wet; or for materials that will not fit into containers without additional breaking, put materials into leak-tight wrapping, and
4. Properly label containers as containing Asbestos Containing Material, and
5. Properly label containers with the name of the waste generator and the location from which the waste was generated

3) Disposal Plan Submittal

A. NESHAP requires that all Asbestos Containing Material waste be disposed of at a waste disposal site operated in accordance with the provisions of NESHAP regulation Section 61.155 – Standard for Operations that Convert ACM waste into Non-Asbestos Material.

B. Waste Shipment Records (WSR) must be maintained for a period of two years by the generator. 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 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.

2. Worker/Public Protection Plan Submittals:

a. OSHA's Construction Industry Standard 29 CFR 1926.1101 Compliance Plan

1. Exposure Levels

2. Provide mitigation plan to minimize workforce & public exposure limits to below Permissible Exposure Limits through engineered controls.
3. Regulated Work Area Plan
    a. Mark Area to minimize number of persons within the regulated area to protect persons outside area;
    b. Limit access to authorized personnel only;
    c. Warning signs must be displayed and posted at all approaches to regulated areas. The sign must bear the following information;
    DANGER ASBESTOS MAY CAUSE CANCER
    CAUSES DAMAGE TO LUNGS
    AUTHORIZED PERSONNEL ONLY
    d. Warning labels must be affixed to all asbestos waste containers. The label must include the following information;
    DANGER CONTAINS ASBESTOS FIBERS
    MAY CAUSE CANCER
    CAUSES DAMAGE TO LUNGS
    DO NOT BREATHE DUST
    AVOID CREATING DUST

3. Medical Surveillance Program Submittal:
    a. The employer must establish document a medical surveillance program, prior to assignment, for all employees who 1) will be required to wear negative-pressure respirators, 2) will be engaged in Class II work for 30 days or more per year, or 3) will be exposed to airborne concentrations of asbestos at or above the Permissible Exposure Level (PEL) and/or Excursion Limit (EL) for more than 30 days per year (or a combination of 2 and 3).
    b. The MSP involves examinations performed or supervised by a licensed physician and shall be provided without cost to the employee. The examinations must include;
        1 A medical and work history;
        2 A physical examination with special emphasis directed to the respiratory, cardiovascular, and gastrointestinal systems;
        3 Completion of a respiratory disease questionnaire;
        4 A pulmonary function test.
        5 Must be provided to the employee within 30 days

    c. Record Keeping - Employers must maintain the following records for a Class II Asbestos Project;
        1 Accurate records of all measurements taken to monitor employee exposure to asbestos. These records must be kept for 30 years.

2 An accurate record for each employee subject to medical surveillance. This record must be maintained for the duration of employment plus 30 years.
3 Employee training records. This record must be maintained for 1 year beyond the last date of employment.

1.05 QUALITY ASSURANCE

A. The CONTRACTOR shall have at least 5,000 LF of experience installing pipe by the CTPS method. The CONTRACTOR shall provide certificates of experience/training for an employee directly involved in the supervision or operation of the CTPS system.

B. FPVC pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and the recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the FPVC pipe. Such training shall be conducted by a qualified representative of the pipe manufacturer.

C. Installation of other materials shall be performed by personnel qualified by the specific product manufacturer.

PART 2. PRODUCTS

2.01 MATERIALS

A. Pipe:

1. Materials:
    a. Conform to requirements of AWWA C900.
    b. PVC resin shall meet or exceed requirements of ASTM D1784 for Cell Class 12454 material. Pressure rating shall be based on hydrostatic design stress of 2000 psi at 73.4 degrees F.
    c. Working pressure: 150 psi, minimum (unless otherwise detailed on design drawings)
    d. Inside diameter equivalent to existing pipe or selected pipe size
    e. Shall contain no recycled compound except that generated in manufacturer's own plant from resin of same specification from same raw material.
2. Color:
    a. Pipe shall be blue for potable water and green or white for sewer.
3. SDR:
    a. Nominal Size: 8 inches and larger with CIOD outside diameters.
    b. Minimum wall thickness conforming to DR 18 for potable water mains and DR 26 for sewer forcemains (unless otherwise detailed on the design drawing)

B. Fittings shall be PVC or Ductile Iron in accordance with AWWA Standards.

C. Joints:

1. Pipe jointing shall be by butt fusion welding, as specified in Paragraph 3.03.

D. Service Connection for Potable Water Mains:

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. DIRECT TAPPING SHALL NOT BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for Saddle Tapping per UNI-PUB-8, PVC Pressure Pipe Tapping Guide".

