



## COURSE OUTLINE FALL 2008

<u>FIR 201</u>	<u>Hazardous Materials</u>
<b>Course Number</b>	<b>Course Title</b>
<u>3</u>	<u>3 Lecture Hours</u>
<b>Credits</b>	<b>Hours: lecture/laboratory/other (specify)</b>

**Catalog description:**

Study of basic fire chemistry relating to the categories of hazardous materials including problems of recognition, reactivity, and health encountered by firefighters.

**Prerequisites:** CHE 100 or Equivalent Background

**Co requisites:** None

**Is course New or Modified?** No

**Required texts/other materials:**

*Chemistry of Hazardous Materials*, Eugene Meyer, Brady Publishing

**Last revised:** n/a

**Course coordinator:** Scott Loh, 799-3245 (Dempster Center), lohs@mccc.edu

**Information resources:**

**U.S. Fire Administration**

Publications:

<http://www.usfa.fema.gov/applications/publications/> See Fire Service Operations, Hazardous Materials, and Terrorism

Applied Research:

<http://www.usfa.fema.gov>

Research Reports:

<http://www.usfa.fema.gov/research>

Technical Reports:

<http://www.usfa.fema.gov/applications/publications/browse.cfm?mc=29>

Topical Fire Research Series:

<http://www.usfa.fema.gov>

Learning Resource Center:

<http://www.lrc.fema.gov>

## National Institute for Standards and Technology

<http://www.fire.nist.gov/> : Publications

<http://www.fire.nist.gov/aloft/>

## National Institute for Standards and Technology

<http://www.fire.nist.gov/>: Fire Tests/Data, Software/Models, Publications, FIREDOC (under Publications)

## References

*Chemistry of Hazardous Materials*; Eugene Meyer, Brady, 2005

*Hazardous Materials Chemistry*; Armando Bevelacqua, Thomson, 2001

*The Common Sense Approach to Hazardous Materials*; Frank L. Fire, Pennwell, 1987

*North American Emergency Response Guidebook*, U.S. Department of Transportation

*Hazardous Chemicals Desk Reference*; Richard J. Lewis, Sr., John Wiley and Sons, Inc.

*Pocket Guide to Chemical Hazards*, Center for Disease Control (CDC), National Institute of Occupational Health and Safety (NIOSH)

*Fire Protection Guide to Hazardous Materials*, National Fire Protection Association (NFPA)

*Emergency Action Guides*, Association of American Railroads and the U.S. Bureau of Explosives

## Other learning resources:

### Lessons Learned Information Sharing

<http://www.llis.dhs.gov/member/secure/index.cfm>

## Current Events/News

<http://www.firehouse.com>

<http://www.fireengineering.com>

<http://www.withthecommand.com>

## Course goals:

### ***The student will be able to:***

- This course provides basic fire chemistry relating to the categories of hazardous materials including problems of recognition, reactivity and health encountered by firefighters.
- Identify the common elements by their atomic symbols on the Periodic Table and demonstrate an understanding of why the table is organized into columns and groups.
- Differentiate between elements, compounds and mixtures, and give examples of each.
- Explain the difference between ionic and covalent bonding and be able to predict when each will occur.
- Comprehend the basic chemical and physical properties of gases, liquids and solids, and predict the behavior of a substance under adverse conditions.
- Identify, name, and understand the basic chemistry involved with common hydrocarbon derivatives.
- Identify, name, and understand the basic chemistry and hazards involved with the nine U.S. Department of Transportation hazard classes and their divisions.
- Analyze facility occupancy, transportation documents, shape and size of containers, and Material Safety Data Sheets (MSDS) to recognize the physical state and potential hazards of reactivity related to firefighter health and safety.
- Demonstrate the ability to utilize guidebooks to determine an initial course of action for emergency responders.

## Course-specific General Education Core Competencies and Goals.

### General Education Knowledge Goals

**Mathematics.** Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

**Science.** Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

**Technology.** Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

### MCCC Core Skills

**Written and Oral Communication in English.** Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

**Critical Thinking and Problem-solving.** Students will use critical thinking and problem solving skills in analyzing information.

