PLASTICS·PIPE·INSTITUTE®
105 Decker Court, Suite 825
Irving, TX 75062
Phone: 469-499-1044
www.PlasticPipe.org

BUILDING COMMUNITY

INFRASTRUCTURE PROGRESS PROCEEDS IN PALO ALTO

Potable Water System Latest Improvement Initiative;
PE 4710 Pipe Trenchless Construction Saves City Money and Time

PALO ALTO, Calif. - Long known as a forward-thinking area, the west coast city of Palo Alto has completed approximately one half of a 300-day project that has replaced three miles of targeted cast iron water main pipe reaching the end of its useful life out of a project total of six miles to help secure the future delivery of reliable water service to its residents. The success of this initiative has propelled the city to adopt PE4710 pipe, installed as much as possible by horizontal directional drilling, for ongoing system replacements. The City is on track to replace the entire 214 mile system.

Palo Alto is considered the economic hub of Silicon Valley. Covering some 25 square miles, the city has a resident population that swells daily to 198,000 people, employed by some 7,000 businesses including Amazon, Facebook and HP along with Stanford University.

"This is a very high tech community," explained Greg Scoby, PE, manager of water, gas, wastewater engineering for the City of Palo Alto Utilities Department. "Consequently, the city is fairly progressive and a lot of new approaches are investigated and used in the utilities department. The latest project involves replacing targeted water mains to eliminate leaks and improve the reliability of the system."

"Current studies indicate that PE materials will provide extended useful service levels over materials previously used for system replacements," Scoby stated.

The water main system currently consists of pipe made from asbestos cement, ductile iron, concrete cylinder, PVC and more than 388,000 feet of cast iron.

The city started to use HDPE pipe because it could be installed by boring instead of the open trench method. The water main replacement program is focused on converting cast iron pipe because the material corroded away over time and leaks.

The advantage of being able to directionally drill (HDD) or bore the HDPE pipe on a horizontal plane is that this method is less disruptive to surroundings, minimizes hauling associated both with excavation and paving, and can result in both lower costs for both installation and material life cycle. The HDPE pipe is also resistant to internal build-up or abrasion and provides a leak-free, fully-restrained system.

PLASTICS·PIPE·INSTITUTE®
105 Decker Court, Suite 825
Irving, TX 75062
Phone: 469-499-1044
www.PlasticPipe.org

BUILDING COMMUNITY

"There has been a continuing increase in the number of water systems that are using HDPE pipe," stated Tony Radoszewski, executive director of The Plastics Pipe Institute (PPI), a non-profit trade association. "This is because more and more systems are failing each and every day. The old pipes split, crack and the connections leak. This loss can be stopped, not just slowed or diminished to an acceptable level that communities feel they have to accept as a normal part of having an outdated product. A new system with fused HDPE pipe sections will not leak."

The process to use PE pipe in Palo Alto started in the mid-1980s with its adoption by the City's gas utility.

"Because of the age of our infrastructure, we recognized at that time that there were issues with our gas, water and waste water systems," explained Scoby who was working on the gas system at the time. "The City Council agreed to accelerate the replacement program. The gas system was first. Then waste water, then we went to water.

"We started the increased level of replacement using trenching methods. We actively pursued leaking mains and areas reaching the end of their respective useful lives, focusing initially in the gas system."

Later, in the mid-1990s, there were several developments in the construction of pipelines, one being directional drilling.

"Again, always looking to be progressive, we were one of the first to test early versions of directional drilling equipment through the Gas Research Institute. We have been using that method since around 1997," Scoby said.

"Just before that development, we were doing about 20,000 feet a year with cut and cover, and were able to increase our replacement by 50 percent by moving to directional drilling, not only because of the time saved, but also because of the reduction in costs caused by tearing up streets and replacing the pavement. Directional drilling allowed us to do a better, faster job and install more feet of pipe for about the same dollar amount."