B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:

1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
2. Manually operated or power operated drilling machines may be used.

PART 3. EXECUTION

3.01 EQUIPMENT:

A. CTPS: Provide equipment of sufficient size and power to accomplish the specified pipe replacement under normal conditions and provide cutting head rotation of 240 RPM's minimum to properly grind AC pipe, soil and slurry into fine enough material to be removed by vacuum excavation from the service excavations and pits. Cutting head shall be no more than ½" greater than the outside diameter of the new pipe to be installed so as to minimize the amount of Asbestos Containing Material (ACM) and to facilitate forcing ACM into service excavations and pits.

3.02 PREPARATION

A. General:

1. Work shall be supervised by personnel experienced in installation of similar pipe and shall be onsite at all times from time of commencement to time of completion.
2. Locate insertion or access pits so that the total number is minimized and footage of pipe installed in a single run is maximized. Use excavations at point repair locations and service connections for insertion pits where possible.

B. Pre-CCTV Inspections:

1. The CONTRACTOR shall perform a pre-installation CCTV inspection, prior to CTPS activities.
2. Pre-CCTV inspection meets the inspection requirement of NESHAP, and is part of the Alternative Work Practice (AWP) approved by EPA.

3.03 PIPE JOINING

A. General:

1. Fusible polyvinyl chloride (PVC) pipe shall be handled in a safe manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.
2. Fusible polyvinyl chloride pipe shall be fused by qualified fusion technicians, as documented by the pipe supplier.
3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:
5. Heat Plate - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be kept clean and free of any debris or contamination. Heater controls shall function properly; cord and plug

shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

6. Carriage – Carriages shall travel smoothly with no binding at low pressure. Jaws shall be in good condition with proper and clean inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
7. General Machine - All fusion machines shall be inspected for obvious defects, missing parts, hydraulic leaks, or potential safety issues prior to fusion.
8. Data Logging Device – An approved, fully functional datalogging device, with the current version of the pipe supplier's software, shall be used. Datalogging device operations and maintenance manual shall be kept with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
9. Other equipment specifically required for the fusion process shall include the following:
   a) Pipe rollers shall be used for support of pipe to either side of the machine
   b) An infrared (IR) pyrometer with an accuracy of 1% or better, shall be used to check pipe and heat plate temperatures.
   c) Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
   d) Facing blades specifically designed for cutting fusible polyvinyl chloride pipe shall be used.
10. For fusion in inclement weather and/or windy conditions, a weather protection canopy with sides that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided per the pipe supplier's recommendations. When the pipe temperature is below 40°F, the pipe supplier's cold weather operating procedures shall be followed.

3.04 PIPE INSTALLATION

A. General:

1. Excavate entry and exit pits or shafts to access the existing pipe. Hand excavate and remove AC pipe sections without creating Visible Emissions (VE) of asbestos fibers. No dry cutting or grinding will be allowed. Bag and remove ACM in compliance with NESHAP requirements. Locations of pits shall minimize quantity of pits and disruption to the public.
2. Drill stem shall be pushed through existing pipe from one pit to another where the guide head, cutting head, and pipe shall be inserted.

3. Drill fluid shall be pumped through drill stem and released in such a manner that would lubricate pipe, collect AC pipe debris, suppress AC dust, and collect AC fibers. No Visible Emissions (VE) will be allowed.
4. Cutting head shall be sized no more than ½" greater than newly installed pipe so that the majority of drill fluid (containing soil, AC pipe debris, and AC fibers) will be forced into pit excavations and service excavations.
5. Drill fluid (containing soil, AC pipe debris, and AC fibers) shall be removed from pit and service excavations and disposed of in a manner in compliance with NESHAP requirements for Asbestos Containing Material (ACM).
6. Asbestos Containing Material (ACM) shall be disposed of at a landfill approved by county, state, and federal environmental agencies.
7. Make reconnections as appropriate.

B. Pit Excavations:
1. Excavate entry and exit pits or shafts to access the existing pipe. Hand excavate and remove AC pipe sections without creating Visible Emissions (VE) of asbestos fibers. No dry cutting or grinding will be allowed. Bag and remove ACM in compliance with NESHAP requirements. Locations of pits shall minimize quantity of pits and disruption to the public.
2. ACM drill fluid will be pushed into excavations for removal. Drill fluid shall be vacuum excavated and hauled to appropriate landfill in a manner consistent with NESHAP and DOT requirements. Bagging, containment, labeling, and record keeping requirements shall be followed.

