

**SOUTHEAST COMMUNITY COLLEGE**  
**CONSTRUCTION, MANUFACTURING AND TECHNOLOGY DIVISION**  
**Energy Generation Operations Technology Program**  
**Revision Date: August 21, 2023**  
[Syllabus Statements](#)

**I. CATALOG DESCRIPTION**

Course Number: ENER2240  
Course Title: Reactor Safety  
Prerequisite(s): ENER2102  
Catalog Description: This course includes an explanation of reactor water chemistry fundamentals. We will cover basic concepts related to nuclear plant protection including administrative controls, procedural concepts and automatic reactor plant protection. Concepts related to accident analysis will be covered. Explanation of basic concepts related to transient prevention and mitigation of core damage and accident management is included.

Credit Hours: 2  
Class Hours: 30  
Lab Hours: 0  
Total Contact Hours: 30

**II. COURSE OBJECTIVES:** *Course will:*

- A. Inform students of relevant safety issues with regard to nuclear reactors.
- B. Provide case studies of various nuclear power plant accidents and how they relate to reactor safety components and practices.
- C. Explain to students the importance of reactor safety to the public and the utility industry.

**III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:**

- A. Student Learning Outcomes: *Student will be able to:*
  - 1. Understand and define “Reactor Safety”
  - 2. Explain the operator’s role in maintaining Reactor Safety
  - 3. Explain the concept of Defense in depth
  - 4. Explain the use of design basis accidents
  - 5. Describe the administrative tools used to maintain safety
- B. General Education Learning Outcomes (GELOs)
  - 1. GELO #3: Critical Thinking & Problem Solving
  - Outcome 5: Acquire and integrate knowledge and construct relationships across disciplines.

**IV. CONTENT/TOPICAL OUTLINE**

- A. What is Reactor Safety?
  - 1. Reactor Safety Definition
  - 2. The elements of Reactor Safety
  - 3. The Public Trust
  - 4. Defense in Depth
- B. Significant Lessons Learned
  - 1. SL-1
  - 2. TMI
  - 3. Chernobyl

4. Browns Ferry
5. Salem
6. Davis-Besse
7. Fukushima
- C. Design Concepts
  1. Design (Engineering)
  2. Procedures and processes
  3. Automatic Protective Systems and Limits
- D. Accident Analysis
  1. Design Basis Accidents
  2. Final Safety Analysis Reports
- E. Basic Reactor Protection Systems
  1. Reactor Shutdown Systems
  2. Injection Systems
  3. Core Cooling Systems
- F. Core Damage
  1. Mechanisms of core damage
  2. Transient response
  3. Methods of damage mitigation
- G. Containments Concepts and Systems
  1. Primary and Secondary Containment
  2. Fuel Cladding
  3. Preventing Environmental release
- H. The Role of Water Chemistry
  1. Effects of impurities
  2. Control of impurities
  3. H<sub>2</sub> addition
  4. Radioanalysis/recombination
- I. Radiochemistry and accident detection
- J. The Role of the Operator
  1. Plant monitoring
  2. Analysis of Information

**V. INSTRUCTIONAL MATERIALS**

- A. Required Text(s): Howlett II, H.C., *The Industrial Operators Handbook*
- B. Other Resources: Internet
- C. Outside Reading/Research required: Internet Research assignments
- D. Supplies: None

**VI. METHODS OF PRESENTATION/INSTRUCTION**

- A. Methods of presentation typically include a combination of the following:
  1. Online

**VII. METHODS OF EVALUATION**

- A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:
  1. Class participation
  2. Regular assignments
  3. Written exams and/or quizzes
  4. Performance and observational assessments

## VIII. SPECIFIC COURSE REQUIREMENTS

- A. A minimum grade of “C” or 70% is required to receive credit for this course.
- B. A minimum grade of “B” or 80% is required to achieve the NUCP certificate, in accordance with ACAD 08-006, Revision 1, dated October 2016.
- C. Cheating within the Construction and Electronic Occupations Division: Any violation of academic integrity on assignments, quizzes, or tests will result in a grade of 0 on that assignment, quiz, or test. A second violation in any course after the initial infraction will result in a grade of F for that course. Any additional violations while in the program will result in a suspension from the program. For additional information, refer to the *Academic Integrity* pamphlet available from Student Services.
- D. Credit by Examination: Credit for the course CANNOT be earned through Credit by Examination.