

ODORANTS IN PLASTIC FUEL GAS DISTRIBUTION SYSTEMS

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Foreword

This report was developed and published with the technical help and financial support of the members of the PPI (Plastics Pipe Institute, Inc.). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users. The purpose of this Technical Note is to provide recommendations for the use of odorants in gas pipelines that are manufactured of plastic materials.

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ODORANTS IN PLASTIC FUEL GAS DISTRIBUTION SYSTEMS

1.0 SCOPE

This technical note provides recommendations when using odorants in fuel gas systems that contain plastic pipelines in whole or in part.

2.0 ODORANT REGULATIONS

Natural gas and propane are odorless unless an odorizing chemical compound is added. Requirements for odorizing natural gas were implemented after un-odorized natural gas ignited in a Texas school in 1937 killing approximately 300 people. To enhance safety, the fuel gas industries add chemical compounds, with a unique odor, to alert the user if a leak occurs. This odor is designed to be readily detectable by smell when the fuel gas reaches a concentration in air of one-fifth of the lower explosive limit.

CFR 192, Minimum Federal Safety Standards, section [192.625](#) establishes requirements for odorization of fuel gases supplied through regulated distribution systems. National Fire Protection (NFPA) Bulletins, [No. 58: Storage and Handling of Liquefied Petroleum Gases](#), and [No. 59: Liquefied Petroleum Gases at Utility Gas Plants](#) provide the requirements for odorization of LP Gas and LP-Air gases. For detailed information on current regulations review these documents.

3.0 ODORANT TYPES

Odorants typically consist of a mixture of various flammable colorless liquid compounds, see Table 1:

Table 1: Odorants - Compound and Chemical Formula

Compound	Chemical Formula
Dimethyl Sulfide (DMS or methylthiomethane)	$(\text{CH}_3)_2\text{S}$
Ethyl Mercaptan	$\text{CH}_3\text{CH}_2\text{SH}$
Isopropyl Mercaptan	$\text{C}_3\text{H}_8\text{S}$
Methyl Ethyl Sulfide	$\text{C}_3\text{H}_8\text{S}$
Propyl Mercaptan	$\text{CH}_3(\text{CH}_2)_2\text{SH}$
Secondary Butyl Mercaptan	$\text{C}_4\text{H}_{10}\text{S}$
Tertiary Butyl Mercaptan (TBM)	$(\text{CH}_3)_3\text{CSH}$
Tetrahydrothiophene (THT)	$\text{C}_4\text{H}_8\text{S}$

These chemical compounds can smell like rotten eggs or cabbage, kerosene, lighter fluid, or skunk spray and are readily detectable at unusually low concentrations. Odorant manufacturers create custom blends of the noted compounds so that they are more suitable for specific applications. Most gas odorants are organosulfur compounds at full concentrations under ambient conditions, and, in this state, might be harmful to some plastic pipe materials. Organosulfur compounds, in sufficient concentration, can swell and soften most plastic pipe materials. The appearance and ability to fuse plastic pipe may also be affected due to odorant saturation when

odorants are used incorrectly. Odorants should never be introduced into a plastic pipe system in a concentrated liquid state using an uncontrolled process. Also, liquid odorants in concentrated form should not be used to locate leaks in plastic pipelines. However, in the concentrations typically needed to odorize the gas being transported and distributed by pipeline, they are in the vapor state and cause no harm to plastic piping.

4.0 ODORIZATION PROCESS

Odorants are typically introduced into gas lines along a distribution system to maintain a level in the natural gas such that the detectable level in air is one-fifth of the lower explosive limit of natural gas.

Newly installed pipelines will absorb odorant and require a conditioning process. This process is commonly called pickling, from a process used for steel pipe treatment. Many utilities will use a temporary odorant station to supplement their standard process, so there is no odor fade as gas travels down the line. Steel pipes can take some time to pickle as the steel will react with the odorant; however, plastic pipes absorb little odorant vapor. During conditioning or pickling, liquid odorant should never be introduced to plastic pipe through an uncontrolled process. To assure the proper concentration of odorant in the gas stream, operators conduct periodic sampling of the gas along their piping system especially at ends of main lines and in low-flow areas.

Odorant is injected in liquid form into the pipeline at a controlled rate determined by gas flow. The liquid odorant quickly vaporizes and mixes with the gas stream during controlled addition processes. Concentrations in the vapor phase should be low enough to prevent condensation at the lowest temperature and the highest pressure encountered in the system. When odorants are injected at nominal rates the concentration rarely exceeds 25 parts per million by weight in the vapor phase. At this concentration, odorants are not harmful to plastic pipe.

INFORMATIVE REFERENCES

ASTM D6273-20 - Standard Test Method for Natural Gas Odor Intensity