ACR Workshop
-Introduction-

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Presented to US Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
September 25, 26, 2002

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Meeting Purpose

To provide a broad overview for the NRC staff of the design and technology base for the Advanced CANDU Reactor (ACR), prior to an initial round of familiarization meetings on technical specifics:

- The ACR Core (November 2002)
- ACR Thermal Hydraulics (January 2003)
- Shutdown System Design and Performance (January 2003)
- ECCS and Containment Design and Performance (February 2003)
- Control System Design and Performance (March 2003)
- CANFLEX Fuel and On-Power Refueling (April 2003)
- Safety Analysis Scope and Methodology (May 2003)

Meeting Scope

<u>Day 1 (September 25, 2002):</u>

Morning

- An Overview of the ACR Design (Stephen Yu)
- An Overview of the ACR Technology Base (Bob Speranzini)

Afternoon

- The ACR Design
  - Reactor and Fuel Handling (Ian Love)
  - Core Design & Reactor Physics (Peter Chan)
  - PCS, Moderator and Auxiliaries (Ian Love)
  - Safety Systems, Safety Support Systems and Safety Assessment (Massimo Bonechi)

Meeting Scope

<u>Day 2 (September 26, 2002):</u>

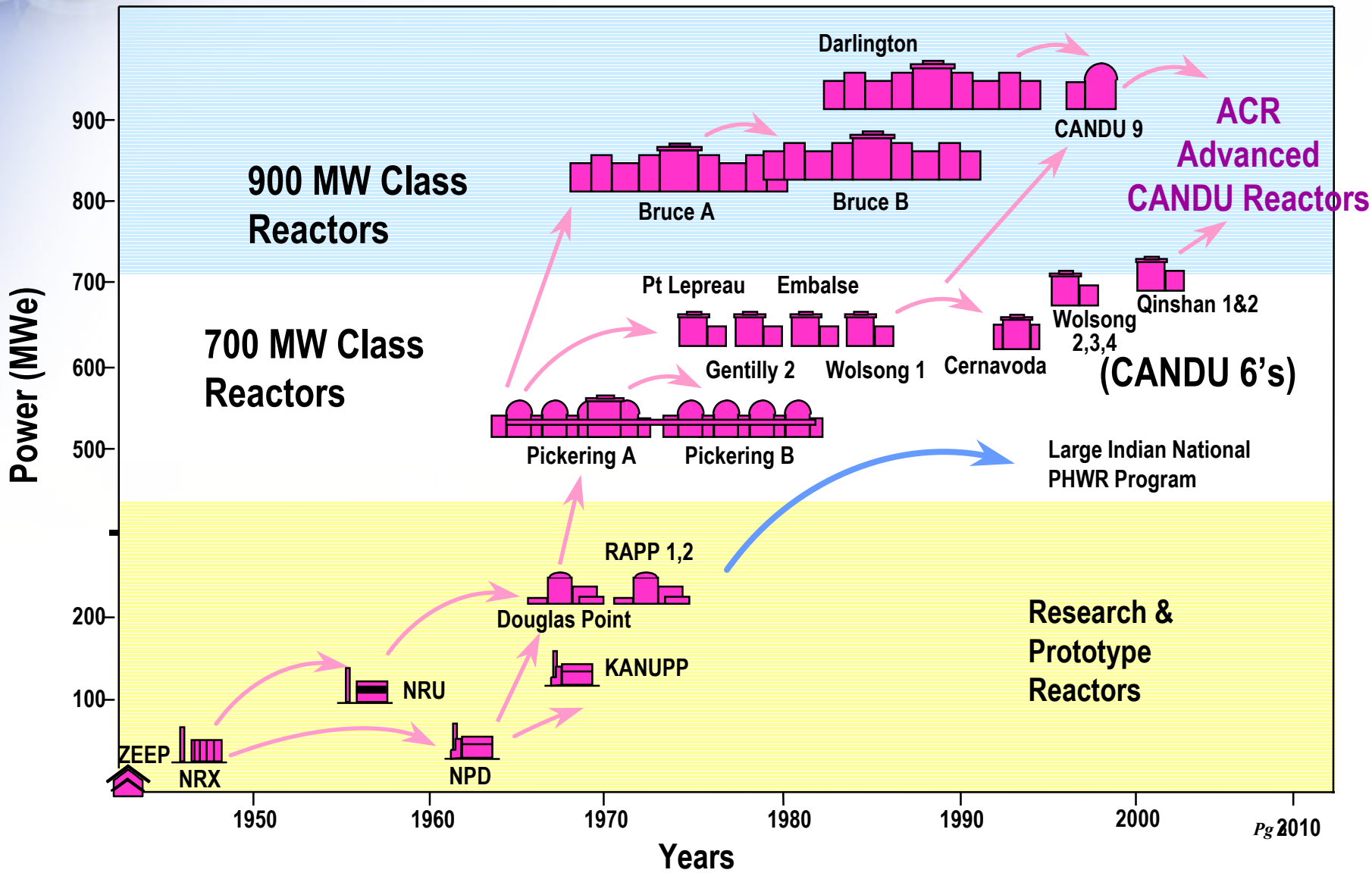
The Technology Base for the ACR

- Core Physics and Fuel (Peter Boczar)
- Fuel Channels (Doug Rogers)
- Thermal Hydraulics
  - System (Dave Richards)
  - Channel (Peter Boczar)
  - Moderator (Dave Wren)
- Containment (Andrew White)
- The Qualification Process for ACR Safety Analysis Computer Codes (Andrew White)

ACR Evolution

- The ACR is an evolutionary extension of the proven CANDU 6 lineage—with eight units in operation on four continents, and three units currently under construction
  - This provides a sound basis for projecting highly reliable performance, low project risk, assured costs, licensability.
  - Safety systems continue to be based on a performance proven design, with enhanced safety margins

ACR Evolution (cont'd)



ACR Evolution (cont'd)

- Most of the ACR construction project improvements have been successfully demonstrated in recent CANDU projects.
- 75% of internal components same as PWR technology
  - Main difference: ACR has pressure tubes and reactor assembly; PWR has pressure vessel.

Most Recent Build Project

- Qinshan Phase III, China
  - 2 x 728 MWe CANDU 6 units scheduled for in-service in 2003
  - Considered the best-run project by the Chinese
  - Uses open-top construction, prefabricated components, project integrating techniques
  - To date: on schedule; fuel loading started
  - Essentially a turnkey project

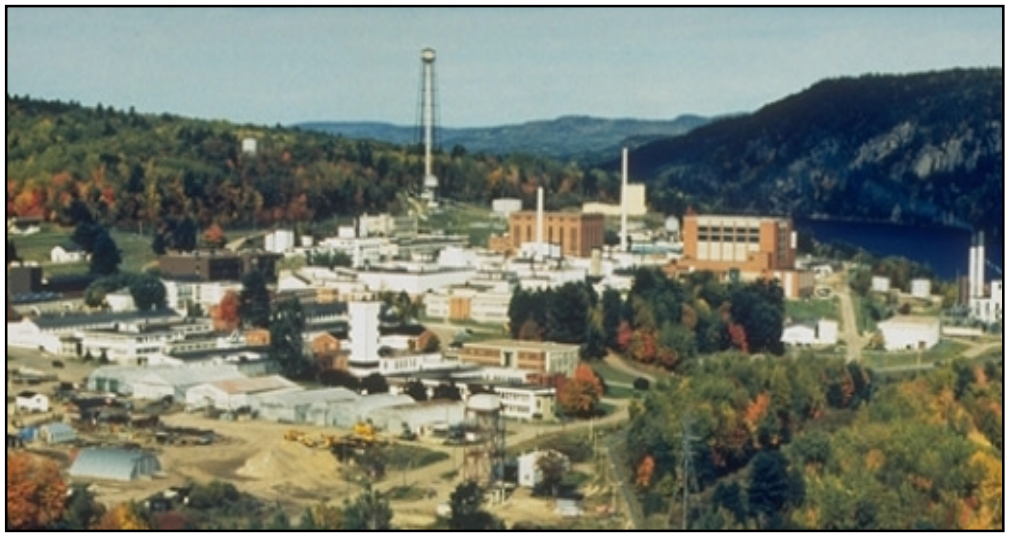
Most Recent Build Project (cont'd.)

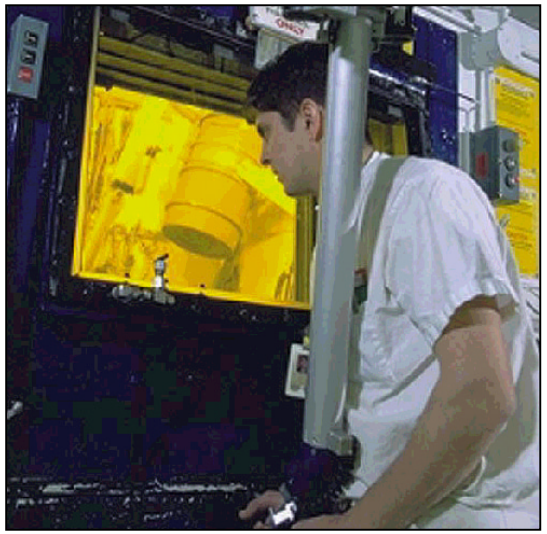
ACR Design - Sheridan Park

Canadian Head Office, near Toronto: product design & development; nuclear services; business development

ACR Technology Base
- Chalk River Laboratories -

Comprehensive R&D infrastructure, including hot cells and research reactors; nuclear platform infrastructure





Design Targets for ACR-700

Specific overnight capital cost:	$1,000/kWe
Project schedule:	60/48 months
LUEC:	$30/MWh
Capacity factor:	>90%
Plant Operating Life:	60 years

AECL's Commitment to ACR

- Product development funding approved
- ACR-700 concept complete
- Non-site specific engineering completed 2005
- Hitachi investing in BOP optimization and plant-wide modularization
- Construction strategy and schedule defined
- Working with Canadian, US and UK utilities to bring ACR to commercialization
- Licensing the product in 3 countries

Progress Since CANDU-3

- Significant design changes from CANDU-3 to ACR
  - Negative coolant void reactivity coefficient (no overpower transient in LOCA)
  - Light water coolant
  - Compact core
  - CANFLEX fuel
  - Increased safety margins
- Extensive, unified Canadian industry effort on the formal validation of safety analysis computer codes for CANDU reactors
- Significant additional R&D related to:
  - Core physics
  - System thermal hydraulics
  - Moderator performance
  - Channel performance
  - CANFLEX fuel
- Use of PRA in design

Areas for Pre-Application Discussion

- Design codes and standards
  - Pressure tubes and fueling machine as RCS components
- Definition of design basis accidents and acceptance criteria
- Safety analysis computer codes
- Severe accidents
  - Definition for ACR
  - Extent of R&D support
- Design approach for safety-related systems
- Use of distributed digital control systems and shutdown safety critical software
- On-power refueling

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