3.05 LUBRICATION

A. Selection of drilling fluids will be the responsibility of the contractor, it is highly recommended that the Contractor contact the drilling fluid manufacture to insure proper fluids are being selected for the soil conditions.
B. The Contractor is responsible for drilling fluid disposal and all other restoration. Contractor must comply with all regulations regarding the proper disposal of drilling fluid. Cleaning, flushing and hydrostatic testing of the pipe shall be conducted as specified elsewhere in our standards.

3.06 NESHAP – APPROVED ALTERNATIVE WORK PRACTICE STANDARDS FOR AC PIPE REPLACMENT

A. Notification
1. Owner or Operator shall notify State or Federal EPA 10 days prior to disturbing AC Pipe.
2. Notification shall include 6-digit latitudinal and longitudinal coordinates

B. Inspection

1. Prior to using CTPS for an ACPRP, the owner/operator must conduct underground pipe inspections (e.g., by using remote technologies like robotic cameras) and shall identify, locate, and mark 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.
2. The owner/operators of any ACPRP must save video recording of inspection and make it available at the ACPRP work site for reference as needed by inspectors, owners, and operators during the ACPRP work.

C. Record Keeping

1. The owner/operator is required to record and maintain for a period of 2 years:

   a. Waste shipment records as required by 40 CFR 61.150(d);
   b. Records of the standard operating procedures for the installation, operation, and maintenance of the drilling head train, CTPS liquid delivery system, and all equipment used to deliver adequate wetting at all vertical access points and cut lengths of pipe;
   c. Malfunction records (if Applicable)
      1) Records of VE events including duration of time, and date. Record of when and how each VE event was resolved.
      2) Record of failed friability test, resulting in a sample that can be crushed, crumbled, or reduced to powder by hand pressure.
2. The owner (typically the state or municipality) is required to record and maintain for the lifetime of the new pipe, and provide the regulatory authority within 15 days of request, the certificate from each friability test outlined below.
3. Each owner/operator is required to submit a malfunction report to the Administration after any malfunction occurrence. The malfunction report must be submitted as soon as practical after the occurrence, but in no case later than 30 days.

D. CTPS Techniques

1. The owner/operator must handle all sections of A/C pipe in accordance with 40 CFR 61.145 and 40 CFR 61.150 of the Asbestos NESHAP.
2. The owner/operator must avoid to the extent feasible, crumbling, pulverizing, or reducing to powder AC Pipe during the excavation of vertical access points. Water and suction should be used to uncover as much of the AC Pipe as needed to begin the CTPS process.
3. Appropriate measures must be taken to prevent the slurry from coming into direct contact with the surrounding soils of the terminal and vertical access holes. The EPA recommends the use of plastic sheathing, or another type of barrier to prevent slurry from contacting the surrounding soils.
4. In order to achieve close tolerance and to minimize the thickness of the skim coat (the portion of waste slurry that remains on the exterior of the

new pipe), the CTPS technique must use an cutting head with slightly larger (approximately ¼") diameter than the new pipe.

5. The cutting head must be drawn around the existing pipe and must grind the old AC Pipe to a fine powder using a liquid delivery system. In order to adequately grind the existing AC Pipe into a fine powder, the EPA recommends maintaining a minimum speed of approximately 220 revolutions per minute (RPM) for grinding apparatus.
6. The process must return the AC Pipe to cementitious slurry that is homogeneous mixture and stays adequately wet through disposal according to the requirements of 40 CFR 61.145.
7. The owner/operator must ensure that the CTPS train pulls the replacement pipe behind it. The new pipe must be sealed to ensure no ACM contacts the inside of the new pipe.
8. The CTPS process must be equipped with ports to deliver liquid material to the cutting head. Drilling fluids must be delivered through these ports to reduce frictional drag on the line; to lubricate the interface along the soil to pipe line, to provide a barrier between the surrounding ground water, soil, rock, and the pipe, and to support the close tolerance cylindrical void during the pipe replacement process.
9. Drilling fluid recipe must consist of a lubrication fluid, a hole sealing fluid (bentonite), and a material suspension fluid.

E. Adequate Wetting and No Visible Emissions (VE)
   1. The owner/operator is required to ensure that no VE are discharged to the air from the slurry.
   2. The owner/operators must ensure that dust suppression equipment is placed at each vertical access point.

