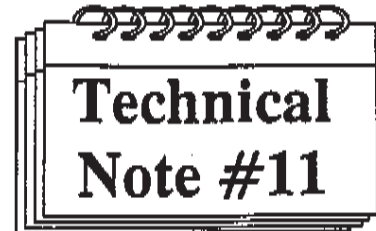


**DRISCOPIPE**POI TN-11
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BURNING CHARACTERISTICS OF POLYETHYLENE

Introduction

Environmental protection, hazardous material, worker safety and flammability are all public issues of great importance. These can become highly emotional issues and, unfortunately, misinformation and distorted facts will influence public decisions and actions.

There are many different plastics each with its own burning characteristics. Some plastics, in a fire situation or with fumes from processing, are more hazardous than others. However, the term "plastic" is used in public debate and, consequently, specific concerns may become a general condemnation of all plastics materials and products.

In order to document analytical facts and dispell any misinformation or myths, this Technical Note will present the burning characteristics of polyethylene which includes the Driscopipe products. Analyses of off-gases in burning and heating and regulatory agency ratings will be summarized.

Burning Characteristics

Polyethylenes will burn when ignited by an outside source of heat. They can generally be compared to candles which are solid, crystalline hydrocarbons very similar chemically to polyethylene except that candles are much lower in molecular weight. The general classification used in the industry is "Slow Burning" (SB). The basic characteristics of burning rate, flash point and ignition temperature are shown in Table I.

The National Fire Protection Association (NFPA) has a system of rating materials in regard to fire hazards which is detailed in NFPA 704, Standard System for the Identification of the Fire Hazards of Materials. This system is used in most fire codes throughout the country and is applicable in industrial storage, manufacture and use of materials. The NFPA system involves a numerical rating from 0 to 4 with severity in ascending order. Table II lists the ratings and definitions for polyethylene.

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Off-Gases

Polyethylene pipe resins are heated to a moderate temperature for extrusion and molding and in a much more limited way for heat fusion in the field. There is an odor but it is generally not considered offensive to the senses nor irritating to the nose or throat. In normally ventilated extrusion or molding plants, OSHA does not require that self-contained breathing apparatus be used.

The off-gases from heating polyethylene to 450°F for 20 minutes were analyzed with the general results shown in Table III. None of the products detected meets the definition of a hazardous material given in 29CFR Part 1910.100 (OSHA).

Combustion Products

As indicated, polyethylene will burn when ignited. There is less than 0.01 per cent ash* on complete combustion. The analysis of the vapors released is shown in Table IV. By far, the major combustion product is carbon dioxide which is a non-toxic, non-irritating gas. Depending on the supply of oxygen present during combustion, some carbon monoxide is also produced as is the case with any naturally occurring organic material such as wood, cotton, etc. Also, it should be noted that no chlorine, nitrogen or sulfur chemicals are present which are present in other plastics used in the pipe industry. In these cases, hydrogen chloride, nitrogen oxides and sulfur oxides are formed which, even in very small quantities, are noxious and irritating to the respiratory system.

*Some pigment will remain as an ash and the amount is relative to the amount of pigment in the original sample.

Summary

Phillips Driscopipe piping products will burn when ignited by an outside heat source. However, they do not present any more of a hazard in their burning rate or combustion products than natural construction materials such as wood. No special storage or handling is required in regard to combustability.

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TABLE I
BASIC BURNING CHARACTERISTICS

<u>Test Procedure</u>	<u>Result</u>
ASTM D 635, Underwriters' Laboratory Bulletin #94 and Motor Vehicle Standard #302	Burning rate-1"/Min.
Flash Point (open cup), ASTM D 92	430°F
Autoignition Temperature UL Bulletin #55	810°F*

*Birch 720°F, Red Oak 781°F

TABLE II
NFPA 704 RATING OF POLYETHYLENE

<u>Rating</u>	<u>Health Hazard</u> 1	<u>Flammability</u> 1	<u>Reactivity</u> 0
Definition	Materials which, on exposure under fire conditions, would cause irritation but only minor residual injury even if no treatment is given.	Materials that must be pre-heated before ignition can occur.	Materials which, in themselves, are normally stable even under fire exposure conditions and which are not reactive with water.

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TABLE III
OFF-GAS ANALYSIS

<u>Constituent</u>	<u>Relative Concentration</u> (Vol %)
Air plus C ₄ olefins	59.1
A group consisting of C ₅ - C ₈ paraffins, C ₄ - C ₆ aldehydes, C ₆ - C ₇ ketones, C ₆ - C ₈ olefins	32.6
A group consisting of C ₇ aldehyde, C ₆ alcohol, C ₉ olefin, C ₁₀ diolefins and C ₉ paraffin.	3.3
A group consisting of C ₁₀ paraffin, C ₁₀ olefin, unknown paraffin compound	3.3
A group consisting of C ₁₁ paraffin, unknown paraffins and unknown olefins	1.7

TABLE IV
GAS ANALYSIS UNDER COMBUSTION CONDITIONS (mg/g)

	<u>Polyethylene</u> (1022°F)
Carbon dioxide	1842
Carbon monoxide	312
Methane	17.6
Ethylene	70.4
Ethane	11.2
Propylene	37.7
Propane	8.5
1-Butene	19.0
Butane	6.45
trans-2-Butene	10.8
cis-2-Butene	1.58
1-Pentene	13.1
Pentane	3.35
1,3-Pentadiene	38.2
1-Hexene	16.5
2-Hexene	5.72