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Compressed Gas Association

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CGA G-6.10—2006

REAFFIRMED 2014

FLAMMABLE GASES AND/OR OXYGEN CONTAMINATION IN CARBON DIOXIDE FEED GAS

FIRST EDITION

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Work Item 10-061
Carbon Dioxide Committee

NOTE—No technical information has been changed from the 2006 edition. This reaffirmed edition may include minor editorial changes.

REAFFIRMED: 2014
FIRST EDITION: 2006

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1 Introduction

This publication is one of a series compiled by the Compressed Gas Association, Inc., (CGA) to satisfy the demand for information relative to the production, storage, transportation, safe handling, and use of compressed and liquefied gases, cryogenic liquids, and related products.

Most merchant liquid carbon dioxide sold in North America is a by-product recovered from sources such as ammonia fertilizer plants, ethanol fermentation, petroleum refinery hydrogen reformers, a variety of petrochemical processes, and natural wells. The by-product gas typically is transported by pipeline from the source to adjacent carbon dioxide purification and liquefaction plants.

Typical by-product carbon dioxide contains 95% to 99.9% carbon dioxide on a dry basis, although some lower purity sources also are used. Depending on the source, the by-product gas also contains a variety of impurities. During process upsets at the source plants, the quantity of impurities can increase significantly and relative concentrations can vary. A number of energy releases at by-product carbon dioxide plants have been attributed to the presence of high levels of hydrogen, hydrocarbons, oxygen, or a combination of these contaminants in the carbon dioxide plant feed gas.

2 Scope

This publication alerts carbon dioxide producers to potential risks related to changing carbon dioxide feed gas composition. It also discusses the dangers related to excess oxygen or hydrocarbon levels in catalytic oxidation and sulfur and hydrocarbon removal systems used to purify carbon dioxide. In addition, potential fire hazards that can be encountered when spent adsorbent media is exposed to air during periodic replacement are reviewed. Finally, this publication provides recommendations to prevent fire and explosions related to these causes in by-product carbon dioxide plants.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Carbon dioxide

Chemical compound consisting of one atom of carbon bonded to two atoms of oxygen, expressed by the chemical formula CO_2.

NOTE—The shipping name for carbon dioxide in uninsulated cylinders in the United States and Canada is “Carbon Dioxide.”

3.2 Carbon dioxide feed gas

Unprocessed (other than compression and/or cooling) gas that flows from a carbon dioxide source plant to a carbon dioxide plant.

NOTE—This gas can contain a variety of components other than carbon dioxide including water vapor, oxygen, nitrogen and other noncondensable gases, carbon monoxide, light hydrocarbons, heavy hydrocarbons, sulfur compounds, oxygenated compounds, volatile organic compounds, or a combination of these contaminants.

3.3 Carbon dioxide feed gas source

Any plant with one or more processes generating gaseous carbon dioxide, usually as a by-product.

NOTE—Examples include steam methane (or hydrocarbon) reforming, grain fermentation, waste acid neutralization, iron ore processing, ethylene oxide production, hydrocarbon combustion, etc. This definition also includes carbon dioxide found within naturally occurring geological formations (wells).

3.4 Carbon dioxide feed gas supplier

Host or owner of a carbon dioxide feed gas source.

3.5 Carbon dioxide plant

Any installed facility that is capable of producing liquid carbon dioxide meeting required industry product specifications.