F. Slurry Characteristics
   1. The owner/operator would be required to ensure that the slurry (including the slurry that remains as skim coat) is a homogeneous mixture comprised of finely ground AC Pipe, drilling fluids, bentonite clay, and other materials suspended in a solution that, when cured, re-hardens so that it meets the sample friability test below.
   2. The Slurry must meet the now VE requirements of 40 CFR 61.145 and 40 CFR 61.150

G. Sampling, Testing, and Utility Map Notation
   1. Sample Collection
      a. After slurry has been pumped from the vertical access points, but before disposal, owner/operator of a CTPS system is required to collect a 2-inch roughly spherical wet sample of the slurry.
      b. A single sample must be collected for each project discharging into a single enclosed tank.
      c. The owner/operator must seal the sample in a leak-tight container and allow the sample to harden and dry.
   2. Sample Friability Test and Certification
      a. When the sample is hardened and dry, the owner/operator would be required to attempt to crush the sample by hand.

i. If the sample cannot be crushed, crumbled, or reduced to powder by hand pressure, the owner/operator would be required to certify as such.

ii. If the sample can be crushed, crumbled, or reduced to powder by hand pressure, the owner/operator would be required to follow the malfunction reporting requirements.

iii. If a malfunction occurs, resulting in friable ACM left along the new pipe, the friable ACM must be retrieved and properly disposed of, or the site must be treated as an active asbestos waste disposal site.

b. After testing, the owner/operator must ensure that the sample is packaged in a leak-tight container for storage, labeled "Asbestos Containing Material. Do not break or damage this sealed package," dated according to the ACPRP date of generation, stored in a secure location that is inaccessible to the general public (such as a locked storage unit), and is maintained by the owner (typically the state or municipality) for a period of 2 years, when it can be disposed of in a landfill authorized to accept Asbestos Containing Waste Material.

3. Utility Map Notations

a. Owner/operators would be required to note utility maps according to the actual location identified by the 6-digit latitude/longitude coordinates of the newly laid line.

b. Notations would have to be maintained for the life of the new pipe by the owner (typically the state or municipality), and would have to be labeled as covered by a skim coat of ACM for future work.

H. Trackable Pipeline Requirements

1. The owner/operator must ensure that the new pipeline is trackable/traceable by a locating wire (or other durable trackable material) laid with the new pipe.

I. Slurry Removal, Containment, Labeling, and Transportation Requirements.

1. The slurry is removed at vertical access points using a vacuum attached to a tank (vacuum truck).
2. The owner/operator would be required to ensue that the slurry remains in an adequately wet state during the slurrification process and in containment throughout removal, transportation, and disposal processes meeting the requirements of 40 CFR 61.145 and 40 CFR 61.150.
3. All slurry produced as a result of conducting ACPRP using the CTPS AWP 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 that may remain is the skim coat on the new pipe from the ACPRP. This skim coat is not subject to the removal disposal requirements (subject to confirmation as non-friable by the friability test), if left undisturbed in the ground.

J. Disposal Requirements – The following requirements apply to disposal of the slurry resulting from an ACPRP conducted using the CTPS AWP.

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

2. The slurry must be managed at the disposal site using procedures meeting the requirements of 40 CFR 61.154.
3. Th slurry must not be used in any public thoroughfare, in any private use as fill material, as cover material for at a landfill, or in any other use.
4. In accordance with the Asbestos NESHAP, the slurry must be disposed of as soon as practicable.

K. Equipment Decontamination or Disposal
1. CTPS AWP equipment used for conducting ACPRP may either be decontaminated or disposed of so that no ACM remains within or on the equipment after each ACPRP. Disposable lining/containers that prevent slurry from coming into direct contact with machinery may also be used.
2. Water used in decontaminating is recommended to be contained and filtered before being released to storm water collection systems.

L. Application of Asbestos NESHAP Requirements
1. Except as noted in the Approved Alternative Work Practice for CTPS, all other requirements of Asbestos NESHAP apply to the CTPS AWP.
2. It is important to note that that projects may not be broken up to avoid regulation under the Asbestos NESHAP.

3.08 RESTORATION

A. The CONTRACTOR shall restore all service pits, launching pits and disturbed surface areas to their original condition.

3.09 TESTING OF WATER & FORCEMAINS

A. Testing of water mains and forcemains shall be in accordance with local standards.

END OF SECTION

EXHIBIT D - SECTION 15200

FLEXIBLE FABRIC REINFORCED PIPE

PART 1- GENERAL

1.01. INTENT

It is the intent of this specification to provide for the reconstruction of the designated pressure pipe by the installation of an aramid (Kevlar) Flexible Fiber-Reinforced Pipe (FFRP) within the existing host pipe. Due to the condition of the host pipe the new FFRP shall be designed as a fully independent, non-interactive and loose-fit pipe, not relying on the remaining strength of the host pipe to withstand long-term internal pressure. When the piping system is intended for the conveyance of potable water, the proposed product shall be certified as complying with the requirements of NSF/ANSI 61. Material and installation requirements are specified in the following subsections.

