

Errata for the Essential CANDU

prepared by

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Summary: This document contains an errata list, chapter by chapter for The Essential CANDU, first edition:

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Chapter 1 Introduction to Nuclear Reactors

- No errata to report.

Chapter 2 Genealogy of CANDU Reactors

- No errata to report.

Chapter 3 Nuclear Processes and Neutron Physics

- No errata to report.

Chapter 4 Reactor Statics

- No errata to report.

Chapter 5 Reactor Dynamics

1. Summary: Small edits as follows: This chapter addresses the time-dependent behaviour of nuclear reactors. ~~It is specifically. This chapter is~~ concerned with short- and medium-time phenomena. Long-time phenomena are studied in the context of fuel and fuel cycles and are presented in Chapters 6 and 7. The chapter starts with an introduction to delayed neutrons because they play an important role in reactor dynamics. Subsequent sections (3 to 6) present the time-dependent neutron-balance equation, starting with “point” kinetics and progressing to detailed space-energy-time methods. Effects of Xe and Sm “poisoning” are studied in Section 7, and feedback effects are presented in Section 8. Section 9 ~~is~~ identifies and presents the specific features of CANDU reactors as they relate to kinetics and dynamics.
2. Section 1.1 – Overview: Sentence edited “Subsequent sections (3 to 6) present the time-dependent neutron-balance equation..”
3. Added missing Eq. 2
4. Section 4.1: corrected typo “re~~a~~ctor”
5. Eq. 91: replaced kmax+1 subscript by k-max
6. Equation 101 should ‘0=...’ for both equations as follows:

$$0 = \frac{\rho_1 - \beta}{\Lambda} \hat{n}(t) + \sum_{k=1}^{k_{\max}} \lambda_k \hat{C}_k(t) \quad (t < t_0)$$

$$0 = \frac{\rho_2 - \beta}{\Lambda} \hat{n}(t) + \sum_{k=1}^{k_{\max}} \lambda_k \hat{C}_k(t) \quad (t > t_0)$$

7. Eq. 168: subscript “1” changed to “I”, for Iodine (both in numerator and denominator)
8. Eq. 169 : subscript “x” changed to “X” (uppercase) for Xe.
9. Section 9.2: Second-last sentence of first paragraph changed to “Reactivities close in value to the delayed-neutron fraction induce transients with a lower peak power in a CANDU core than in an LWR core.”
10. Fig. 4: updated Xenon plot to include lower steady-state flux and, consequently lower

peak. Changed sentence describing fig. 4 accordingly.

“This behaviour is shown in Fig. 4, which shows the Xe reactivity worth after shutdown from full power for two steady-state flux values: (1) $\Phi_{ss} = 2 \times 10^{14} \text{ cm}^{-2} \text{ s}^{-1}$ and (2) $\Phi_{ss} = 5 \times 10^{13} \text{ cm}^{-2} \text{ s}^{-1}$. “

