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## STATIC ELECTRICITY AND POLYETHYLENE PIPE

### INTRODUCTION

The phenomenon which we call static electricity has been observed, studied, reported on and often misunderstood, since 600 B.C. It is considered by most people to be a nuisance. To those in the gas industry, static electricity is also recognized as a potential ignition source and hence a potential hazard.

Plastic pipe, with its excellent electrical insulating properties, under certain operating conditions can develop a very large static charge build up. The following discussion reviews the various field conditions which may cause a charge buildup and discharge and presents practical methods for dealing with this potential problem.

ELECTROSTATIC CHARGE ACCUMULATION Plastic pipe can be represented electrically as a cylindrical capacitor. In order to induce a static charge, physical contact must be made by another solid state body. Two identical materials cannot create any charge after their contact because there is no energy gain in the process of transferring. However, if different materials are in contact with each other, there is generally some energy difference between two sides of the potential barrier. For example, rubbing the pipe with a cloth can build up a charge. On the other hand, clean, dry gas flow will not. However, if small amounts of particulate matter are present in the flowing gas (dust or rust), a high charge can be created. One particular situation that can produce a high charge on the polyethylene pipe is where there is a break and the resulting gas flow causes dirt particles to strike the pipe at high velocities.

Literature sources cite laboratory and field experiments that show substantial voltages can be generated on plastic pipe, either as a result of transporting gas containing particulate matter or from a break in the line. A charge of only 1000 to 3000 volts is necessary to produce a detectable spark on discharge to ground. The stored energy from 1000 volt charge is 0.1 millijoule, which is the minimum energy necessary to cause ignition of a flammable gas/air-mixture. Therefore, static electricity must be considered as a potential hazard with polyethylene gas pipe if flammable gas is present.

ELECTROSTATIC DISCHARGE As an object (electrode) approaches an electrically charged body, the electric field surrounding the charged body is disturbed. If the electrode is initially uncharged, the electric field gradient around charged body will increase with the approach of the electrode. This increase results in a discharge, from the charged body, to the electrode, of a low-level, non-visible charge. If the electrode continues to move closer to the charged body, a visible electrical discharge (spark) occurs.

There is a natural discharge with time to the air around the pipe. The higher the humidity the more rapid the discharge. When a charge does accumulate, it is important to have intimate contact of the pipe with a way to ground. It is not the static electricity directly that is a hazardous in a gas/air mixture, but rather the spark produced at the point of discharge. Therefore, in all cases where a static spark discharge could be hazardous, precautions must be taken.

### AGA PROCEDURES

The following are the precautions recommended by the American Gas Association in the 1994 Plastic Pipe Manual for Gas Service:

1. The use of a grounded antistatic PE film or wet tape conductor wound around or laid in contact with the entire section of the exposed piping.
2. If gas is already present, the pipe should be wet with a very dilute water solution of dishwasher-type detergent suitable for use with plastic starting from the ground end. The tape should then be applied immediately and left in place.
3. The tape should be kept wet by occasional applications of water. Where ambient temperatures below 0° C (32° F) are encountered, glycol may be added to the water to prevent freezing. The tape should be grounded with a metal pin driven into the ground.
4. Do not vent gas using ungrounded plastic pipe or tubing. Even with grounded metal piping, venting gas with high scale or dust content could generate a charge in the gas itself and could result in an arc from the dusty gas cloud back to the pipe and ignition. Venting should be done at a down-wind location remote from personal or flammable material.
5. Ground the tools and remove potential sources of ignition.
6. In all cases, appropriate safety equipment such as flame-resistant clothing treated to avoid static buildup, and respiratory equipment should be used.
7. Commercially available electrostatic discharger systems may be considered as a means of eliminating static electricity from both the inside and outside of PE pipe.

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