1.02. SUMMARY OF WORK

A. This work consists of host pipe cleaning, CCTV inspection, and lining the existing **(OWNER SUPPLIED INFORMATION – e.g., 16" diameter cast iron water main)** with the FFRP system; all in accordance with these Specifications, the contract Drawings, manufacturer's instructions, and any other regulatory requirements. This work requires coordination of work between the Owner, the Engineer, and the Contractor.

B. The FFRP System includes both the FFRP Liner Material, and the FFRP Connectors.

C. The work shall be done as described in the Contract Drawings.

1.03. SUBMITTALS

A. Submit specifications and shop drawings for materials and equipment furnished under this section.

B. Submit all required documents of Section 2.0.

C. Submit manufacture's liner and end connector data/cut sheets.

D. Submit Manufacture's engineering project feasibility review, design, and SOP.

E. Submit Manufacturer's Certificate: Prior to first shipment of FFRP, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the testing specification standards specified herein. Certify that all products furnished meet or exceed specified requirements herein.

F. Submit manufacturer's requirements for receiving, handling, and storage of materials.

G. Submit detail description and requirement for preparing existing host pipe for lining, liner and end connector installation procedures.

H. Submit CCTV Inspection video and report of the existing pipe condition, pipe bends, joints and location of existing valves, tees, and appetencies after cleaning, prior to authorization to line.

I. Submit all field installation and test reports.

J. Submit warranty from the FFRP manufacturer certifying that the FFRP system shall befree from defects in material and workmanship under normal and proper use and service, for a period of five (5) years after startup and acceptance by the Owner. The Contractor shall provide all labor and materials to repair or replace any defective warranted items specified in this section.

PART 2- PRODUCT, MANUFACTURER/INSTALLER QUALIFICATION REQUIREMENTS

2.01. The pipe lining materials shall be Primus Line® as manufactured and supplied by Rädlinger Primus Line, GmbH. or Engineer approved equal. Only pipe lining materials in conformance with the requirements of this contract document shall be considered as an "or equal" for this item.

Approved Manufacturers: Raedlinger Primus Line Gmbh

2.03. Any product not complying with these specifications for any reason must be pre-approved prior to the formal opening of bids. No later than two weeks before the formal proposal due date, each proposer shall submit to the Owner the required prequalification submittals designated in PART 2, PART 3, and PART 4 of this specification to be considered and approved as an "or equal." The proposer is hereby made aware that the specified product in this contract document has been thoroughly vetted and has met the technical qualifications and capabilities needed for the project. After the evaluation of the data, the Owner will notify those firms that have produced acceptable submittal packages that they are qualified to furnish proposals for this project and shall be accepted by addendum. The Owner's decision shall be final.

2.04. The Installer of the FFRP liner: **(a)** must satisfy all insurance, financial, and bonding requirements of the Owner. **(b)** The installation crew must be trained and certified by the manufacturer of the product being installed and shall submit their certifications. **(c.)** Must have at least (3) years of active experience installing the intended FFRP system bid and as specified in the contract documents, and **(d.)** at least 5 (five) similar installations of pressure rated FFRP in a similar application, size and length as indicated in these Contract Documents. Acceptable documentation supporting the above must be submitted to the Owner with the bid.

2.05 To be Commercially Proven, the Manufacturer must have had at least 5 (five) years active experience and a minimum of 150,000 linear feet of commercial installation of pressure rated aramid (Kevlar) FFRP products in pressure pipe applications in the United States and Canada. Acceptable documentation supporting the above must be submitted to the Owner with the bid.

PART 3- MATERIALS

3.01. The pipe lining system specified herein is a material and methods product as manufactured and specified by Rädlinger Primus Line GmbH, Kammerdorfer Str. 16, 93413 Cham, Germany. Material and installation requirements are specified in the following subsections. The proposer is hereby made aware that the specified product in this contract document has been thoroughly vetted and has met the technical qualifications and capabilities needed for the project.

Approved FFRP Products: Primus Line

3.02 Materials for water systems shall meet the appropriate American Water Works Association (AWWA) standards and American National Standards Institute (ANSI) specifications, and be NSF 61 certified, except non-potable water applications as modified by these specifications.

3.03 Materials that are defective, damaged, or otherwise deemed unacceptable for use prior to installation shall be rejected and replaced at Contractor's expense. Materials damaged during installation shall be repaired or replaced as recommended by the Contractor and approved by the Owner.

