CGA

Compressed Gas Association

The Standard For Safety Since 1913

CGA G-8.4—2016

SAFE PRACTICES FOR THE PRODUCTION OF NITROUS OXIDE FROM AMMONIUM NITRATE

SECOND EDITION

PREFACE

As part of a program of harmonization of industry standards, the Compressed Gas Association (CGA) has issued CGA G-8.4—2016, *Safe Practices for the Production of Nitrous Oxide from Ammonium Nitrate*, jointly produced by members of the International Harmonization Council and originally published by the European Industrial Gases Association (EIGA) as EIGA Doc 175, *Safe Practices for the Production of Nitrous Oxide From Ammonium Nitrate*.

This publication is intended as an international harmonized standard for the worldwide use and application of all members of the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association (EIGA), and Japan Industrial and Medical Gases Association (JIMGA). Each association's technical content is identical, except for regional regulatory requirements and minor changes in formatting and spelling.

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This document is subject to periodic review, and users are cautioned to obtain the latest edition. The Association invites comments and suggestions for consideration. In connection with such review, any such comments or suggestions will be fully reviewed by the Association after giving the party, upon request, a reasonable opportunity to be heard. Proposed changes may be submitted via the Internet at our web site, www.cganet.com.

This document should not be confused with federal, state, provincial, or municipal specifications or regulations; insurance requirements; or national safety codes. While the Association recommends reference to or use of this document by government agencies and others, this document is purely voluntary and not binding unless adopted by reference in regulations.

A listing of all publications, audiovisual programs, safety and technical bulletins, and safety posters is available via the Internet at our website at www.cganet.com. For more information contact CGA at Phone: 703-788-2700, ext. 799. E-mail: customerservice@cganet.com.

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NOTE—Technical changes from the previous edition are underlined.

SECOND EDITION: 2016
FIRST EDITION: 2013

Contents **Page**

Tables

Figure

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1 Introduction

Nitrous oxide (N_2O) has been produced and distributed by the industrial gases industry for many years. It is mainly used for medical purposes (anesthesia). It is also used in the food and electronic industries.

Severe accidents, such as violent explosion of ammonium nitrate or decomposition of nitrous oxide, have occurred at facilities producing nitrous oxide from ammonium nitrate. In addition, nitrous oxide gas in elevated concentrations can cause health effects in operators, which should be prevented.

A major cause of accidents and health effects, when producing nitrous oxide from ammonium nitrate, has been insufficient attention to the specific properties of these materials when designing equipment and developing operating procedures. For that reason, this publication describes the properties and hazards of ammonium nitrate and nitrous oxide. On this basis, the principles and relevant details of safe production of nitrous oxide from ammonium nitrate are considered.

Regulatory requirements for medical applications shall also be followed, usually specified in the applicable Pharmacopeia for the country of operation. For example, the European Guide Good Manufacturing Practice in Europe, U.S. FDA and Health Canada good manufacturing practices in North America, as well as NFPA 99, *Health Care Facilities Code* in the United States and CSA Z305.1, *Nonflammable Medical Gas Piping Systems* in Canada for medical gas piping systems [1, 2, 3, 4, 5].[1]

2 Scope

This publication serves the interest of all who could, in any way, be associated or concerned with nitrous oxide manufacturing from the thermal decomposition of ammonium nitrate. It also serves to acquaint persons not versed in ammonium nitrate and nitrous oxide technology with those factors considered important to health and safety.

This publication applies to safety in the design, construction, installation, operation, and maintenance of nitrous oxide plants using ammonium nitrate technology. Emphasis is placed on equipment, operational, and maintenance features that are particular to nitrous oxide plants.

For details of publications covering the safe practices for storage and handling of nitrous oxide see CGA G-8.3, *Safe Practices for Storage and Handling of Nitrous Oxide* and CGA G-8.1, *Standard for Nitrous Oxide Systems at Customer Sites* [6, 7].

This publication is not applicable to the process of production of nitrous oxide from other raw materials, but may be used as a guideline for the purification, drying, compression, liquefaction, and storage as applicable.

Nitrous oxide emissions during production are not covered by the scope of this publication.

3 Definitions

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

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicates that the procedure is optional.

[1] References are shown by bracketed numbers and are listed in order of appearance in the reference section.