Bngoville Natural Gas (BNG) is a local natural gas distribution company which experienced pinhole leaks in numerous service risers. In order to prevent pinhole leaks while improving overall safety of its system, BNG installed an Ionix Static Eliminator at the city gate to eliminate static in their system.

BNG discovered the pinhole leaks in numerous service risers and determined these leaks were probably caused by static electricity in the PE riser. It was suggested to BNG that the leaks might actually be gas permeation through the pipe riser wall. However, BNG trenched a typical leaking riser and filled it with water. They videotaped the bubble rate of the gas through the water. The bubble rate was visibly greater than any natural gas permeation through the pipe wall.

**Background Of Pinhole Leaks**

Pinhole leaks are created by static electricity building up inside PE pipe. Since PE is an electrical insulator, static charges generated by gas passage inside the pipe remain and accumulate inside the pipe wall. When the static charge reaches a sufficiently high level, the charge arcs through the pipe wall to the grounded earth on the outside wall (or to the grounded metal sheathing of the riser). When this occurs, the heat from the electrical arcing melts the PE pipe, creating a pinhole leak.

Industry reports of pinhole leaks date back to 1981 when Mark Staker at then Mountain Fuel (now Questar) first documented pinhole leaks. Since then, other LDCs have reported pinhole leaks. However, the lack of numerous reports must be tempered with the fact that over 99% of the possible leaks are buried and difficult, if not impossible, to detect. However, in the 1% of the pipe that pinhole leaks are easily detectable – the service riser – leaks at this point are beginning to generate national attention.

BNG’s experience with pinholes in service risers is not isolated or unique. This phenomenon of leaking risers has been recently cited in Fire Findings Newsletter. This quarterly newsletter for fire investigators published an article about pinholes in gas service risers in response to numerous incidents around the U.S. where fires have begun as gas meters. They suspect the leaks at these gas meters are due to pinhole leaks caused by static.

These incidents conform to the one common characteristic of pinhole leaks in PE fuel gas pipe — it generally occurs in smaller diameter pipe. Given this observation, we theorize that as load increases in a system, the velocity of gas passing through a smaller diameter pipe is proportionally greater than that of a larger diameter pipe. This “velocity effect” is further enhanced by the fact the pressures are generally lower in smaller diameter pipe since pressures have been stepped down for delivery.

Therefore, all things being equal, velocity must increase proportionately more in smaller lower pressure PE pipe than higher pressure PE to deliver the load. If this is true, this higher velocity results in greater friction of the gas against the pipe wall, creating higher static charges inside the pipe wall. The result is pinhole leaks in small diameter pipe when load and conditions are such to generate excessive static electricity inside the pipe.

This paradigm is consistent with the pinholing during squeeze-offs reported by Mark Staker at Questar. During squeeze-off, Staker observed as velocity increased at the squeeze-off point, static built up to a level which overcame the dielectric resistance of the PE. The charge arced through the PE pipe wall and the heat from the arcing caused a pinhole. The increase in velocity during squeeze-off is similar to increase in velocity in small diameter PE pipe that occurs during periods of high demand.

BNG receives its gas at 400 psi into a 4-inch main. At that point, BNG installed an Ionix Static Eliminator in a 600 ANSI steel housing. After gas passes through the static eliminator, it is stepped down in pressure and delivered to more than 3,000 services in the system. Ionix is installed in the steel part of the system and then the steel transitions to PE.

Testing the effectiveness of static elimination in the system is easy. All that is required is an electrostatic voltmeter. BNG uses a Trek 510. Ionix uses an ACL 300B. To test for elimination of static in a system, you first measure the static currently present in the system. To accomplish this, you locate static in risers as far away from the installation as possible. Therefore, if static is shown to be eliminated at these downstream points, you can be assured that static is eliminated upstream of these points.

To measure static in a riser, first carefully mark a point on the riser convenient to take a static reading. Use the conventional industry procedures to dissipate static on the riser. When completely dry, measure the static at the marked point following the electrostatic voltmeter manufacturer’s instructions. This reading is the static inside in the pipe.

BNG followed this procedure. They chose several risers at the end of their system and measured static prior to the introduction of Ionix at the city gate.

After introducing the static eliminator into the gas stream at the city gate, BNG personnel measured the static at the same riser monitor points and all static was gone. Additionally, BNG measured static at risers of another LDC just outside their service area but near their static monitoring points. Static was present in these risers.

LDC’s need to check risers for “frog bubbles” or “Fizzies” leaks at their risers. This is the area where electrostatic pinhole leaks are most likely to be detected and cause fires at meters. Additionally, operators should be aware that the presence of pinhole leaks in service risers is a strong indicator of the probability of additional pinhole leaks in buried service lines.