



AECL

AECL Technologies

15400 Calhoun Drive
Suite 100
Rockville Maryland
20855 USA
1-800-USA-AECL
(301) 738-2005
Fax (301) 738-2246
Telex 403-442

March 11, 1991

Document Control Desk
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: AECL Technologies' Report TTR-305
"The Technology of CANDU On-Power Fueling"

Reference: (1) Letter from D. R. Shiflett (AECLT) to NRC re: Project 679,
submitting the CANDU 3 LRBD, dated January 31, 1991

Gentlemen:

The purpose of this letter is to transmit the second of the CANDU background reports, TTR-305, "The Technology of CANDU On-Power Fueling" as promised in the proposed CANDU 3 LRBD, reference (1).

This report contains technical information which can be used by the NRC in their evaluation of on-power fueling systems and development of acceptance criteria for future CANDU license applications. The report describes the on-power fueling system from the arrival of new fuel, fueling the reactor and the on-site wet and dry storage of irradiated fuel. The report provides: the design requirements for the system; an explanation of the interactions of fuel handling with reactor physics and fuel design; a safety assessment of the system; a description of fueling machine recovery; a history of the development of on-power fueling; and a description of CANDU 3 specific features.

Examples of the type of information included in the enclosed report which can be used by NRC in establishing criteria for review and approval of CANDU type reactor licensing applications include the following:

1. **DESIGN** - The CSA N285 series of standards has been produced to provide uniform rules for the design, fabrication, and installation of pressure-retaining systems and components in CANDU nuclear power plants. This report identifies which of these standards are used in the on-power fueling system design.

9103110400 910311
PDR PROJ
679A PDR

A Division of AECL Inc.

2037
1/19

During on-power fueling, the fueling machine (F/M) becomes an extension of the reactor fuel channel end fitting and is subjected to the pressure in the primary heat transport system. The F/M is designed as a reliable high integrity device. Portions of it are equivalent to static pressure vessels and are designed to the CSA Standard CAN3-N285.0 which provides general requirements for all pressurized systems of the plant including administrative, regulatory and quality requirements. CSA Standard CAN3-N285.1 specifies the use of the ASME Code for Class 1, 2 and 3 systems and components for all technical rules of design and construction. Other portions, such as elastomeric hoses, the failure of which could result in release of fluid, are designed to CSA Standard CAN/CSA-N285.2 which provides technical rules for those components which are unique to the CANDU design and are not adequately dealt with by the ASME Code. Additionally, the on-power fueling concept requires the F/M pressure boundary and its support structure to be seismically qualified to the requirements of CSA Standard CAN 3-N289.3.

Furthermore, the F/M must visit different reactor fuel channels, the fuel transfer port and auxiliary ports. Therefore its support system must provide transport mobility, whereas the requirements for ASME pressure vessel supports generally address static structural components.

These design standards provide the necessary assurance of structural adequacy throughout the design life of the on-power fueling system.

2. **PERFORMANCE** - This report describes the operating history of the F/M, including problem areas, station incapability due to fuel handling, improvements that were made to increase fueling capability, and continuing development programs. This information provides assurance that the performance of the on-power fueling system is reliable and safe.
3. **FUELING MACHINE RECOVERY** - This report describes the methods for recovering a malfunctioning fueling machine from the reactor end fitting, provides examples of how significant malfunctions have been resolved in the past and describes modifications that have been incorporated in the fueling machine to prevent recurrence. This information provides assurance that adequate provisions are made for recovery operations.

Document Control Desk

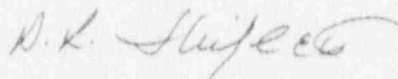
Page 3

March 11, 1991

4. **SAFETY ASSESSMENT** - This report describes the assessment of on-power fueling with regard to the protection of the work force, the public and the environment. The assessment covers: undesired fuel handling related events at existing CANDU power plants, probabilistic assessment of accidental occurrences, and deterministic calculation of the consequences of selected hypothesized accident cases. This assessment provides assurance that on-power fueling systems will not pose an unacceptable risk to the work force, the public or the environment.

We believe the information in this report will enable NRC to establish their acceptance criteria for the review of on-power fueling systems of future license applications for CANDU type reactors. We look forward to your response to the enclosed submittal. We are prepared to provide additional information which the staff may request and would be pleased to arrange a technical briefing on the material covered in the report.

Sincerely,



D. R. Shiflett
Vice President/General Manager
AECL Technologies

TTR-305/DRS/bb

Attachment - TTR-305

cc: Mr. Joe Glitter (1 cy)
NRC Document Control (19 cys)