

**WORKSHOP ON
NUCLEAR POWER PLANT SIMULATION**

29 October - 9 November 2001

INTRODUCTORY NOTES


**Bob LYON
Division of Nuclear Power
International Atomic Energy Agency (IAEA)
Wagramer Strasse 5
A-1400 Vienna
AUSTRIA**

These are preliminary lecture notes, intended only for distribution to participants

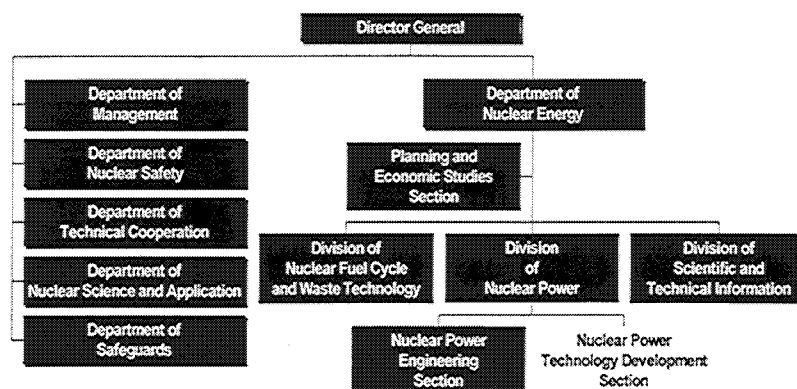
**WORKSHOP ON
ADVANCED NUCLEAR POWER
PLANT SIMULATION
(29 October – 9 November 2001)**


(ICTP, Trieste, Italy)

Bob Lyon, IAEA

Department of Nuclear Energy
International Atomic Energy Agency 

**The simulator activity is conducted within
the IAEA Nuclear Power Technology
Development Section**



Department of Nuclear Energy
International Atomic Energy Agency 

NPTDS Projects

- **Requirements and Prospects for Innovative Small and Medium Sized Reactors**
- **Technology Advances for Water-Cooled Reactors for Improvement of Reliability, Economics and Safety**
- **Technology Advances in Fast Reactors and Accelerator-driven Systems for Actinide and Long-Lived Fission Product Transmutation**
- **Support for the Demonstration of Nuclear Seawater Desalination**
- **International Task Force on Innovative Nuclear Reactors and Fuel Cycles**

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Educational simulators


- **To provide university professors and engineers involved in teaching topics in nuclear energy with tools (PC-based software) to demonstrate the operational response characteristics of various reactor types. The tools are also supplied directly to students, junior engineers, and senior engineers and scientists interested in broadening their understanding of the topic**
- **The simulators are not intended for plant-specific purposes such as design, safety analysis, licensing or operator training, and they are not designed to link with control system components**
- **Since 1997, ten workshops have been held, in Egypt, Saudi Arabia, the Republic of Korea, Italy and Vienna. Training has been given, and simulators have been distributed to more than 181 participants from 42 countries.**

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Simulator Software


- CASSIM Simulator Development System
- CANDU Simulator
- PCTTRAN PWR Simulator
- VVER-1000 Simulator
- Classroom Advanced Reactor Demonstrators (CARDS)

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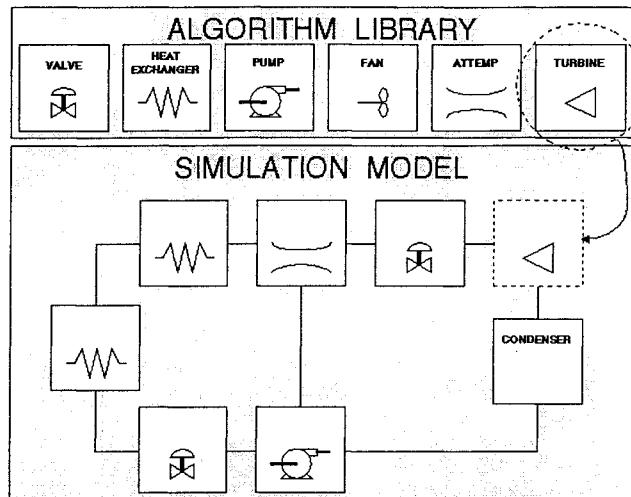
WEEK 1: Monday to Thursday

W.K. LAM (CTI Simulation International Corporation, Toronto, Canada)

