Course Title: ESCI 4490.005 – Chemistry of Hazardous Materials for Emergency Response

Instructor: Michael Garcia  
Office: NRC 1109  
Office Hours: MF 0800-1700

E-mail: (Preferred) Michael.Garcia@tamucc.edu  
Lecture Room: TBA

Course Description: This 3-day, 2 credit hour, elective course will provide an overview of the historic, current & future perspective of Hazardous Materials (HazMat) chemistry and emergency response to HazMat incidents to include; but are not exclusive to, the following topics: environmental health & safety (EH&S); Incident Command Systems (ICS) in HazMat response; personal protective equipment (PPE) and chemical protective clothing (CPC); regulatory requirements & consensus standards applicable to HazMat response; common HazMat chemicals & reportable quantities; hazard & risk analysis; physical & chemical properties of HazMat’s; General Chemistry; the Hazard Communication Standard (HCS) and Globally Harmonized System (GHS); Department of Transportation (DOT) nine hazard classes & the Emergency Response Guidebook (ERG); labeling/manifesting/tracking of HazMat’s; HazMat Chemistry for Chemical, Biological, Radiological, Nuclear and Explosives (CBRNe), weapons of mass destruction (WMD), Terrorism and Clandestine Labs; HazMat chemistry demonstrations; internet resources & computer programs for HazMat’s; table-top scenario response involving a hazardous materials incident; and developing “lessons learned” from a response. Additional exercises, demonstrations & activities will be included as well as discussions of associated & current event topics.


Pre-requisites/Co-requisites: None. Emergency Management or Science & Engineering background preferred.

Course Objectives: Successful participation and study in this course will enable students to:

1. Have basic knowledge of the history and reasoning for hazardous materials regulations.

2. Understand the Incident Command System and how HazMat response actions are conducted.

3. Demonstrate an operations level competency or greater of local, state and federal regulations regarding hazardous materials as well as the significant voluntary consensus standards that are an integral part of hazardous materials operations.

4. Possess operations level knowledge or greater of the hazards associated with chemicals most common in hazardous materials responses and their reportable quantities.

5. Understand the difference between hazards and risks and be able to determine the levels of both regarding hazardous materials.
6. Possess an operations level understanding or greater of both the physical and chemical properties of hazardous substances and the causes and effects of chemical reactions.

7. Observe lab scale reactions that can release heat, energy, hazardous byproducts, and/or result in spontaneous combustion.

8. Possess an operations level understanding of HCS/GHS, the Nine DOT Hazard Classes and be able to effectively interpret and use a Safety Data Sheet, DOT Emergency Response Guidebook and other information resources to develop strategies and tactics when dealing with hazardous materials.

9. Possess an operations level understanding of labeling, manifesting and tracking of hazardous materials or hazardous wastes.

10. Possess operations level competencies of chemical, biological, radiological, nuclear, and explosive materials and how they are related to hazardous materials, terrorist attacks and clandestine drug labs.

11. Be able to cite the various classes of chemicals that are generally compatible or incompatible with each other and to be able to use documentation or electronic resources to determine both.

12. Be able to utilize computer based and internet emergency response programs to conduct planning, training or response activities to hazardous materials incidents.

13. Be able to use the ICS structure in addition to the above mentioned competencies to develop strategies and tactics regarding a hazardous materials incident.

Course Requirements:

1. This course is a three-day, short course with extensive information and activities scheduled for each day. **Attendance at each day of this class attendance mandatory and will be documented.** Students who must miss any part of class are responsible for obtaining notes and instructions or assignments from other class members and not the instructor(s). Students should inform the instructor in advance of any University Excused absences or extenuating circumstance absences, especially concerning the exam day.

2. There is only one exam for this course at the end of the third day. Students are expected to be prepared and complete this exam successfully. Unexcused absences for the final exam will result in a grade of “0” for the final exam. No make-up exams are given except for extenuating circumstances that result in a University Excused Absence (**documented and authentic** severe illness or injury, family emergency, university approved athletic event, etc.)

3. Take home assignments may be given to University students. They are due the day after they are handed out or on the prescribed date. **Late assignments will not be accepted.**

Evaluation Criteria:

1. Attendance 30%
2. Assignments, Activities & Exercises 20%
3. Tabletop Exercise 20%
4. Final Exam 30%
**Make Up Exams:** Make up exams will only be given for University excused absences, University sanctioned events (i.e. athletic teams, environmental conference), or documented medical reasons. In such cases it is the student’s responsibility to arrange and schedule the make-up exam for no later than one week after the regular scheduled exam.

**Academic Integrity and Honesty:** All students are expected to conform to college-level standards of ethics, academic integrity and honesty. By enrolling in this course, you agree to be bound by the Regulations and Procedures published in the TAMU-CC STUDENT HANDBOOK. Students are expected to do their own work and not duplicate that of others. Duplicative work will be considered cheating and the student will receive a zero on that assignment/exam.

