Course Overview:

Process safety and safe operation and maintenance of industrial facilities require thorough understanding and knowledge of the concept of risk. This course is designed to train students to assess, quantify risk and its elements, and develop plans to manage, reduce, and mitigate it. By applying the risk assessment techniques, the students will be able to identify areas of potential safety concerns, and extent and likelihood of occurrence of accidents and incidents both in new and existing facilities. The course will further present the concept of hazards, and how hazards are identified, determined, quantified and analyzed and the methods of developing safeguards to mitigate them. Among its key objectives are incorporating the concept of risk and hazard analysis, the integral components of sound process safety, in safer design, and safer operating and maintenance practices.

Instructor: Dr. M. Daneshvar

Course Location: 0120 Manoogian

Class Times: 5:30 PM – 8:30 PM T & Th

Email: dr1095@wayne.edu

Textbook:


Supplementary References:


Layer of Protection Analysis - Simplified Process Risk Assessment, by CCPS (Center for Chemical Process Safety) of AICHE, 2001
Prerequisites:

It is recommended that the students have completed one semester of the following subjects prior to taking this course: Fluid Flow & Heat Transfer, Kinetics and Reactor Design and Mass Transfer and Separation Processes

Course Outline:

Introduction to the concepts of Hazard, Risk, and System Safety

System Safety versus Safety Management System

Risk Assessment Methodologies

Identifying Risk in a System

Risk Analysis Model

Risk Acceptance and Risk Management

Hazard Identification and Control

Leading and Lagging Safety Performance Indicators

Standards of Safety- Government and Industry

  OSHA Regulations and guidance
  EPA Risk Management Program (RMP)
  DHS Chemical Facilities Anti-Terrorism Standards (CFATS)

Process Hazard Analysis (PHA), an integral Part of Process Safety Program

  Elements of a PHA

  Incorporating PHA in Process Safety Management (PSM)

  PHA Techniques
Hazard and Operability Method (HAZOP)

Mechanics of HAZOP: Node Selection; Process and Deviation
Guidewords Common Issues: Loss of Containment; High/Low/No Flow; High Pressure; High Temperature; High/Low level

What-If Method

Node review
Equipment and Function Review
Operating Procedures What-If
Common Scenarios: Distributed Control Systems (DCSs); Blocked-In Pump; External Fire; Critical Control Valves in Fail Safe Positions; Check Valve Reliability; Blocked-In Relief Systems

Checklists and Failure Modes and Effects Analysis (FMEA)

The FMEA Technique: Organization; Failure Modes
Fault Tree Analysis

Fault Tree Development: Top Event; OR Gate; intermediate Events; AND Gate; Base Events

Risk Ranking; Common Cause Effects; Generic Fault Trees

Implementing PHAs in Design

Conceptual, Preliminary, and Final Design
Pre-startup Safety Review
Management of Change
Shut-Down, Decommissioning and Demolition

Strengths and Limitations of PHAs

Layer of Protection Analysis (LOPA)

LOPA, its Application, Implementation, Limitations and Benefits

Estimating Consequences and Consequences Evaluation Methods

Identifying Initiating Events and Determining Failure Rates

Identifying Independent Protection Layers (IPLs)
Preventing IPLs versus Mitigating IPLs

Applying LOPA to

Make Risk Decisions
Management of Change
Mechanical Integrity Programs
Risk-Based Inspection/Risk-Based Maintenance Programs
Risk-Based Operator Training
Emergency Response Planning
Incident Investigation

Case Studies: Lessons Learned from Accidents

Accident Reporting, Investigation, Documentation and Communication

Course Learning Objectives:

Upon successful completion of this course, students will be able to:

1) understand Risk Assessment and Hazard Analysis techniques and apply them to System Safety Engineering.
2) design a safe process, to determine how safe a process or operation is, and to ensure that a system is safe for all people, environment and equipment
3) identify and assess the risk and hazards of a process and operation and determine the underlying causes of the hazards.
4) apply the technical methods to identify risk and analyze hazards, the common mistakes made in applying those methods, and the pragmatic ways to decide when and where to apply a given method.
5) have technical and practical knowledge to develop controls, and methods to either eliminate the hazards or mitigates their consequences.
6) gain the necessary know-how to ensure that adequate controls and safeguards are in place for a safe start-up, operation, and maintenance of a facility.
7) have the ability to further evaluate, monitor the existing operations and implement modifications as needed to improve safety.
Grading and Course Policy:

Grades will be based on the following:

<table>
<thead>
<tr>
<th>Exam</th>
<th>Points</th>
<th>Tentative Date</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>100</td>
<td>7/19/16</td>
</tr>
<tr>
<td>Exams 2</td>
<td>100</td>
<td>8/2/16</td>
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<tr>
<td>Final Exam</td>
<td>200</td>
<td>8/18/16</td>
</tr>
<tr>
<td>Total Points</td>
<td>400</td>
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All Exams will be closed books and closed-notes. Any material needed for the exams (i.e., equations, formulas, tables, ...) will be provided.

No make up exam will be given except in extraordinary circumstances with the prior approval of the instructor. Student missing an exam will be given 0 points for that exam.

Exams will be administered during class time and on designated dates. The dates will be communicated during class in advance.

No extra credit projects will be assigned and no differed grades will be allowed. Students who wish to drop the class must do so in accordance with the University’s policy and deadline.

The final letter grade shall be determined by adding the points earned in the exams including the final exam and dividing the total by 400 to calculate the percentage point. The letter grades will be based on the following table:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percentage Point</th>
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<tbody>
<tr>
<td>A</td>
<td>90% and Above</td>
</tr>
<tr>
<td>B</td>
<td>80% - 89%</td>
</tr>
<tr>
<td>C</td>
<td>70% - 79%</td>
</tr>
<tr>
<td>D</td>
<td>56% - 69%</td>
</tr>
</tbody>
</table>

Attendance in the class is not mandatory, however, an attendance sheet will be circulated during each class. The instructor will examine the attendance sheets if a student’s percentage point is very close to the cut-off percentage point at the time of conversion to letter grades.

Use of cell phones or other electronic devices are not permitted in the class. Laptops and tablets (for ONLY taking notes during the class) are allowed.