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DOE FUNDAMENTALS

CHEMISTRY



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ABSTRACT

Chemistry was developed to assist nuclear facility operating contractors in providing operators, maintenance personnel, and the technical staff with the necessary fundamentals training to ensure a basic understanding of chemistry. This document includes information on the atomic structure of matter; chemical bonding; chemical equations; chemical interactions involved with corrosion processes; water chemistry control, including the principles of water treatment; the hazards of chemicals and gases, and basic gaseous diffusion processes. This information will provide personnel with a foundation for understanding the chemical properties of materials and the way these properties can impose limitations on the operation of equipment and systems.

Key Words: Training Material, Atomic Structure of Matter, The Periodic Table of the Elements, Chemical Bonding, Corrosion, Water Chemistry Control, Water Treatment Principles, Chemical Hazards, Gaseous Diffusion Processes

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FOREWORD

Chemistry was prepared as an information resource for personnel who are responsible for the operation of the Department's nuclear facilities. A basic understanding of chemistry is necessary for DOE nuclear facility operators, maintenance personnel, and the technical staff to safely operate and maintain the facility and facility support systems. This understanding will enable contractor personnel to understand the intent of the chemical concerns within their facility. The information in the handbook is presented to provide a foundation for applying engineering concepts to the job.

This text is by no means all encompassing. An attempt to present the entire subject of chemistry would be impractical. However, *Chemistry* does present enough information to provide the reader with a fundamental knowledge level sufficient to understand the advanced theoretical concepts presented in other subject areas, and to better understand basic system and equipment operation.

The *Chemistry* handbook consists of five modules. The following is a brief description of the information presented in each module of the handbook.

Module 1 Fundamentals of Chemistry

Introduces concepts on the atomic structure of matter; Discusses the periodic table and the significance of the information in a periodic table; Explains chemical bonding, the laws of chemistry, and chemical equations.

Appendix A - Basic Separation Theory

Introduces basic separation theory for the gaseous diffusion process; Discusses converter construction and basic operating principals.

Module 2 Corrosion

Supplies basic information on the chemical interaction between the environment and corroding metal during the corrosion process.

Module 3 Reactor Water Chemistry

Describes the chemical measures taken to retard the corrosion often found in water systems, including the consequences of radioactivity on facility cooling water systems.

Module 4 Principles of Water Treatment

Details the principles of ion exchange in the context of water purity; Discusses typical water treatment methods and the basis for these

methods.

Module 5 Hazards of Chemicals and Gases

Explains why certain chemicals are considered hazardous to facility personnel; Includes general safety rules on handling and storage.