Course Description

A systematic analysis of how hazardous materials escalate an incident or emergency event. Examination of the basic fundamental concepts common to hazardous chemicals with an emphasis on how some key elements, compounds and mixtures are inherently dangerous.

Course Overview

Emergency incidents can be caused by natural phenomena or man-made circumstances. When hazardous materials are involved with these incidents, significant health or life hazards can impede the mitigation of the situation. Chemistry affects everything that we do on a daily basis. The study of hazardous materials presented in this course will explain and utilize the fundamental concepts common to organic and inorganic chemistry clearly and concisely for all professionals in the fields of environmental management, occupational health & safety, or the fire service.

The course will not focus on balancing equations or memorizing chemical structural components. Rather, it will present how some key elements, compounds, and mixtures are inherently dangerous. In addition, it will show how these substances undergo important changes during the evolution of a hazardous materials incident.

Understanding how and why these materials interact the way they do is very important to the safety and security of any professional who has responsibility in the manufacture, transportation, storage, and use of hazardous materials. The EH&S or FS professional must be able to recognize potential problems before they happen; consequently, he or she must mitigate incidents in the safest most secure manner possible. This course is designed with those goals in mind.

Supplemental, and more detailed, course material regarding pertinent chemical features of matter, energy, flammable gases/liquids, principles of chemical reactions, along with DOT Hazardous Materials Regulations are contained in Appendices A, B, and C, which can be found within the “Appendices” button in the course. These appendices are ungraded course material and are available to any student who desires more detailed information, wants the material for future reference, or requires the need for extra credit work for this course.

Prerequisites

CHM 1030

Course Textbook


Students will find the information contained in the website for the U.S. Chemical Safety and Hazard Investigation Board very useful for this course. The link to this site can be found at U.S. Chemical Safety Board.

Course Learning Objectives

Upon completion of this course, students should be able to:

1. Relate the field of chemistry to the profession of the emergency responder, whether they are from the fire service, occupational safety & health or environmental management field.
2. Identify the seven classes of hazardous materials and four classes of fire as traditionally noted in the field of fire science.
3. Discuss the federal laws that affect the contents and labeling of household and other products.
4. Employ figures within the textbook to describe the general practices recommended for EH&S and FS professionals when they encounter a hazardous materials incident involving the major categories discussed within each unit.
5. Illustrate an understanding of basic DOT Hazardous Materials Regulations from identification, classification, labeling, marking, transporting, and emergency response.
6. Describe and discuss the chemistry of some common elements such as oxygen, ozone, hydrogen, fluorine, chlorine, phosphorous, sulfur and carbon.
7. Describe and illustrate the importance of chemical factors in corrosive materials, water-reactive substances, toxic substances, oxidizers, organic compounds and polymeric materials.
8. Summarize the importance of chemical factors in handling, storage and use of explosive materials and radioactive materials.

Credits

Upon completion of this course, the students will earn three (3) hours of college credit.

Course Structure

1. **Unit Summaries:** Each unit contains an overview, or summary, of the information to be covered.
2. **Unit Learning Objectives:** Each unit contains learning objectives that specify the measurable skills and knowledge students should gain upon completion of the unit.
3. **Key Terms:** Key terms are intended to guide students in their course of study. Students should pay particular attention to key terms as they represent important concepts within the unit material and reading.
4. **Reading Assignments:** The assignments include approximately 1-4 textbook chapters in each course unit. Assigned readings are not limited to textbook chapters, but may include supplemental reading, professional journals, and internet sites.
5. **Assessments:** This course contains eight unit assessments – one for each unit - to be completed at the end of each unit.
6. **Case Study:** Students are required to complete two scenario based case studies. The first case study is presented in Unit III, and the second case study is presented in Unit VI. General directions are also provided below. Questions related to the scenario will encompass principles and techniques introduced throughout the course itself.
7. **Ask the Professor:** This communication forum provides you with an opportunity to ask your professor general or course content related questions.
8. **Student Break Room:** This communication forum allows for casual conversation with your classmates.

Case Study #1 (Unit III)

**Instructions:**

Students should read the scenario below and respond in the form of an essay, which should consist of several paragraphs and appropriate priority or task lists. Responses should be supported fully and completely. A well-thought-out response can be accomplished in 300-500 words (one or two pages, double spaced). Any published material used to support a response should be cited per the APA style guidelines.

