CANDU OVERVIEW

text prepared by

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INTRODUCTION

COURSE OBJECTIVES

At the successful completion of this course the participants will be able to:

1. Describe the following features of a CANDU Generating unit:
   - the principles of overall unit operation and control
   - the functions, equipment and operation of the main process systems
   - how each major system is controlled
   - how reactor safety and the protection of the public is achieved;
2. Conduct normal and abnormal operations on a simulated CANDU-9 Generating unit, including:
   - power maneuvers
   - poison override operation
   - recovery from a reactor trip
   - recovery from a turbine trip
   - responses to reactor, heat transport, steam and feedwater system malfunctions.

This text has been prepared to support the CANDU Overview course, which is the introductory module of a Nuclear Power Plant Training Program. The course itself will have the following main components:

- lectures in science fundamentals, equipment and systems principles relevant to CANDU reactors;
- lectures in CANDU reactor power plant systems and their operation;
- self-study of this text to support the above lectures;
- problem solving assignments to reinforce the understanding and application of the course material;
- operation of a CANDU-9 power plant simulator;
- reviews in a workshop format to answer questions and exchange information on topics that are of interest to the majority of the participants.

The traditional approach to teaching nuclear power plant design and operation has been to begin with the scientific theory and mathematical representation of the fundamental processes that take place in a nuclear power plant, studying simplified models, individual pieces of equipment, eventually combining these into systems and finally synthesizing a complete generating unit. This approach may be called 'bottom-up', since each building block must be understood before subsystems can be formed into systems and eventually into a working whole. Although this approach has been used successfully for many generations of students, it is not considered appropriate for a class of adult learners with varied experience in the nuclear power field. Such individuals will typically be experts in one or more areas relevant to nuclear power plants, but few if any will have a good understanding and experience with the overall operation of specific power plant types.

The approach followed in this text and in the course it supports is called 'top-down'. It is built on the assumptions that the participants want to achieve an overall understanding of how a nuclear power plant operates, that each of them are already familiar with many of the underlying science fundamentals, equipment and system principles of nuclear electric generation, and that each participant will want to study different aspects of nuclear power plants to different degrees. As such, while the lectures will treat topics that are necessary for everyone to achieve the desired level of common understanding, it is left to the self-study sessions for each individual to pursue various topics to different depths. The Simulation and Problem Solving sessions are designed to ensure that the desired level of understanding is achieved by every participant. Any shortcomings identified during these sessions will be addressed during the review period, and if necessary will result in changes to the content of the lectures and/or the conduct of the self-study and simulation sessions.

The sequence and content of the lectures and the assignments are designed to achieve the terminal course objectives in the most direct way, subject to the knowledge and skill level of the participants. As much as practicable, the final learning outcome of each session is to be presented first, followed by covering as much detail as is necessary for the participants to gain the desired level of knowledge. For example, if the participants are familiar with reactor theory and with light water reactors but not with the specific features of heavy water reactors, the lecturer should begin with the latter, and only cover the other topics if they are needed to understand the operation of the heavy water reactor. The subsequent assignments would include questions and problems that were designed to verify the assumed level of theoretical and light water reactor specific knowledge, and if significant shortfalls were discovered, these would be taken up in the subsequent review session and/or lecture.

ACKNOWLEDGEMENT

The material for this text is based principally on the CANDU 9 480/NU Technical Description, AECL document 69-01371-TED-001 Rev. 1, published in January 1995. Diagrams and text have also been based on various AECL and Ontario Hydro training manuals.

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