3.04 Flexible Fabric Reinforced Pipe (FFRP):

A. The FFRP shall be as manufactured and specified by Rädlinger Primus Line GmbH, Kammerdorfer Str. 16, 93413 Cham, Germany to meet the requirements of the pipeline.

A. The FFRP shall be a thermoplastic pipe that is reinforced with aramid (Kevlar) fiber or hybrid reinforcement containing polyester and aramid (Kevlar) fiber woven yarns. No substitutes will be approved.

B. The FFRP Composite shall be constructed of (3) or more distinct layers by a single extrusion process. The layers shall have a distinct individual uniform thickness and meet or exceed the specified internal pressure requirement in Section 4.04.

1. Outer Layer: shall be made of an abrasion-resistant polyethylene PE or TPU. The outer PE layer shall be UV resistant.

2. Reinforcement Layer: shall be a seamless continuous twill of woven aramid (Kevlar®), either one or two layers depending on the required pressure.

3. Inner layer: shall be made of PE or TPU based on media transported.

C. The FFRP shall be clearly marked with the following information:

1. Nominal composite liner diameter.

2. Fluid and maximum operating pressure for the transported fluid.

3. Trade name/trademark.

4. Year, Month, and Day of manufacture in the format YYYY.MM.DD.

5. FFRP batch number.

6. Continuous production run length in feet with the units labelled.

D. There shall be no bonding to the host pipe and no interaction with the host pipe once installed. The outside diameter of the FFRP shall be reduced for a loose-fit within the host pipe with a continuous annular gap and shall be pressure rated to meet or exceed the pressure requirements in Section 4.04 independently of the host pipe being rehabilitated. Close-fit and or interactive products which apply radial stresses on the host pipe will not be accepted.

E. Bend Traversing Capability:
   a. The FFRP shall be capable of passing through bends.
   b. The FFRP shall be capable of passing a 90° bends with approval of the manufacturer.

F. Hydraulic Capacity:
   a. The C-factor for the FFRP shall be 150.
   b. All layers of the FFRP shall be between 0.24 inches to 0.32 inches thick.
   c. The FFRP shall provide a minimum design life of 50 years.

G. The FFRP shall be pressure rated and tested to meet or exceed the pressure requirements independently without interacting with the pipeline being rehabilitated. The pressure class of the FFRP shall be determined by long-term and short-term pressure testing for the core reinforcement layer used. Testing results shall be submitted for verification. See Table 1 for acceptable short-term burst (STBP) minimums.

Table 1. Minimum Short-term Bust of Core Reinforcement

Pressure Class	Diameter inches	Core Reinforcement	Wall Thickness inches (mm)	Minimum Short-term Burst (STBP)
Low	6 - 16 in.	Single-layer Aramid & Polyester	0.24 (6 mm)	435 psi
Medium	6 – 20 in.	Single-layer Aramid	0.24 (6 mm)	580 psi
High	6 – 16 in.	Double-layer Aramid	0.31 (8 mm)	1,189 psi

H. The FFRP shall be marked for a distance at regular intervals along its entire length, not to exceed 5 feet. Such markings shall include the Manufacturers name, production lot and intended use or identifying symbol. Where applicable, the tube shall be marked "NSF 61" in accordance with the NSF protocol.

3.05 **FFRP End Connectors:**

B. The FFRP end connectors shall be as manufactured and specified by Rädlinger Primus Line GmbH, Kammerdorfer Str. 16, 93413 Cham, Germany to meet the requirements of the pipeline and the FFRP specified in this contract document.

C. The End connector shall be constructed of cast iron, carbon steel or stainless steel and be designed to encapsulate and terminate the ends of the FFRP and provide a flanged or welded point for tie-ins.

D. The end connectors shall be pressure rated for the application and consist of an inside core, an external sleeve and equipped with 150/300 psi ANSI flanges for each section. The connector shall be designed according to the pressure of the FFRP used in the rehabilitation.

E. FFRP end connectors are manufactures from either cast iron, carbon steel or stainless steel. Connectors are both available with flanges or welded ends. While models with welding ends are not coated, models with flanges have a full-surface, high quality epoxy coating, which provide corrosion protection on all sides. The internal core of the high-pressure connector is made of stainless steel. Flanges used by FFRP comply with EN 1092, ANSI B16.5 of AS4087. All connectors preserve the overall integrity and function of the liner.

F. The end connectors shall be installed according to the Manufacturer installation specifications by a trained and certified technician.

G. The FFRP and end connector as part of the lining systems shall be from the same system manufacturer and designed and tested for compatibility. When tested together, the system shall meet or exceed the pressure requirements of the rehabilitated pipeline.

H. The supplier of all materials shall be an ISO 9001 certified producer or have implemented a quality system similar to that in the ISO 9001 requirements.

I. All materials that come in contact with potable water shall comply with applicable requirements of NSF/ANSI/CAN Standard 61 and indicated by a current listing by an ANSI accredited certification or testing agency when required by the authority having jurisdiction or other international requirements as applicable.

PART 4- DESIGN REQUIREMENTS

4.01 The FFRP shall be designed with the projects design parameters in Section 4.04.

4.02 The FFRP shall be designed to assume no bonding to the host pipe wall and withstand all internal pressure without interaction with the host pipe for its design life according to EN ISO 11295.

4.03 FFRP shall be designed to be operated as an independent pipe within the host pipe with a minimum design life of 50 years.

4.04 PROJECT DESIGN PARAMETERS

The design of the FFRP shall be based on the following parameters:

Host Pipe Outside Diameter (OD):	**Supplied by Owner**
Host Pipe Internal Diameter (ID):	**Supplied by Owner**
Host Pipe Material:	**Supplied by Owner**
Existing Host Pipe Lining/Coating:	**Supplied by Owner**
Transported Fluid:	**Supplied by Owner**
Internal Operating Pressure:	**Supplied by Owner**
Maximum Operating Pressure:	**Supplied by Owner**

Test Pressure:	**Supplied by Owner**
Operating Temperature:	**Supplied by Owner**
Degree and Radius of Bends:	**Supplied by Owner**
Position of Bends:	**Supplied by Owner**
Host Pipe Location & Profile:	**Supplied by Owner****

** Site plans provided by the Owner shall indicated and service or branch connections, Tees, valves, hydrants, horizontal and vertical bends, that are located on the host pipe section or length to be rehabilitated.

PART 5- INSTALLATION

5.01. CLEANING AND CCTV INSPECTION

Water necessary for cleaning, disinfection, and flushing will be available, at no cost, from locations (fire hydrants) indicated by the Owner prior to the start of work. The water source provided shall be in close proximity to lines being worked on. The Contractor shall arrange with the Owner, for issuance of an approved combination meter and backflow prevention device. The Contractor shall provide necessary piping or flexible hoses and fittings, for connection between fire hydrant and end of pipe section where water is required. The Owner shall provide a location at no cost to the Contractor (e.g., sanitary sewer, etc.) for proper disposal of water after use.

A. <u>Cleaning Pipelines</u>: The Contractor shall remove all internal debris and tuberculation from the host pipeline that will interfere with the installation of the FFRP or be detrimental to the final product. ALL WATER shall BE SUPPLIED BY OWNER

B. <u>Removal of Obstructions and Protrusions</u>: All obstructions and protrusions shall be removed that could be detrimental to the final product and brought to the attention of the Manufacturer, Owner or Engineer prior to the FFRP insertion for correcting. Where inspection reveals an obstruction or protruding weld seam that cannot be removed by conventional remote equipment and practice, a point repair excavation shall be made to uncover and remove or repair the obstruction prior to the installation of the FFRP.

Host Pipe Failures: If any host pipe failures have occurred prior to the installation of the modified FFRP or are revealed through internal inspection that would inhibit installation or the operation of the pipe they shall be recorded and brought to the owner's representative to evaluate and correct as necessary by external or internal point repairs prior to lining.

C. Confirmation of Bends: The location, radius and position of bends shall be noted and brought to the attention to the Manufacturer, Owner or Engineer for lining approval.

D. CCTV Inspection: A video inspection shall log and confirm the adequacy of the cleaning and removal of all debris, tuberculation, obstructions, protrusions and the confirmation of radius of bends within the section.

   a. All appetencies, i.e., valves, tees, services etc. shall be noted on the inspection log and brought to the attention of the Manufacturer, Owner or Engineer for lining approval.

   b. The inspection video and logs shall be submitted to the Owner for lining approval.

5.02. INSTALLATION

The method for installation shall be the modified sliplining method per AWWA M28 and be in accordance with the latest edition of the Manufacture's Installation Manual. The installation shall be performed by a trained and certified Installer.

FFRP Insertion:

A. The reel of modified FFRP is positioned at the insertion point (a manhole, chamber, excavated pit or shaft that serves as the point of entrance for the insertion of the modified pipe into the existing pipe) and an appropriately sized winch at the destination point (a chamber, excavated pit or shaft that serves as the point of exit for the modified pipe from the existing pipe).