**The Scenario:**

You are an EH&S professional returning home from your plant on a Summer Friday afternoon at about 4 p.m. You have just picked up some materials from a nearby building supply store for a weekend backyard project (cement, sand, wood, concrete blocks, lumber, etc.). You are about one mile outside of the main population zone of your small town, and you come upon an accident scene in which a placarded tanker truck is turned on its side in a ditch about 20-25 feet off the two-lane road. There is no sign of fire and no sign of the driver from your vantage point inside your truck. The only sign you can see from your vantage point is a Dangerous When Wet placard with a Class 8 label code and a UN 1836 on an orange panel. What might this chemical be? You think you can make out an NFPA diamond with a 0 at 12 o'clock; a 2 at 3
o'clock; a 4 at 9 o'clock; and a slashed W at 6 o'clock. You take out the small binoculars from your truck and scan the scene. There seems to be a thin, small volume of dripping liquid (red to yellow color) coming from a valve on the tanker.

There is an agricultural field directly next to the incident site. A large irrigation unit is spraying the fields, but the extent of the spray seems to end 20-25 yards away from the overturned truck. Slight, but steady winds are blowing about 5-8 mph across the scene towards town.

Your small community has a fire department, but it does not have a hazardous material squad attached to it. Your chemical plant (3 shift operation, bleach, pool chemicals, and household products, 15 miles away) does have a hazardous material team that you trained and is under your direction. You do have your cell phone and an emergency response guidebook.

Questions:
1. How should you proceed? Discuss the actions you should take.
2. What, if any, restraints should you exercise?
3. What advice would you give to any other individuals or drivers coming upon the scene?
4. What would you say to the next responders coming on the scene?

EXTRA POINTS, if you need them, for identifying the “minor error” in the description of this scenario; and what might this chemical be?

Submit your case study by clicking on the appropriate link within the unit. Do not e-mail your case study directly to your professor. Your university record will automatically be updated to indicate you have submitted your paper and the paper will be provided to your professor for grading.

Case Study #2 (Unit VI)

Instructions:
Students should read the scenario below and respond in the form of an essay, which should consist of several paragraphs and appropriate priority or task lists. Responses should be supported fully and completely. A well-thought-out response can be accomplished in 300-500 words (one or two pages, double spaced). Any published material used to support a response should be cited per the APA style guidelines.

The Scenario:
You are back at your plant the Monday after the Dangerous When Wet leaking tanker incident happened, and you are telling your fellow HazMat Team Coordinator how you handled the situation. Before he has a chance to offer his opinion, a call comes in over your radio that a forklift has punctured a 55 gallon drum at the door between the oxidizer storage area and the production department. There is a spill, and no one is injured; however, the production employee does not know what was spilled. You make an immediate page to all emergency response team members in the area, and then you head out the door to the scene with your fellow HazMat Team Coordinator (the production department chief engineer). While en route to the scene, you call the plant manager and apprise her of what you know and that you will report back as soon as you have more information.

The incident command center can either be the production office or the conference room near the plant manager's office. In this case, your first choice is the production office.

The storage area building has multiple storage bays for oxidizers, flammables, acids, and bases. When you arrive near the scene, you find the punctured drum on its side against a pallet of three other drums and a very small fuming cloud of vapor developing from the area, but you cannot tell its exact point of origin. It turns out that the drums are just inside the storage area building. You can see that the drums on the pallet have flammable labels. The fourth flammable drum has been knocked off the pallet and is also lying on its side next to the punctured drum. The punctured drum has not been identified at this point – it is a strong oxidizer, strong acid, or strong base raw material.

Questions:
1. How do you proceed?
2. What information are you after, how do you gather it, and what instructions do you provide for your team?
3. What hazardous situations are you and your team facing? If you need to, you can differentiate these situations depending on the punctured drum being a strong oxidizer, strong acid, or strong base. Develop a brief priority list and a brief action list for what you should do.
4. What, if any, restraints should you exercise?
5. What advice would you give to any other individuals coming upon the scene?
6. Do you call for an evacuation of any, or all, of the plant itself? There are approximately 180 employees currently on site during this first shift – located in different areas around the plant (i.e., administrative offices, shipping and receiving, raw material bulk chemical storage, finished product bulk chemical storage, production operations, packaging operations, labs, and production/engineering offices).

Submit your case study by clicking on the appropriate link within the unit. Do not e-mail your case study directly to your professor. Your university record will automatically be updated to indicate you have submitted your paper and the paper will be provided to your professor for grading.

