ESCI 4490.002 – Chemistry of Hazardous Materials for Emergency Response  
Department of Physical and Environmental Science  
Maymester 2018

A. COURSE INFORMATION  
Course number/section: ESCI 4490.002  
Class meeting date/time: May 15-17, 2018  
9:00AM – 1:00PM, 2:00PM – 6:00PM  
Class location: Center for the Sciences (CS) Room 101

B. INSTRUCTOR INFORMATION  
Instructor: Michael Garcia  
Office location: CS 129  
Office hours: M-F 1300-1400 hrs  
Telephone: 361-825-2125  
e-mail: Michael.Garcia@tamucc.edu  
Appointments: For appointments outside office hours, please email or call first

C. COURSE DESCRIPTION  
Catalog 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 including, but not exclusive to, historical case studies and important legislation resulting from HazMat incidents; former and current practices and procedures regarding HazMat incidents and HazMat response; “HazMat Chemistry”; strategies, tactics and chemical countermeasures in response to HazMat incidents; HazMat Chemistry demonstrations; weapons of mass destruction (WMD) Chemistry and countermeasures and common HazMat’s in the workplace and how to deal with them.

Extended Course Description  
The course will at minimum cover the following topics: the history of HazMat, 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; Prevention, Control, Containment, & Countermeasures; 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, guest speakers, demonstrations & activities will be included as well as discussions of associated & current event topics.

D. PREREQUISITES AND COREQUISITES

Prerequisites
None. Emergency Management or Science & Engineering background preferred.

Corequisites
None.

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Recommended Textbook(s)

Optional Textbook(s) or Other References
None. Additional references and texts will be provided.

Supplies
Flame Retardant Lab Coat and ANSI Z78.1+ Splash Resistant Goggles
Note taking materials (Pen/Pencil, Paper, Tablet, Laptop)
Proper Chemistry Lab Attire

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to
both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should:

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, 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.

14. Be able to list spill prevention, control, containment and countermeasures; the strategies and tactics associated with deploying those techniques and demonstrate such techniques through a mock, tabletop exercise with the assistance of their classmates.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

The instruction of this course will be carried out through approximately 50% lecture and powerpoint, 20% demonstrations and activities, 20% group discussion; 5% teamwork through the tabletop exercise and 5 % exam assessment via the one exam for the class.

H. MAJOR COURSE REQUIREMENTS AND GRADING

1. This course is a three-day, short course with extensive information and activities scheduled for each day. Attendance for each day of this class attendance mandatory and will be documented. Students who must miss any part of the 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. One take home assignment will 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.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Attendance</td>
<td>30%</td>
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<tr>
<td>Take Home Assignment</td>
<td>10%</td>
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<tr>
<td>Activities and Exercises</td>
<td>10%</td>
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<tr>
<td>Participation/Tabletop Exercise</td>
<td>20%</td>
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<td>Final Exam</td>
<td>30%</td>
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4. COURSE CONTENT/SCHEDULE
Listed below is the 3-Day, Tentative, Topics and Schedule. Please follow along with these topics in your book and study them in your own time after class.

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 for Personnel in HazMat
- OSHA
EPA
DOT
NFPA
Other Voluntary Consensus Standards
Environmental Health and Safety & PPE/CPC Review/Overview

Lunch

Chemicals frequently involved in incidents (“Top 10” & “Serious 7”)
Hazard vs. Risk
What makes a chemical hazardous?
   Physical Properties
   Chemical Properties
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 (HazMat) Chemistry
HAZCOM/GHS 2013
DOT Hazard Classes & the North American Emergency Response
Guidebook (ERG 2016)
Chemistry of the DOT and GHS Hazard Classes and Pictograms
   Explosives
   Compressed Gases
   Flammable Liquids
   Flammable Solids
   Oxidizers
   Poisons
   *Radioactive Materials
   Corrosive
   *Miscellaneous
HazMat Spill Prevention, Containment, Control and Countermeasures
Strategies, Tactics and Response Techniques
Waste Management and Waste Disposal – “After the Party”
Labeling, Manifesting & Tracking of Hazardous Materials/Hazardous Wastes

HazMat Chemistry Demo #1
Lunch – Hope you’re hungry!

Chemistry of WMD (CBRNe), Terrorist Attacks & Clandestine Labs
Chemical Weapons & Mitigation Techniques
  Nerve agents
  Vesicants (blistering agents)
  Blood agents
  Choking agents
  Riot-control agents

Biological Weapons & Mitigation Techniques
  Bacteria
  Viruses
  Fungi
  Mid-spectrum Agents (Toxins & Psychochemical Weapons)

Radiological, Nuclear and Explosive Weapons & Response
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 & their Countermeasures
  Infrastructure Attacks
  Destabilization
  Fear-Based Attacks
  Media and Social Media

Clandestine Drug Labs and Interdiction/Response
  Mobile Meth Labs
  Other Illicit Drug Labs

HazMat Chemistry Demo #2

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

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

5. COURSE POLICIES

Attendance/Tardiness
Strict attendance will be kept. Tardiness or absences will not be tolerated.

Late Work and Make-up Exams
Late work will NOT be accepted. There are NO make-up exams. If you have a University Excused Absence (i.e. Mandatory University Sanctioned Event, documented medical emergency (life-threatening), documented immediate-family emergency (life-threatening)) other arrangements will be made as per the instructor.

Extra Credit
Extra credit is at the instructor’s discretion.

Cell Phone Use
During lecture or exercises, 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 an emergency message to someone
during class, please leave the classroom quietly from the rear and hold your conversation outside the classroom. Cell phones or any other electronic devices are not allowed during the exam! No Exceptions.

**Laptop Use**
Computers, tablets and other 21st Century educational devices are permitted during regular class periods but NEVER DURING EXAMS.

**Food in Class**
Food OR Drinks in the lab are STRICTLY PROHIBITED. We will be working with various, hazardous chemicals during our demonstrations and other chemicals reside in the lab already. You are not allowed to bring in food or drinks into the lab at any time! A table and a shelf are provided for you in the hallway outside the lab so that you may keep your caffeine or other food/drinks outside the lab nearby. If you require refrigeration for your lunch, I can provide you with space in the refrigerator downstairs. The refrigerators in the labs are NOT for food or drink.

**Missed Exam**
There are NO make-up exams. Please refer to the “Late Work and Make-up Exam” section of this syllabus

**Participation**
You will be graded upon your participation and contribution to discussions in this course. Get involved!

**Class Conduct:**
(1) All students are expected to follow proper Lab 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/improper act, please inform the instructor or make an on the spot correction of their actions, 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.

6. COLLEGE AND UNIVERSITY POLICIES

• Academic Integrity (University)
   University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

• Classroom/Professional Behavior
   Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

• Statement of Civility
   Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.
• **Deadline for Dropping a Course with a Grade of W (University)**
The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation **WILL NOT** automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that **must** be submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.

• **Grade Appeals (College of Science and Engineering)**
As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 upon 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, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [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, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

• **Disability Services**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a
disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

7. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

**GENERAL DISCLAIMER**

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.