March 11, 2004

ORGANIZATION: ATOMIC ENERGY OF CANADA LIMITED (AECL)

SUBJECT: SUMMARY OF MEETING HELD ON FEBRUARY 5 AND 6, 2004, TO DISCUSS ACR-700 PROBABILISTIC RISK ANALYSIS (PRA)

The Nuclear Regulatory Commission (NRC) hosted a public meeting with Atomic Energy of Canada Limited (AECL) on February 5 and 6, 2004, at the U. S. Nuclear Regulatory Commission (NRC) Headquarters in Rockville, MD. The purpose of this meeting was to discuss the Advanced CANDU Reactor (ACR-700) Probabilistic Risk Analysis (PRA). For a list of meeting attendees refer to Enclosure 1.

The discussion focused on the following topics and the results of the discussions are summarized below:

Distinction Between Design Basis Accidents (DBA) and PRA

Draft Canadian Regulatory Guide C-006 (Rev. 1)(E) contains proposed frequency guidelines for the five classes of events used in Canadian safety analysis. This document was provided to the NRC staff during the meeting. AECL stated that limited core-damage accidents (LCDAs) are included within CNSC Classes 4 and 5 and they are treated as design basis accidents using deterministic acceptance criteria. In contrast, severe core-damage accidents (SCDAs) are assessed using PRA. The ACR-700 PRA will estimate the frequencies of LCDAs and the frequencies of each plant damage state (PDS) defined in the PRA.

AECL suggested that for the purposes of the NRC licensing process, Classes 1, 2, and 3 should be addressed in Chapter 15 of the Safety Analysis Report (SAR). LCDAs (Classes 4 and 5) should be addressed in a separate SAR chapter, and SCDAs should be addressed in a separate PRA report. The NRC staff needs to consider this proposal further.

PRA Peer Review

AECL stated that they would hire a U.S. company to assist in the performance of the PRA peer review. The peer review team would also contain other PRA experts from Canada, who are familiar with the CANDU design. AECL asked whether it was acceptable to conduct the PRA peer review in parallel with the initial application for standard design certification. The NRC staff needs to consider this proposal further.

Staff Review of the Application

AECL requested that the NRC provide its Requests for Additional Information (RAI) in batches as the staff conducts its review, rather than sending all questions after the entire review has been conducted. The NRC staff agreed.

ACR-700 Operating States

AECL will develop event trees for the following plant operating states (POS):

a. Full-power. Note that, for the purposes of PRA, the refueling machine is considered to be attached at all times during this POS. The PRA also considers the refueling machine when it is not attached to the reactor.

b. Shutdown, with the heat transport system (HTS) full and depressurized

c. Shutdown, with the HTS drained

It is planned that the ACR-700 be shutdown once every 3 years, with a duration of about 1 month for routine refurbishment activities. Once every 1-12 years, the fuel channels are inspected, checks are made for hydrogen pickup, and pressure tube spacers are adjusted. AECL also stated that a containment leakage test is planned once every 5 years. AECL agreed to provide the NRC staff with a typical CANDU outage schedule.

Interpretation of PRA Results

AECL stated that the PRA report for the design certification will contain a discussion of completeness uncertainty including modeling uncertainties through sensitivity analyses and a parametric uncertainty analysis. It was agreed that the importance rankings will be based on both the pre-recovered minimal cut sets and the post-recovered minimal cut sets.

Consideration of Recovery and Repair Activities

The ACR-700 PRA will credit repair, based on a review of the minimal cut sets and consideration of the mean-time-to-repair (MTTR). The ACR-700 PRA methodology limits the application of multiple recovery actions on a single minimal cut set; the maximum credit taken will not exceed 1E-5.

External Event Analysis

The PRA report for the design certification will provide a mapping of components and their locations to PRA basic events.

Human Reliability Analysis

The NRC staff raised concerns on adequate treatment of human actions during on-power refueling. AECL stated that the frequencies of initiating events during on-power refueling will be estimated from previous CANDU experience (approximately 400 years of data) which has shown no wrong-channel events or inadvertent bridge motion due to a software error.

AECL also stated that pre-accident human errors will be modeled in various fault trees with probability estimation using the accident sequence evaluation program (ASEP) approach [simplified technique for human error rate prediction (THERP)]. The ASEP approach uses a basic human error probability (BHEP) of 0.03 that is adjusted upwards or downwards using

recovery factors. Post-accident human errors will consider both diagnosis and execution errors with no credit for operator action during the first 15 minutes of an accident.

AECL informed the NRC staff that every CANDU plant has a simulator and the emergency operating procedures are characterized as “symptom-based.” Overall direction is provided through the Power Reduction Action Guide (PRAG), which may bridge to other event-based procedures following diagnosis of the accident. AECL is currently developing severe accident management guidelines, based on the Westinghouse approach, over the next 2-3 years.

Members of the public were in attendance but did not make public comments.

/RA/

James Kim, Project Manager
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Project No. 722

Enclosures: As stated

cc w/encls: See next page

recovery factors. Post-accident human errors will consider both diagnosis and execution errors with no credit for operator action during the first 15 minutes of an accident.