Scoby became responsible for the water system in March 2009. "The water department started the year before to develop a project putting in PVC. The water engineers had traditionally used PVC as our primary replacement material. I, however, convinced my then supervisor that we had to get out of putting in a mechanical-type joining system in favor of a heat-fused one."

Scoby's experience on the gas side provided the real-world results that backed up his recommendation. "We had just conducted a 100-percent leak survey of our gas system and we had zero leaks on PE mains, some of which had been around since 1985-86. Since we had the familiarity with the PE material and great results, we decided it was prudent to conduct a pilot project for water."

PLASTICS·PIPE·INSTITUTE®
105 Decker Court, Suite 825
Irving, TX 75062
Phone: 469-499-1044
www.PlasticPipe.org

BUILDING COMMUNITY

Specifications were developed and the job was sent out to bid involving about six miles of replacement mains, the majority being 8-inch with some 10-inch and 12-inch diameter pipe. The project called for half the system to be installed with open cut and cover, and the other half using directional drilling.

"We really didn't have a feeling for installing large diameter pipe by directional boring," Scoby explained, "because we directionally drilled the gas system using 1-inch CTS through 8-inch IPS diameter medium density polyethylene pipe. So for the water system that would use pipe up to a foot in diameter, we had to determine at what point does it become more cost effective to use the open cut method.

"We couldn't predict at that time how long it would have taken to install the larger diameter pipe, and we had about 6,500 feet in all."

The project began in September 2009 with a contractor from San Francisco, Ranger Pipelines, Inc., who was knowledgeable about HDPE pipe. "The contractor installed at a much quicker rate than we projected. This included both open cut and directional - the mix came out about 50 percent each way," Scoby related. "It's been a very successful project to date." After the installation was complete, the mains were disinfected, tested and tied in starting in early December 2009. The water delivered by the San Francisco Public Utilities Commission contains approximately 1.88 mg/L of chloramine, which was adopted as the primary disinfectant in 2004.

A recent study by Jana Laboratories was commissioned by PPI to investigate the effects of disinfection on the lifetime of polyethylene pipes. Based on this methodology, Jana developed case studies and confirmed that 100-plus year life is projected for pipes made from the higher performance PE 4710 materials that are being installed in four utilities. Palo Alto was one of the participants. The study is found at www.janalab.com/pdf/PE%20Chlorine%20Report%20-%20Final-2.pdf

The city's water main replacement project used PE 4710, SDR 11 potable water pipe from Performance Pipe, Inc., a division of Chevron Phillips Chemical Company LP and a PPI member. The DriscoPlex® 4100 pipe is certified to ANSI/NSF Standard 61 for potable water applications and is manufactured from a PE compound with an ASTM D3350-02a cell classification of PE 445574C. The fittings utilized in the piping system were also molded PE 4710, Class 200 fittings. DriscoPlex 4100 piping components are made from a pressure-rated PE 3408/4710 extra-high molecular weight, high-density polyethylene material. Palo Alto's operating pressure is 65 psig.

PLASTICS·PIPE·INSTITUTE®
105 Decker Court, Suite 825
Irving, TX 75062
Phone: 469-499-1044
www.PlasticPipe.org

BUILDING COMMUNITY

BE A HERO BUILDING COMMUNITY

"The PE 4710 designation basically notes an improvement in materials over the older, more general PE 3408 designation, which has been the standard specification for pipe in a typical potable, pressure water system," explained Scoby.

According to Stephen Boros, PPI's technical director, "Advances in PE polymer chemistry and manufacturing have resulted in the creation of high performance PE 4710 compounds that exhibit greater resistance to the development and propagation of cracks when subjected to localized stress intensifications typically found in water piping systems. These compounds can be utilized with a design factor of 0.63 if they meet key additional performance criteria as established by the Hydrostatic Stress Board. This translates to the ability for the piping system to have a higher design pressure with increased flow capacities and without compromising safety or long-term service."

"Improvements in HDPE pipe resin and in manufacturing are a continuous process, and the codes and standards evolve to reflect these changes," explained PPI's Radoszewski.