- Benefits of Classroom Simulators to NPP Development & Operations
- Modular Modeling Systems & Dynamic Simulation Fundamentals
- CASSIM Simulation Models Building Process
- Reactor Kinetic Model & Modeling Exercise
- Neutron Sources on Reactor Kinetics & Reactivity Feedback Effects
- Modeling Exercises on Xenon/Iodine Reactivity Feedback Model
- Reactor Controls - Liquid Zone Reactivity Control Modeling for PHWR
- Liquid Zone Reactivity Control Modeling continued
- BWR Reactor Characteristics & Modeling Overview
- Exercises - Build Simple Spreadsheet Model For BWR Plant
- BWR Boiling Core Dynamics & BWR Simulator Exercises
- BWR Simulator Exercises
- NPP Balance of Plant Modeling Overview
- U-tube Steam Generator Model
- Simple Balance of Plant Models & Modeling Exercises
- Modeling Exercises continued & Wrap-Up Session

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Building a Simulator



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WEEK 1: Friday, WEEK 2: Monday

G. BEREZNAI (Consultant)

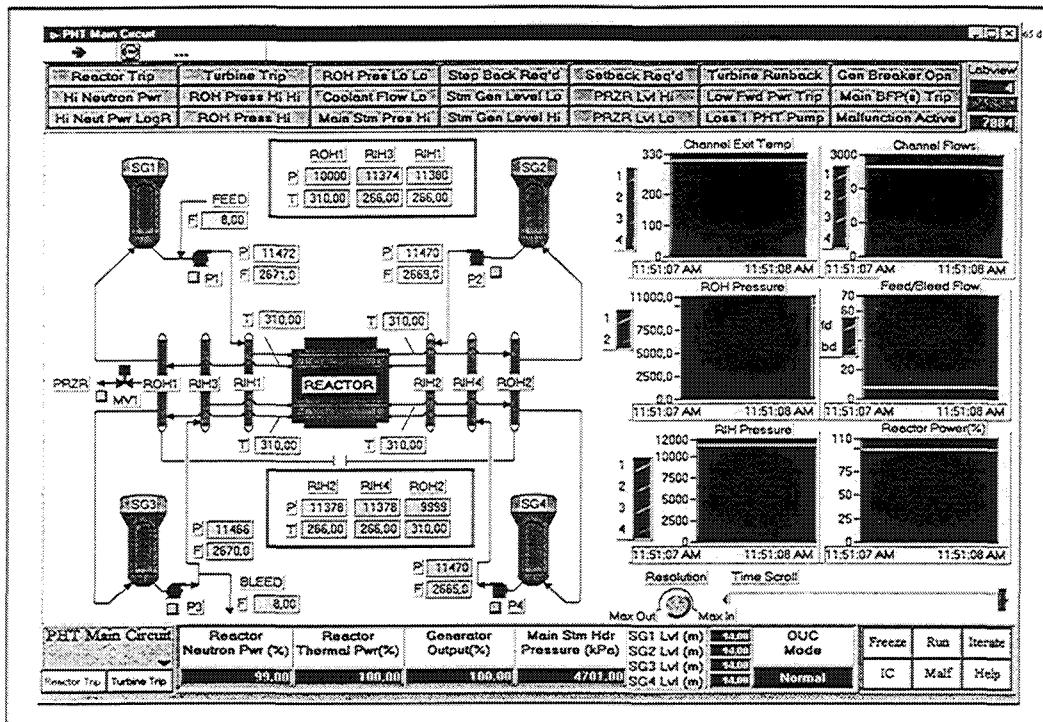
- CANDU Station Systems and Overall Unit Control
- Simulator – Plant Overview, UPR, Power maneuver
- CANDU Reactor, Reactor Regulating System
- Simulator – Shutdown Rods, Reactivity Control, RRS/DPR
- Heat Transport System, Pressure and Inventory Control
- Simulator – PHT Main Circuit, Feed & Bleed, Inventory Control
- Balance of Plant Systems
- Simulator – Steam Generator Level Control, Turbine-Generator,
- Major Plant Transients

J. CLEVELAND (IAEA, Vienna, Austria)

- Global Nuclear Power: Current Status and Overview of New Development

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WEEK 2: Tuesday, Wednesday

C. PO (Microsimulation Technology, Montville, U.S.A.)

- PCTTRAN PWR for ARS Introduction
- PWR Systems
- PCTTRAN Operations
- PCTTRAN Plant Data Input and Transient Data Output
- PCTTRAN Core Kinetics and Thermal-hydraulics Theory
- PCTTRAN Transient Simulation
- PCTTRAN Accident Simulation
- PCTTRAN Radiation Release Theory and Simulation