B. The winch cable shall be strung through the host pipe and attached to the pulling head with an anti-twist devise to prevent the FFRP from twisting while being inserted. The FFRP shall be pulled through the host pipe via the winch located at the destination point.

C. Pulling forces shall be monitored, recorded and limited so as not to exceed the axial strain limits of the FFRP. The manufacturer shall provide information on the maximum allowable tensile stress of the FFRP and the appropriate pulling device (pulling head or a steel cable) needed for the liner being installed.

D. Lubricant: The use of a non-toxic lubricant, suitable for drinking water if required, during the insertion is required to reduce friction during the insertion. The lubricant shall not support the growth of bacteria and will not adversely affect the fluid to be transported. The lubricant can be swabbed or sprayed applied or by other means.

E. The FFRP shall be reverted to its original round shape using forced air pressure when applied to a rubber flow-through plug. The pressure shall be contained within the FFRP by a rubber stopper plug at the termination point and processed in accordance to the Manufacturer's Installation Manual. Internal pressure shall not exceed 14.5 psi.

F. Upon completion of the insertion and re-rounding process of the FFRP, end connectors shall be installed by a trained and certified technician at the termination ends of the FFRP in accordance to the Manufacturer's Installation Manual and provide a flanged or welded point for tie-ins.

PART 6- HYDROSTATC PRESSURE AND LEAKAGE TESTING / PRESSURE TESTING

6.01 The FFRP shall be subjected to a hydrostatic pressure test in accordance with the owner's requirements. In the absence of owner requirements, a recommended pressure and leakage test shall be at 1.5 the known working pressure or at working pressure plus 50 psi, whichever is less.

6.02 Hydrostat and Main Pressure tests in water and wastewater pipeline applications must be executed with water.

6.03 Hydrotest Preparation & Procedures:

a. The FFRP-lined section of the pipeline to be tested must be filled with water and air-free. In the case of potable water applications, disinfectants may be added if required.
b. Apply the pre-determined test pressure, and rest for 5 (five) minutes.
c. After the 5-minute rest period with pressure drop, the test pressure must be reapplied by pumping. The pumping process must be repeatedly applied with 5-minute rest period intervals. The pressure drop should decline after each repetition compared to the pressure drop measured from the step before.
d. The test pressure should be reapplied every 5 minutes until the pressure drop "after 5-minute period" is 0.23 PSI (0.016 bar) maximum.

6.04 Main Pressure Test:

a. Main pressure test shall begin after completion of hydrotest in 6.03.
b. Main pressure test must be executed for 2 (two) hours.
c. Main pressure test is considered successful if the pressure loss does not 3 PSI/hour. Hence after the 2-hour period, the pressure loss must not exceed 6 PSI (0.4 bar).

6.05 Leakage Allowance- There is no leakage allowance for a section of FFRP, because when properly made in continuous lengths and installed with approved connectors, it does not leak. Other types of joints or connections in the system may have a leakage allowance. Contact the joint or connection manufacturer for information.

NOTE: If the installed system needs to transport liquid media it shall be assessed with water (hydrostatic pressure testing). If the installed system needs to transport a gaseous media, it should be evaluated with compressed air in accordance with F2786.

PART 7- ACCEPTANCE TESTING

7.01 The FFRP shall be deemed acceptable when the installation is performed according to Section 5. and the applicable tests according to Section 6. are satisfied.

7.02 The finished lining shall be continuous over the entire length and be impervious and free of any leakage from the pipe to the surrounding ground.

PART 8 - DISINFECTION OF THE PIPLINE FOR POTABLE WATER

8.01 In potable water applications the rehabilitated system and all exposed sections of any other pipe and appurtenances of existing pipelines shall be cleaned, disinfected, and verified through bacteriological testing in accordance ANSI/AWWA C651, unless otherwise specified in the contract documents or approved by the Owner.

PART 9 - WATER MAIN RECONNECTION AND CLEAN-UP

9.01 Upon project completion, the Owner or Contractor, as specified by contract documents or purchase order, shall return the piping system to service by closure of all access pits with appropriate pipe spools, valves, and other relevant pipe fittings.

9.02 Upon acceptance of the installation, the Contractor shall reinstate, the project area affected by the operations.

END OF SECTION 15200

EXHIBIT E - Cement Mortar Lining for Potable Water

[redacted]

<u>**Epoxy Lining for Potable Water**</u>

[redacted]

Valves for Potable Water

[redacted]

Close Tolerance Pipe Slurrification

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]