**Information Literacy.** Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

### Units of study in detail.

- I. Introduction
  - A. General Characteristics of Hazardous Materials
  - B. Hazardous Household Products
  - C. Hazardous Substances in the Workplace
  - D. Hazardous Materials in Transit
  - E. Hazardous Materials within Communities
  - F. NFPA System of Identifying Potential Hazards
- II. Matter and Energy
  - A. Matter and Energy Defined
  - B. Common Units of Measurement
  - C. Temperature, Pressure, and Volume Relationships
  - D. Heat Transmission
  - E. Understanding Fluid Principles
- III. Chemical Forms of Matter
  - A. Elements and Compounds
  - B. Periodic Classification of Elements
  - C. The Nature of Chemical Bonding
  - D. Writing Chemical Formulas
  - E. Naming Ionic and Covalent Compounds
- IV. Chemistry of Some Common Elements
  - A. Oxygen
  - B. Hydrogen
  - C. Fluorine
  - D. Chlorine
  - E. Phosphorus
  - F. Sulfur
  - G. Carbon
- V. Principles of Chemical Reactions
  - A. Types of Chemical Reactions
  - B. Factors Affecting the Rate of Reaction

- C. Oxidation-Reduction Reactions
- D. Fire Extinguishing Agents

VI. Flammable Gases and Liquids

- A. Flammability
- B. General Hazards of Compressed Gases
- C. Storage and Transport of Compressed Gases
- D. General Hazards of Flammable Liquids
- E. Storage and Transport of Flammable Liquids
- F. Response to Flammable Gas and Liquid Emergencies

VII. U.S. Department of Transportation Hazard Classes and Their Divisions

- A. Identification of Hazardous Materials by Container Shape and Size
- B. Identification of Hazardous Materials by Transportation Placards
- C. Identification of Hazardous Materials by Shipping Documents
- D. Identification of Hazardous Materials by Material Safety Data Sheets (MSDS)

VIII. Hazardous Materials in Fixed Facilities

- A. Identification of Hazardous Materials by Location and Occupancy
- B. Identification of Hazardous Materials by Container Shape and Size
- C. Identification of Hazardous Materials by NFPA 704 System
- D. Identification of Hazardous Materials by Material Safety Data Sheets (MSDS)

IX. Response Guidelines

- A. Utilization of North American Emergency Response Guidebook
- B. Utilization of NIOSH Pocket Guide to Chemical Hazards
- C. Utilization of NFPA Fire Protection Guide to Hazardous Materials
- D. Utilization of Bureau of Explosives Emergency Action Guides

X. Chemistry of Some Hazardous Organic Compounds

- A. The Nature of Organic Compounds
- B. Aliphatic Hydrocarbons
- C. Aromatic Hydrocarbons
- D. Functional Groups
- E. Halogenated Hydrocarbons
- F. Alcohols
- G. Ethers
- H. Aldehydes and Ketones
- I. Organic Acids
- J. Esters
- K. Amines
- L. Peroxo-Organic Compounds

XI. Chemistry of Some Corrosive Materials

- A. The Nature of Acids and Bases
- B. The PH Scale
- C. Acids and Bases as Corrosive Materials
- D. Sulfuric Acid
- E. Nitric Acid
- F. Hydrochloric Acid
- G. Perchloric Acid
- H. Hydrofluoric Acid
- I. Phosphoric Acid

- J. Acetic Acid
- K. Alkaline Metal Hydroxides
- L. Response to Corrosive Material Emergencies

XII. Chemistry of Some Water-Reactive Materials

- A. The Nature of Water Reactive Materials
- B. Alkali Metals
- C. Combustible Metals
- D. Metallic Hydrides
- E. Metallic Phosphides
- F. Metallic Carbides

**Evaluation of student learning:** Students will be evaluated for mastery of learning objectives by methods of evaluation to be determined by the instructor. Periodic tests or quizzes as well as a final exam may be utilized. Other methods such as a research or group projects are encouraged.

**Academic Integrity Statement:** Mercer County Community College and the Fire Science program are committed to Academic Integrity -- the honest, fair and continuing pursuit of knowledge, free from fraud or deception. This implies that students are expected to be responsible for their own work and that faculty and academic support services staff members will take reasonable precautions to prevent the opportunity for academic dishonesty. The Fire Science program affirms its support of the Academic Integrity Policy as printed in the Student handbook and approved by the College Board of Trustees March 18, 2004.