AECL informed the NRC staff that every CANDU plant has a simulator and the emergency operating procedures are characterized as “symptom-based.” Overall direction is provided through the Power Reduction Action Guide (PRAG), which may bridge to other event-based procedures following diagnosis of the accident. AECL is currently developing severe accident management guidelines, based on the Westinghouse approach, over the next 2-3 years.

Members of the public were in attendance but did not make public comments.

/RA/

James Kim, Project Manager
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Project No. 722

Enclosures: As stated

cc w/encls: See next page

ADAMS ACCESSION NUMBER: ML040680549

OFFICE	PM:RNRP	SC:RNRP
NAME	JKim	LDudes
DATE	3/10/04	3/11/04

OFFICIAL RECORD COPY

Distribution for February 4 and 5, 2004, Meeting Summary dated March 11, 2004

Hard Copy
RNRP R/F
PUBLIC
JKim
LDudes

E-Mail:
PUBLIC
JDyer
WBorchardt
BSheron
RNRP Group
DE Branch Chiefs
DE Section Chiefs
OGC
ACRS/ACNW
JLyons
MKotzalas
AThadani
FEltawila
MStutzke
AEl-Bassioni
JRidgely
DCarlson
BSosa

ACR-700 Fuel Handling Meeting
FEBRUARY 4 AND 5, 2004, Room O-4B8

ATTENDANCE LIST

Name	Representing
Raj Jaitly	AECL
Hymie Shapiro	AECL
Beomsu Lee	AECL
James Kim	NRC
Martin Stutzke	NRC
Adel El-Bassioni	NRC
John Ridgely	NRC
Don Carlson	NRC
Yi Zeng	CNSC
Cal Reid	Bechtel
Mike Muhlheim	ORNL
Bill Smith	Energetics
Stephen Mazurkrewier	Framatome-ANP
Kenneth Rogers	Self

Attachment

ACR-700

cc:

Mr. Charles Brinkman
Westinghouse Electric Co.
Washington Operations
12300 Twinbrook Parkway, Suite 330
Rockville, MD 20852

Mr. Thomas P. Miller
U.S. Department of Energy
NE-20, Rm. A286
Headquarters - Germantown
19901 Germantown Road
Germantown, MD 20874-1290

Mr. David Lochbaum
Nuclear Safety Engineer
Union of Concerned Scientists
1707 H Street, NW, Suite 600
Washington, DC 20006-3919

Mr. Paul Gunter
Nuclear Information & Resource Service
1424 16th Street, NW, Suite 404
Washington, DC 20036

Mr. James Riccio
Greenpeace
702 H Street, NW, Suite 300
Washington, DC 20001

Mr. Ron Simard
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708

Patricia Campbell
Winston & Strawn
1400 L Street, NW
Washington, DC 20005

Mr. Paul Leventhal
Nuclear Control Institute
1000 Connecticut Avenue, NW
Suite 410
Washington, DC 20036

Mr. Jack W. Roe
SCIENTECH, INC.
910 Clopper Road
Gaithersburg, MD 20878

Mr. David Ritter
Research Associate on Nuclear Energy
Public Citizens Critical Mass Energy
and Environmental Program
215 Pennsylvania Avenue, SE
Washington, DC 20003

Mr. James F. Mallay, Director
Regulatory Affairs
FRAMATOME, ANP
3315 Old Forest Road
Lynchburg, VA. 24501

Mr. Tom Clements
6703 Gude Avenue
Takoma Park, MD 20912

Mr. Vince Langman
Licensing Manager
Atomic Energy of Canada Limited
2251 Speakman Drive
Mississauga, Ontario
Canada L5K 1B2

Mr. Victor G. Snell
Director of Safety and Licensing
Atomic Energy of Canada Limited
2251 Speakman Drive
Mississauga, Ontario
Canada L5K 1B2

Mr. Glenn R. George
PA Consulting Group
130 Potter Street
Haddonfield, NJ 08033

J. Alan Beard
GE Nuclear Energy
13113 Chestnut Oak Drive
Darnestown, MD 20878-3554

Mr. Ian Grant
Canadian Nuclear Safety Commission
280 Slater Street, Station B
P.O. Box 1046
Ottawa, Ontario
K1P 5S9

Mr. Gary Wright, Manager
Office of Nuclear Facility Safety
Illinois Department of Nuclear Safety
1035 Outer Park Drive
Springfield, IL 62704

Dr. Gail H. Marcus
U.S. Department of Energy
Room 5A-143
1000 Independence Ave., SW
Washington, DC 20585

Mr. Ronald P. Vijuk
Manager of Passive Plant Engineering
AP1000 Project
Westinghouse Electric Company
P. O. Box 355
Pittsburgh, PA 15230-0355

Dr. Greg Rzentkowski
Canadian Nuclear Safety Commission
P.O. Box 1046, Station 'B'
280 Slater Street,
Ottawa, ON, K1P 5S9
Canada

Mr. Ed Wallace, General Manager
Projects
PBMR Pty LTD
PO Box 9396
Centurion 0046
Republic of South Africa

Mr. John Polcyn, President
AECL Technologies Inc.
481 North Frederick Avenue
Suite 405
Gaithersburg, MD 20877

Mr. Russell Bell
Nuclear Energy Institute
Suite 400
1776 I Street, NW
Washington, DC 20006-3708