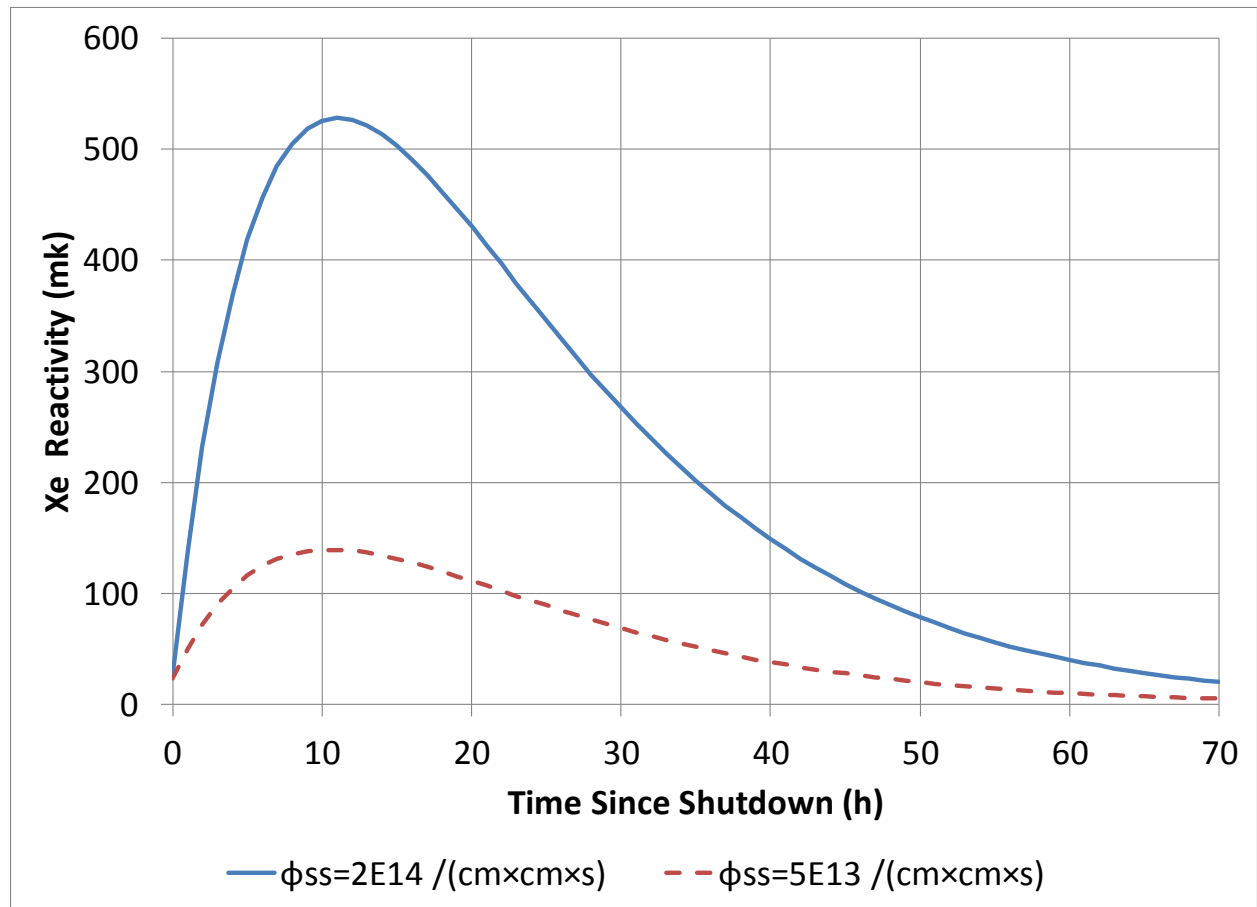


Figure 1 ^{135}Xe reactivity worth after shutdown

11. Problem 2: replaced SA, etc. with equation symbols.
12. Problem 6: There are only 2 parts. Removed bullet numbers beyond 2.
13. Problem 8: replaced “point b” with “part b”
Wrote time derivatives explicitly instead of using the dot notation.
Added hats for integral quantities.

Chapter 6 Thermalhydraulic Design

- No errata to report.

Chapter 7 Thermalhydraulic Analysis

- No errata to report.

Chapter 8 Plant Systems

- No errata to report.

Chapter 9 Plant Operations

1. The title for Figure 15 should be bold and centred.
2. The title for Figure 29 should be below the figure, not above.

Chapter 10 Instrumentation and Control

- No errata to report.

Chapter 11 Electrical Systems

- No errata to report.

Chapter 12 Radiation Protection and Environmental Safety

- No errata to report.

Chapter 13 Reactor Safety / Safety Analysis

1. Section 1.1, second paragraph: Replace “Section 0” with “Section 1”.
2. Section 1.7 Replace “These exist in the ratio of about 9:1 for the highest-powered fuel element in a CANDU reactor, as shown in [Ionescu, 2009]” with “Even for the highest-powered fuel element in a CANDU reactor, about 90% of the fission products are trapped in the UO₂ and only 10% are mobile gases within the sheath, as shown in [Ionescu, 2009] and illustrated in Figure 1.4; for lower power elements, the percentage is even more skewed to trapped fission products.”
3. Section 4.1.3 Safety goals in Canada: under “These are developed into design goals:” the headings should read “2. Small Release Frequency” and “3. Large Release Frequency”, not Low Release Frequency and High Release Frequency.
4. In the paragraph following the above, “replace Low Release Frequency” with “Small Release Frequency” in two occurrences.
5. Section 5.3.1: Replace the second paragraph beginning “For economic reasons...” with the following:
“For economic reasons, another subsystem is provided which can dump up to 60% steam directly from the steam generators to the condenser. This is used for poison prevention—that is, if the grid is lost, the reactor will reduce power quickly to a level just sufficient to prevent a poison-out due to xenon build-up. Enough steam still goes to the turbine so that the turbine-generator can supply house loads; the rest is dumped directly to the condenser, by-passing the turbine. Because (unlike steam dump to atmosphere) the secondary water is recycled from the condenser back to the steam generators, it is

possible to do this for considerable periods of time. This is a big advantage in the case of a prolonged loss of electrical grid; if the reactor can avoid a trip when the grid is lost and is kept running, it remains ready to supply power as soon as grid stability is restored."

Chapter 14 Nuclear Reactor Materials

- No errata to report.

Chapter 15 Nuclear Process Systems Chemistry and Corrosion

- No errata to report.

Chapter 16 Regulatory Requirements and Licensing

- No errata to report.

Chapter 17 Fuel

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