"Therefore, as these improved materials are introduced, pipe manufacturers may imprint the pipe with the old and new codes in order to meet engineering design or purchase specifications. It is typical to see, for example, PE 3408/4710 on the same pipe."

PE 4710 water pipe materials are also available from multiple PPI member manufacturers as listed on http://plasticpipe.org/municipal_pipe/mi_members.html

The PPI's reference guide called *The New PE Pipe Material Designation Codes* lists the historical and new codes as well as the associated design parameters, which is helpful in deciphering the data.

The solid wall pipe grade typically used in potable water systems historically was PE 3408 as per ASTM D 3350-02a. Because this designation was broad in scope, it was not possible to differentiate newer materials with increasing performance characteristics. In 2004, ASTM D 3350 was modified so the high performance materials could be recognized and thus differentiated in the marketplace taking advantage of the improved performance properties.

Product specifications in various industries and end-use applications are being revised to recognize these newer material designation codes as well. Because of their increased performance capabilities, PE 4710 compounds were required in developing ASME code for the use of PE pipe in nuclear power plant safety water systems.

PLASTICS·PIPE·INSTITUTE®
105 Decker Court, Suite 825
Irving, TX 75062
Phone: 469-499-1044
www.PlasticPipe.org

BUILDING COMMUNITY

BE A HERO BUILDING COMMUNITY

Connecting the new HDPE solid wall pipe to the existing system was one of the most important considerations for Scoby and his department. "Since PVC has been the primary material used for water main replacement, the city specifications, standards, and installation procedures required major revision to incorporate HDPE," explained Aleksandr Pishchik, PE, senior project engineer, City of Palo Alto Utilities Department, and the project's manager.

A number of fittings were considered for integrating new HDPE pipe into the existing water distribution system.

The following fittings were selected:

- Mechanical Joint Adapters (MJ) for joining HDPE to Ductile Iron and PVC pipes. The MJ adapter connection is fully self-restrained.
- PE Flange Adapters for joining HDPE to existing flanged valves.
- Mechanical coupling Smith-Blair 441 series were selected for joining HDPE and Asbestos Concrete pipes.
- Mechanical coupling Smith-Blair EZ-W series were specified for joining HDPE and Cast Iron pipes.

"The advantage of the HDPE system is that pipes and fittings can be connected by heat fusion and form joints that are fully restrained against pullout," stated Pishchik. "The butt-fusion method, which creates permanent leak-free joints, was specified for connecting lengths of HDPE pipe, as well as for fittings such as valves, tees, ells, and reducers."

In order to minimize the number of mechanical joints, the staff specified American AVK6 resilient seated gate valves with polyethylene pipe ends. These valves can be joined by butt fusion with other components in an HDPE water system.

The majority of butt fusion was done on a McElroy Rolling 28 Combination Unit

Electro-fusion Frialen VA service saddles manufactured by Friatec Gas Water Inc. along with saddles manufactured by George Fisher Central Plastics were selected as tapping hardware for reconnecting existing services.

For proper installation of tapping hardware, the specifications required the use of a top loading clamp for eight inch and larger saddles. Electro-fusion couplings by Friatec and Central, both PPI members, were specified for connection to HDPE pipe at locations where butt fusion was not feasible.

"On the strength of the success of PE pipe in our gas and now our water system," Scoby summarized, "we're currently revising our standards to reach our goal to have a 100 percent fused, no-leak system."

PLASTICS·PIPE·INSTITUTE®
105 Decker Court, Suite 825
Irving, TX 75062
Phone: 469-499-1044
www.PlasticPipe.org

BUILDING COMMUNITY

BE A HERO BUILDING COMMUNITY

For additional information about the Palo Alto project or HDPE pipe, please go to the Plastics Pipe Institute's website at: www.plasticpipe.org.

About PPI

The Plastics Pipe Institute Inc. (PPI) is the major trade association representing all segments of the plastic pipe industry and is dedicated to promoting plastics as the material of choice for pipe applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in development and design of plastic pipe systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.