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THE INTRODUCTION OF PE-100 AT WASHINGTON GAS

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ABSTRACT:

Washington Gas has been researching a number of innovative methods for the repair and replacement of older large diameter cast iron mains. We considered direct burial, rolldown, U Lining, PIM, and guided boring. The ideal replacement technique would allow for a fully rated (64 psi or 5 bar) system which would have a low installation cost, a minimum 50 year life, rapid and easy installation, and provide a safe, secure, all-fused system. Trenchless technology is very attractive due to the low cost and minimal disruption to our customers. We wanted to replace an older 24" cast iron pipe operating at 20 psi (1.4 bar) with an inserted 16" IPS plastic main rated for 64 psi.

Washington Gas would require the following performance criteria:

- 1) The polyethylene (PE) pipe must be rated at 64 psi and yet have the maximum internal diameter. Thus high density Standard Dimension Ratio (SDR) 17 was chosen.
- 2) The PE pipe must have a very high resistance to slow crack growth because of the potential stresses and damage that would be inherent in insertion.
- 3) The pipe must have the highest resistance to rapid crack propagation since it would be unrestricted inside several sections of a 24" cast main. Furthermore, it would be possible to have dramatic swings in pipe temperature, and if the pipe were to be impacted with enough force to break through the casing rapid crack propagation (RCP) could, in theory, initiate.
- 4) Controlling the gas flow is also critical; therefore a 16" squeeze off tool was developed and tested by Mustang Manufacturing. Ideally, the PE pipe would have to be able to be squeezed to 100% shutoff with no damage or reduction in usable life.
- 5) Joining the PE pipe was also an important consideration. It was imperative to develop and test plastic-to-steel transition fittings as well as complying with the requirements of the Plastic Pipe Institute (PPI) universal procedure (PPI TR – 33/99)

We selected a material that would meet all of these criteria and that is PE-100. It is impervious to RCP because it has a critical temperature of zero degrees Fahrenheit (-18

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degrees Celsius), and has a slow crack growth resistance of over 2000 hours in the PENT test. PE-100 can withstand substantial backhoe hits and mechanically induced damage that would cause failures in other piping systems. The PE-100 material we chose was Phillips 8300 pipe made from Solvay TUB 121 resin.

On August 21, 2000 Washington Gas installed the first 16" IPS PE-100 material in the United States. We will monitor its performance closely over the next 10 years.

INTRODUCTION:

Since the 1850's, Washington Gas has provided natural gas service to the mid-Atlantic seaboard region of the United States. Today, the Washington Gas distribution network includes over 800,000 residential, commercial and industrial services extending from Baltimore, Maryland to the mid-Virginia region of the US. Brown's Directory ranks Washington Gas as one of the largest natural gas distribution companies in the US based on number of services and geographic region served. (1)

The high visibility of this natural gas system which includes our nation's capitol combined with sustained demographic growth of the region has resulted in significant engineering challenges associated with the construction and maintenance of this vast distribution network. This paper shall examine one such case history. In the paragraphs which follow, we shall explore the engineering considerations involved in the rehabilitation of a 24" cast iron natural gas line in the Greater Washington DC area using the PE100 quality of HDPE gas pipe. Through an examination of a project such as this we can gather insight into Washington Gas' commitment to utilize the latest technological developments in HDPE pipe materials and construction techniques to safely improve distribution efficiencies to its customer base.

THE M STREET CAST IRON RENEWAL PROJECT:

In early 1999, Washington Gas analyzed the growing demand for gas in the southern District of Columbia and northern Virginia region of its system. Based on information available at the time, Washington Gas determined that the increasing need for gas in this region would be difficult to service through the existing series of older cast iron mains and the existing service network. A critical element of the plan that was developed to improve service to this area was the use of a 24" OD cast iron line that was originally installed in the mid 1940's. This line was intended to serve as a major transfer link within the system.

Concerns over the use of the older cast iron line arose as plans developed and it was soon determined that by rehabilitating the line with butt fused HDPE that the pressure capability of the line could be gradually increased over time as demand necessitated higher gas flow. The use of butt fused HDPE would circumvent any concerns regarding joint integrity or corrosion of the older cast iron line that may have occurred since its original installation. Utilizing the performance capability of modern HDPE pipe combined with the latest in trenchless installation techniques, Washington Gas would be