**APA Guidelines**

CSU requires that students use the APA style for papers and projects. Therefore, the APA rules for formatting, quoting, paraphrasing, citing, and listing of sources are to be followed. A document titled “APA Guidelines Summary” is available for you to download from the APA Guide Link, found in the Learning Resources area of the myCSU Student Portal. It may also be accessed from the Student Resources link on the Course Menu. This document provides links to several internet sites that provide comprehensive information on APA formatting, including examples and sample papers.

**CSU Grading Rubric for Papers/Projects**

The course papers will be graded based on the CSU Grading Rubric for all types of papers. In addition, all papers will be submitted for electronic evaluation to rule out plagiarism. Course projects will contain project specific grading criteria defined in the project directions. To view the rubric, click the Academic Policies link on the Course Menu, or by accessing the CSU Grading Rubric link, found in the Learning Resources area of the myCSU Student Portal.

**Communication Forums**

These are non-graded discussion forums that allow you to communicate with your professor and other students. Participation in these discussion forums is encouraged, but not required. You can access these forums with the buttons in the Course Menu. Instructions for subscribing/unsubscribing to these forums are provided below.

Once you have completed Unit VIII, you MUST unsubscribe from the forum; otherwise, you will continue to receive e-mail updates from the forum. You will not be able to unsubscribe after your course end date.

Click here for instructions on how to subscribe/unsubscribe and post to the Communication Forums.

**Ask the Professor**

This communication forum provides you with an opportunity to ask your professor general or course content questions. Questions may focus on Blackboard locations of online course components, textbook or course content elaboration, additional guidance on assessment requirements, or general advice from other students.

Questions that are specific in nature, such as inquiries regarding assessment/assignment grades or personal accommodation requests, are NOT to be posted on this forum. If you have questions, comments, or concerns of a non-public nature, please feel free to email your professor. Responses to your post will be addressed or emailed by the professor within 48 hours.

Before posting, please ensure that you have read all relevant course documentation, including the syllabus, assessment/assignment instructions, faculty feedback, and other important information.

**Student Break Room**

This communication forum allows for casual conversation with your classmates. Communication on this forum should always maintain a standard of appropriateness and respect for your fellow classmates. This forum should NOT be used to share assessment answers.
Grading

Unit Assessments (8 @ 10% each) = 80%
Case Study #1 (Unit III) = 10%
Case Study #2 (Unit VI) = 10%
Total = 100%

Course Schedule/Checklist (PLEASE PRINT)

The following pages contain a printable Course Schedule to assist you through this course. By following this schedule, you will be assured that you will complete the course within the time allotted.
BOS 3640, Interactions of Hazardous Materials

Course Schedule

By following this schedule, you will be assured that you will complete the course within the time allotted. Please keep this schedule for reference as you progress through your course.

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Notes/Goals:
### Unit IV: Chemistry of Some Toxic Substances

**Review:**
- Unit Study Guide

**Read:**
- **Chapter 10:** Chemistry of Some Toxic Substances

**Submit:**
- Assessment

### Notes/Goals:

### Unit V: Chemistry of Some Oxidizers

**Review:**
- Unit Study Guide

**Read:**
- **Chapter 11:** Chemistry of Some Oxidizers

**Submit:**
- Assessment

### Notes/Goals:

### Unit VI: Chemistry of Some Hazardous Organic Compounds and Case Study #2

**Review:**
- Unit Study Guide

**Read:**
- **Chapter 12:** Chemistry of Some Hazardous Organic Compounds: Part I
- **Chapter 13:** Chemistry of Some Hazardous Organic Compounds: Part II
- **Supplemental Reading:**
  - See Study Guide

**Submit:**
- Assessment
- Case Study #2

### Notes/Goals:
### Unit VII: Chemistry of Some Polymeric Materials and Some Explosives

**Review:**
- [ ] Unit Study Guide

**Read:**
- [ ] Chapter 14: Chemistry of Some Polymeric Materials
- [ ] Chapter 15: Chemistry of Some Explosives

**Submit:**
- [ ] Assessment

### Notes/Goals:

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### Unit VIII: Radioactive Materials

**Review:**
- [ ] Unit Study Guide

**Read:**
- [ ] Chapter 16: Radioactive Materials

**Submit:**
- [ ] Assessment

### Notes/Goals: