

June 30, 2003

MEMORANDUM TO: James E. Lyons, Director
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation

THRU: Joseph F. Williams, Acting Deputy Director **/RA/**
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation

FROM: Belkys Sosa, ACR-700 Project Manager **/RA/**
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation

SUBJECT: TRIP REPORT FROM VISIT TO THE ACR-700 RD-14M FACILITY AT
WHITESHELL RESEARCH LABORATORIES, MANITOBA, CANADA

On June 4-5, 2003, Kenneth Heck, Walton Jensen, Samuel Miranda, Paul Clifford, and Belkys Sosa of the Office of Nuclear Reactor Regulation (NRR) and David Bessette and Stephen Bajorek of the Office of Nuclear Regulatory Research (RES) participated in a meeting with the Canadian Nuclear Safety Commission (CNSC) and Atomic Energy of Canada, Limited (AECL) at Whiteshell Research Laboratories in Manitoba, Canada. The purpose of the meeting was to discuss integral facility testing in support of the Advanced CANDU Reactor (ACR-700) design and to provide details on the RD-14M scaling and the Quality Assurance (QA) program. Attached is the trip report from this activity.

cc: M. Cullingford, NRR
J. Dunn Lee, OIP
F. Eltawila, RES
C. Rosales-Bush, OIP
T. Rothschild, OGC
J. Jolicoeur, OEDO

Project No. 722

Attachment: As stated

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OFFICE	PM:NRLPO	(A)DD: NRLPO
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DATE	6/26/2003	6/26/2003

OFFICIAL RECORD COPY

Subject

Advanced CANDU Reactor (ACR-700) RD-14M Thermal Hydraulic Test Facility at Whiteshell Laboratories

Dates of Travel and Countries/Organization Visited

June 4-5, 2003

Whiteshell Research Laboratories (WRL), Manitoba, Canada

Author, Title, and Agency Affiliation

Belkys Sosa

ACR-700 Project Manager

New Reactor Licensing Project Office (NRLPO)

Office of Nuclear Reactor Regulation

Other NRC participants:

- Walton Jensen, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation
- Kenneth Heck, Division of Inspection Program Management, Office of Nuclear Reactor Regulation
- Paul Clifford, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation
- Samuel Miranda, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation
- Stephen Bajorek, Division of System Analysis and Regulatory Effectiveness, Office of Nuclear Regulatory Research
- Dave Bessette, Division of System Analysis and Regulatory Effectiveness, Office of Nuclear Regulatory Research

Sensitivity

Distributed meeting materials are available to the public (ADAMS Accession # ML031690521).

Background/Purpose

By letter dated June 19, 2002, Atomic Energy of Canada, Limited (AECL) requested that the U.S. Nuclear Regulatory Commission (NRC) begin a pre-application review of the Advanced CANDU Reactor (ACR-700) design. The ACR-700 is a 731 MWe, heavy-water-moderated, light-water-cooled, pressurized-water reactor design with an on-line refueling capability.

The pre-application activities for the ACR-700 include a series of technical presentations and tours of AECL test facilities. These activities facilitate the staff's review of the ACR-700 design and offer an opportunity to gather technical insight. This meeting supports the pre-application review process for the ACR-700 design. The meeting was conducted to address the ongoing

ACR-700 pre-application reviews of two Focus Topics (FT): "Computer Codes and Validation Adequacy" (FT#3) and "ACR Technology Base" (FT#12).

Abstract: Summary of Pertinent Points/Issues

NRC staff members met with members of the Canadian Nuclear Safety Commission (CNSC) and the applicant, AECL, at Whiteshell Research Laboratories on June 4-5, 2003, to discuss integral facility testing in support of the ACR-700 reactor design.

The main purpose of the meeting was to familiarize the staff with the details on the RD-14M facility, including description of the scaling philosophy and scaling methodology applied, and results specific to the RD-14 and RD-14M facilities. The RD-14 facility, which modeled a one-channel, two-pass core, was rebuilt to accommodate more or "multiple" channels, and designated as the RD-14M facility. The integral facility test data is used to validate the thermal hydraulic computer code used for ACR-700, CATHENA. The meeting also included a discussion on the RD-14M quality assurance (QA) process. WRL has conducted thermal hydraulic testing with the RD-14M facility in support of the CANDU 6 reactor design. The RD-14M facility has also been modified and used for a series of ACR-700 specific tests. The RD-14M configuration was modified so that only two fuel channels were used, and additional modifications were made to allow the facility to operate at the higher pressures and temperatures representative of the ACR-700. In this configuration, the facility is referred to as RD-14/ACR. The tests in RD-14/ACR were designed to show that the higher operating pressures and temperatures of the ACR-700 do not cause results to differ significantly from RD-14M results. Additional ACR-700-specific testing is planned for January 2004.

Discussion

The meetings were structured as a series of presentations and facilities tours. The RD-14M test facility is a full height, full length model of a CANDU reactor. The primary purpose of the facility is to provide scaled thermal hydraulic data for validation of the CATHENA code for loss-of-coolant accident (LOCA) evaluation. CATHENA is AECL's principal computer code for reactor system thermal hydraulic analysis. AECL emphasized that the purpose of the facility is for computer code verification and not to provide a proof test for CANDU reactors.

The facility tours included the Large-Scale Vented Combustion Chamber Test Facility (LSVCTF), the only large-scale test facility in North America that can be used to perform hydrogen combustion tests with air-steam mixtures. The experimental database generated with the combustion chamber has been employed to validate the GOTHIC code for CANDU containment analyses. In addition to the LSVCTF, a Containment Test Facility (CTF) has been developed to investigate flammability limits, ignition, turbulent combustion, flame acceleration, detonation, and detonation transition.

In addition to the facilities describe above, the visit included tours to the following WRL facilities: RD-17 facility, flow calibration laboratory, visual header facility, flame diffusion facility, and the combustion test facility.

Pending Actions/Planned Next Steps for NRC

The staff is currently reviewing the details on the integral test programs applicable to ACR-700 to determine if confirmatory testing using RD-14M is appropriate to support the ACR-700 design review. The ongoing international cooperation efforts with the CNSC on the ACR-700 pre-application phase will be very useful to the staff in expediting the review of the ACR-700 computer codes and validation adequacy.

The staff will proceed with the pre-application review interactions with AECL. These interactions are intended to provide details of the design features of the ACR-700 and the scope of the available and planned analysis and testing in support of the design. The next familiarization meetings are scheduled for August 2003, at the NRC and will focus on the ACR CANFLEX fuel design and the ACR on-line refueling capabilities.

A visit to an operational CANDU 6 reactor is currently planned for September 2003. The staff supports the site visits as early as possible in the pre-application review phase.

Points for Commission Consideration/Items of Interest

AECL plans to submit their application for ACR Standard Design Certification in September 2004.

The NRC staff begun review of the CATHENA code as part of the pre-application review. The staff will evaluate the validation of CATHENA models for thermal hydraulic phenomena significant to transient and accident conditions for the ACR-700. The scaling of facilities used to validate CATHENA including the RD-14/14M facility will be investigated relative to ACR-700. The ACR-700 pre-application review plan calls for the NRC to provide AECL with a report documenting the staff's conclusions and comments from the review of CATHENA in July 2004.

Additional RD-14 ACR-700 specific testing is planned for January 2004. The RD-14M test facility should be considered for NRC sponsored testing to provide independent data for code validation and to provide information for supporting regulatory decisions. The facility is of significant scale. It is full-height, and is capable of high-pressure operation. The RD-14M is well instrumented and has been used to simulate a wide range of LOCAs type tests.

Attachments

None