Introduction

The purpose of this manual is to provide a practical set of guidelines for safe oxygen system design, storage, handling, and usage. This manual begins with an overview of the basic oxygen safety guidelines, followed by a description of oxygen system ignition mechanisms and materials information related to flammability, ignition, and combustion. Next, the process for performing an oxygen compatibility assessment is described, followed by design principles, which are fundamental to the safe use of oxygen. Cleaning for oxygen service is the next topic, followed by various operational issues, such as storage facility design, transportation and transfer, equipment hazards, and emergency procedures.

The appendices include some chemical and physical properties of oxygen, a summary of physical properties of engineering materials, and a summary of some pressure vessel†1 testing, inspection, and recertification† requirements. In addition, the appendices include a general discussion of applicable codes, regulations, and guidelines related to the use of oxygen, as well as a brief review of scaling laws, explosions†, blasts, and fragments. Furthermore, there is a review of the organizational policies and procedures, project management techniques, and various reviews (design, safety, operational, and hazard) that are recommended for minimizing or eliminating the risks† involved in the use of oxygen. Finally, definitions for many of the terms used in this manual are given.

The intent of this manual is to provide enough information so that it can be used alone but, at the same time, to reference data sources that can provide much more detail if required. Any information contained herein on the hazards and use of oxygen is based on current knowledge and is subject to change as more testing is done and more information becomes available. The intent of the chapter construction of this manual is such that each chapter should contain sufficient information to stand alone, yet not be too repetitious throughout the manual. This objective does result in some duplication of information in various chapters. This duplication will assist readers who bypass some chapters and proceed directly to the chapter and topic of immediate interest.

The information contained in this manual was originally based on the material and design information in the NASA Safety Standard for Oxygen and Oxygen Systems and the NASA Design Guide for High-Pressure Oxygen Systems. Designers, users, operators, maintainers, quality assurance personnel, insurance and safety inspectors, and project managers will find guidelines in this manual for incorporation into their projects or facilities. For the purposes of this manual, oxygen refers to gaseous oxygen (GOX) and liquid oxygen (LOX), and not to solid oxygen.

† The † indicates a term defined in the Glossary (Appendix G).