

## References

### *Textbook references*

LAR83 John R. Lamarsh, *Introduction to Nuclear engineering*, Addison-Wesley Publishing Company, 1983, ISBN 0-201-14200-7.

MCC81 Norman J. McCormick, *Reliability and Risk Analysis*, Academic Press, 1981, ISBN 0-12-482360-2.

SMI83 David J. Smith, *Reliability Maintainability and Risk, Practical Methods for Engineers*, 1993, ISBN 0 7506 08544.

TOD90 Neil E. Todreas and Mujid S. Kazimi, *Nuclear Systems I, Thermal Hydraulic Fundamentals*, Hemisphere Publishing Corporation, 1990, ISBN 0-89116-935-0 (v. 1)

### *General Safety Principles*

HUR72 D. G. Hurst and F. C. Boyd, "Reactor Licensing and Safety Requirements", CNA Conference, 1972.

INS88 "Basic Safety Principles for Nuclear Power Plants", Safety Series No. 75-INSAG-3, a report by the International Nuclear Safety Advisory Group, International Atomic Energy Agency, Vienna, 1988.

SNE81 V.G. Snell, "Probabilistic Safety Assessment Goals in Canada", Atomic Energy of Canada Ltd., AECL-8761, presented to the IAEA Technical Committee Meeting on Prospects for the Development of Probabilistic Safety Criteria, Vienna, January 27-31, 1986.

### *Codes and Standards*

AECB C6

AECB R7

AECB R8

AECB R9

ANSI B31.1

IEEE Class IE

NUREG Part 50

***Safety Design Documents***

HOL90 R. Holmes, "Accident Analysis Overview", CANDU Training Course on NSSS Design and Analysis, December 4, 1990.

LBD86 "Point Lepreau Nuclear Generating Station Unit 2 Licensing Basis Document", Maritime Nuclear, April 1986, Revision 3.

LBD94 "Licensing Basis Document, CANDU 9 Licensing Basis", AECL 69-00580-LBD-001 Revision 0, September 1994.

NAT85a A. Natalizio, "CANDU Safety Report", IAEA Training Course on Safety Review and Assessment for Construction Permit, Lecture L2.5, Ankara, Turkey, September 9 - October 4, 1985.

NAT85b A. Natalizio, "CANDU 600 Overview", IAEA Training Course on Safety Review and Assessment for Construction Permit, Lecture L3.7, Ankara, Turkey, September 9 - October 4, 1985.

NATH85 V. NATH, "CANDU Safety Analysis - LOCA", IAEA Training Course on Safety Review and Assessment for Construction Permit, Lecture L2.6 (material prepared by V. Snell), Ankara, Turkey, September 9 - October 4, 1985.

TIN90 E. Tin, "Wolsong-2 Licensing Basis Document", CANDU Training Course on NSSS Design and Analysis, Lecture 6.5, December 4, 1990.

SHA90 H. Shapiro, "Fault Tree Symbology and Construction", CANDU Training Course on NSSS Design and Analysis, Lecture 11.2, December 10, 1990.

WAS75 "Reactor Safety Study, An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants", U.S. Nuclear Regulatory Commission Report WASH-1400, NUREG 75/014, October 1975.

***General Nuclear***

TUS94 "The Untold Story: Economic and Employment Benefits of the Use of Radioactive Materials", report prepared by Management Information Services, Inc. for Organizations United for Responsible Low-Level Radioactive Waste Solutions, March 1994.

**Nuclear Reactor Safety Design  
Detailed Outline and Schedule  
for Two Week Intensive Course  
February 1998**

**Day 1 February 16**

1. Admin and course overview
  - a. Sign in and introduction
  - b. What this course is about and how we will proceed
  - c. Learning outcomes
  - d. Course outline and schedule handouts
  - e. Out of class contact
  - f. Reading assignment: Chapter 1
  - g. Announcements
2. Course Overview (Chapter 1)
  - a. Risk
  - b. Simple example
  - c. Safety methodology
3. Workshop activities (5% of final mark)
  - a. Concept map
  - b. Risk preference
  - c. Reading assignment: Chapter 2 (sections 1 to 9)

**Day 2 February 17**

4. Discussion of workshop activity results
5. Probability Tools and Techniques (Chapter 2)
  - a. Definitions and rules
  - b. Bayes equation
  - c. Example: core monitoring system
  - d. Failure rate estimation
  - e. Probability distributions
  - f. Demand systems
  - g. Failure dynamics
  - h. Repair
6. Workshop Activities (5% of final mark)
  - a. Probability exercises
  - b. Reading assignment: Chapter 2 (sections 10 to end)

**Day 3 February 18**

7. Discussion of workshop activity results

**8. Probability Tools and Techniques (Chapter 2 continued)**

- a. Example: shutdown system
- b. Fault tree example
- c. 2/3 logic
- d. Ladder logic
- e. Unavailability targets

**9. Workshop Activities (5% of final mark)**

- a. Probability examples
- b. SDS calculation for MNR (time permitting)
- c. Reading assignment: Chapter 3

**Day 4 February 19****10. Discussion of workshop activity results****11. MNR**

- a. System description
- b. Project outline

**12. Workshop Activities (5% of final mark)**

- a. Project planning
- b. Catchup time for previous assignments

**Day 5 February 20****13. Discussion of workshop activity results****14. Safety Criteria (Chapter 3)**

- a. Safety goals
- b. Deterministic approach
- c. NRX accident
- d. Single / dual mode failures
- e. C6
- f. Current practice

**15. Workshop Activities (10% of final mark)**

- a. Summarize chapter on a concept diagram
- b. Project time
- c. Reading assignment: Chapter 4 and 5

**Day 6 February 23****16. Discussion of workshop activity results****17. PSA (Chapters 4 and 5)**

- a. Design Basis Accidents
- b. Event Trees
- c. Fault Trees

**18. Workshop Activities (10% of final mark)**

- a. DBA for MNR

- b. Assign DNAs to event classes
- c. ET for deer avoidance example
- d. SDS FT for MNR
- e. Start working on IE and FT for 4 main events for MNR
- f. Reading assignment: Chapters 6, 7 and 8

**Day 7 February 24**

- 19. Discussion of workshop activity results
- 20. Safety Analysis (Chapter 6)
- 21. Safety Systems (Chapter 7)
- 22. Good Design Practice (Chapter 8)
- 23. Workshop Activities (10% of final mark)
  - a. Calculate iodine activity
  - b. Question of functional requirements
  - c. Continue working out ET and FT for 4 main events
  - d. Catch up time

**Day 8 February 15**

- 24. Discussion of workshop activity results
- 25. Final exam (50% of final mark)

**Project Outline:**

- 1. MNR description (in class)
- 2. Set safety goals
- 3. SDS fault tree
- 4. Design basis accidents
- 5. Event trees and supporting fault trees for 4 main events:
  - a. LOCA
  - b. LOR
  - c. Loss of flow
  - d. Flow blockage