

PURGING MANUAL

FOURTH EDITION

September 2018



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September 2018

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PREFACE

Recognition of industry-wide increased focus on process safety involving purging operations prompted revision of AGA's "Purging Principles and Practices," Third Edition, 2001, now designated as "Purging Manual," Fourth Edition, 2018. The former document served the gas industry and other related industries for decades as the primary resource and reference on principles and practices to help conduct safe and effective purging operations. This manual builds on those principles and practices with more detailed information for routine day-to-day as well as non-routine complex purging operations.

The information provided in this manual is based on sound engineering theories and practices, and years of experience in performing safe purging operations. The intent is to provide the user with core engineering and operating fundamentals to analyze, plan, develop and conduct purge procedures with the goal of minimizing risks associated with purging operations. It is important to recognize that each purge operation is unique and presents site-specific challenges. While typical routine purge operations involving short segments of pipe are generally covered in individual company standard operating procedures, however, the fundamental concepts addressed in this manual still apply. It is essential that the individuals planning and preparing purge procedures and the field operations personnel performing purge operations become familiar with the fluid dynamics and gas chemistry explained in this manual. Relevant industry standards, such as those issued by the National Fire Protection Association (NFPA), as well as local, state and federal regulatory agencies require adequate precautions be taken to minimize or control mixtures of flammable gas and air to prevent unintended ignition during purging, welding and cutting operations.

There is no "one-size-fits-all" solution to safe and efficient purging operations. As a result, the user shall apply the information in this manual with caution, recognizing that site-specific conditions shall be considered and addressed as appropriate in the planning and execution of any purging operations.

Updated diagrams of flammability end-points for developing purge plans and procedures prior to purging operations are included in this revision. The manual also provides recommendations to minimize methane emissions during purging operations. Appendices include a process safety purging checklist, and examples of purging procedures for gas piping in distribution system and in power plant operations. The appendices also include the complete research report published in 1997 by the Gas Research Institute (GRI), now known as the Gas Technology Institute (GTI). The GRI Report details the core engineering principles of fluid dynamics that will help the reader understand the basis of application of these principles in purging operations.

The GRI Report was also accompanied with a software package (Purge Program) that is currently being updated by GTI with the cooperation of AGA and some members of Operations Technology Development (OTD). GTI has targeted this to be released before the end of 2018. The program can be used for modeling purge operations based on actual field conditions. Section 5.0 discusses various purging calculations and examples of application of these calculations. The updated purging software can be applied to site-specific conditions other than the examples in this manual.

SCOPE

This manual provides theory and general procedures for safe and efficient purging into and out of service of systems containing flammable gas in order to maintain a safe atmosphere inside and outside of the system being purged during and after purging operation. System may refer – individually or collectively – to pipes, tanks/vessels, LNG, LPG and other facilities and pertinent equipment and components.

1.0 GENERAL INFORMATION

1.1 Introduction

Purging, as implied in this manual, is the process of a flammable gas being either removed from or introduced into a system. When a flammable gas is purged into or out of service by air, the interface between the gas and the air may create a flammable mixture inside the system as well as outside when it is discharged into air. A flammable gas, when purged into or out of service by an inert gas, may create a flammable mixture when it is discharged outside into the air. Proper purging operation will eliminate or minimize the formation and discharge of a flammable gas mixture, thus helping to avoid conditions for hazardous uncontrolled ignition.

Controlling formation of a flammable mixture during purging is necessary even though no apparent source of ignition is present. This can be accomplished by means of controlled injection of purge gas to prevent formation of a flammable mixture of gas and air. Figure 1-1 represents the concentration profile at the interface between the purge gas and the purged gas. The mixed gas region length (usually starting as 98% purge gas concentration at the beginning to 98% purged gas concentration at the end of the mixed gas region) grows as the gas interface moves along the pipe with increasing percentage of purge gas. Carefully controlled purging of air from pipelines by direct displacement with natural gas has been safely conducted for many years with the recognition that a controllable flammable mixture is present. Purging of natural gas from pipelines by direct displacement with air under controllable conditions is also considered an acceptable industry practice. Direct displacement purging techniques may be applicable to system other than pipelines where applicable.

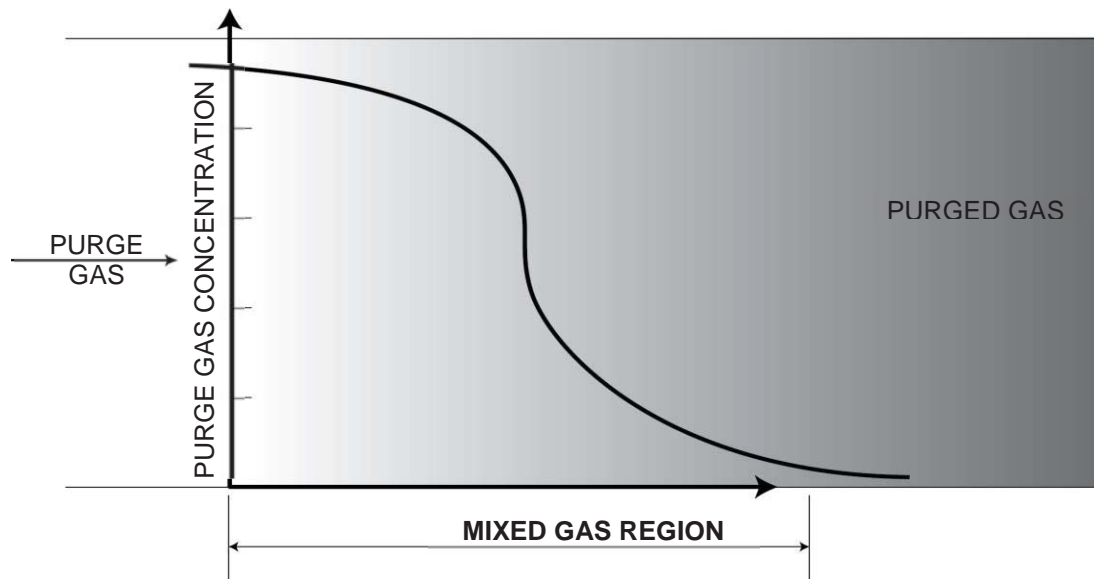


Figure 1-1
Concentration profile at the interface between the purge gas and the purged gas