**Grade Appeals:**
A student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is on the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details on the process, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, consult Texas A&M University-Corpus Christi University Procedure 13.02.99.C2.01 [Student Grade Appeal Procedures](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school or the College of Science and Engineering Dean’s Office.

**Students with Special Needs:** The Environmental Science Program complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. If you need disability accommodations in this class, please see me as soon as possible. Please have your accommodation letter from TAMU-CC Services for Students with Disabilities Office with you when you come see me. If you suspect that you may have a disability (physical impairment, learning disability, psychiatric disability, etc.), please contact the Services for Students with Disabilities Office (located in Driftwood 101) at 825-5816. It is important that you contact them in a timely fashion as it may take several days to review requests and prepare accommodations.

**Class Conduct:**
(1) All students are expected to follow proper Classroom behavior and treat other students and the instructor with respect. Disruptive behavior will cause the student to be removed from class for the day. Repeated disruptive behavior will make the student subject to dismissal from the class for the semester.

(2) This course is a course on the environment, health and safety. As a result, everyone is a safety officer during the progress of this course. If at any time during this course, students intentionally participate in unsafe or unethical behavior those parties involved will be removed from the class that day or indefinitely based on severity. If at any time you or someone else observes an unsafe condition or act, please inform the instructor immediately. If a student is found to have knowledge of an unsafe/improper act without informing the instructor, he or she may be subsequently disciplined, as well.

(3) During lecture or lab, cell phones and other electronic devices will be on silent or turned off during class time. As professionals in the field, it is not always practicable for individuals to turn their cell phones off or miss calls. Therefore, if you must take a call or send a message to someone during class, please leave the classroom quietly from the rear and hold your conversation outside the classroom. Once complete, rejoin the class with as little disruption as possible. Computers, tablets and other 21st Century educational devices are permitted during regular class periods but NEVER DURING EXAMS.
Day 1: The Basics of Hazardous Materials and Emergency Response

Introduction
Overview of Course
Incident Command Systems in HazMat Response
Regulatory History of Hazardous Materials
  Incident History
  Case Studies
Regulatory Requirements and Consensus Standards for Personnel in HazMat
  Occupational Safety and Health Administration (OSHA)
  Environmental Protection Agency (EPA)
  Department of Transportation (DOT)
  National Fire Protection Association (NFPA)
  Other Voluntary Consensus Standards
Environmental Health and Safety & PPE/CPC Review/Overview
Lunch
Chemicals most frequently involved in incidents (“Top 10” and “Serious 7”)
Hazard vs. Risk
  What makes a chemical hazardous?
    Physical Properties and Hazards
    Chemical Properties and Hazards
Chemical Terminology and Definitions
Review of (Intro to) Basic Chemistry
  States of Matter
  Atoms and Elements
  Chemical Periodicity
  Molecules and Compounds
  Chemical Bonding and Reactivity
  Organic vs. Inorganic Chemicals

Day 2: Hazardous Materials Chemistry

The Hazard Communication Standard (HAZCOM/GHS 2013)
Chemistry of the DOT and GHS Hazard Classes and Pictograms
  Explosives
  Compressed Gases
  Flammable Liquids
  Flammable Solids
  Oxidizers
  Poisons
  *Radioactive Materials
  Corrosive
  *Miscellaneous
Labeling, Manifesting and Tracking of Hazardous Materials/Hazardous Wastes
Lunch
Chemistry of WMD (CBRNe), Terrorist Attacks and Clandestine Drug Labs

Chemical Weapons
- Nerve agents
- Vesicants (blistering agents)
- Blood agents
- Choking agents
- Riot-control agents

Biological Weapons
- Bacteria
- Viruses
- Fungi
- Mid-spectrum Agents (Toxins and Psychochemical Weapons)

Radiological, Nuclear and Explosive Weapons
- Sub-critical Ordinance
  - Explosives and IED’s
- Dirty Bombs
- Critical or Super-Critical Ordinance
  - Fission Bombs
  - Atom Bombs (Fission-Fusion or Multi-Stage Bombs)

Psychological Weapons
- Infrastructure Attacks
- Destabilization
- Fear-Based Attacks
- Media and Social Media

Clandestine Drug Labs
- Mobile Meth Labs
- Other Illicit Drug Labs

Chemical Demonstrations

Day 3: HazMat Chemistry Resources, Table Top Exercise and Final Exam

Internet Resources and Computer Programs for Hazardous Materials
- Chemical Reactivity Worksheet (CRW2)
- Computer Aided Monitoring of Emergency Operations (CAMEO)
- Aerial Locations of Hazardous Atmospheres (ALOHA)
- Mapping Application for Response, Planning, and Local Operational Tasks (MARPLOT)
- Wireless Information System for Emergency Responders (WISER)
- Additional Resources (GNOME, ADIOS, ERMA, DMP2, etc.)

Lunch
Table Top Exercise Involving a Hazardous Materials Incident Scenario
“Hot Wash” (Group Discussion of Lessons Learned) from Table Top Exercise
Multiple Choice Final Exam
Course Summary and Evaluation