

# CONTENTS

<b>Preface</b> .....	vii
<b>Biographies</b> .....	xi
<b>Chairman's Opening Remarks</b> .....	1
- Ara Mooradian	
<b>Moderator's Remarks</b> .....	3
- Robert Bothwell	
<b>How It All Began in Canada: The Role of the French Scientists.</b> .....	5
- Bertrand Goldschmidt	
<b>Personal Reminiscences</b> .....	15
- Leslie Cook	
<b>Fission and Physics in Canada</b> .....	23
- Geoff Hanna	
<b>The Development of Nuclear Power</b> .....	37
- John Foster	
<b>The Second Fifty Years of Nuclear Fission</b> .....	57
- Alvin Weinberg	
<b>The Growth of Nuclear Medicine</b> .....	63
- Sylvia Fedoruk	
<b>Chairman's Closing Remark</b> .....	75
- Ara Mooradian	



## CONTENTS

### VOLUME 2: SESSIONS 1 to 9

#### SESSION 1

Page

##### ADVANCED FUEL CYCLES

Chairman: R.W. Morrison, Energy, Mines and Resources

Future Prospects for CANDU Advanced Fuel Cycles J.B. Slater, AECL-CRNL	1-1
Use of Advanced Fuel Cycles in CANDU Power Plant Optimization J.R. Hardman, A.C. Mao, A.R. Dastur*, AECL-CANDU Operations	1-6
The R&D Program in Support of Advanced Fuel Cycles for CANDU E.O. Moeck*, F.N. McDonnell, A.D. Lane, J. Griffiths, AECL-CRNL	1-10
The Role of the New CANFLEX Fuel Bundle in Advanced Fuel Cycles for CANDU Reactors A.D. Lane*, J. Griffiths, I.J. Hastings, AECL-CRNL	1-16
Reactor Physics Measurements in Support of Advanced Fuel Cycles in CANDU Reactors R.T. Jones*, J. Griffiths, A. Okazaki, A. Celli, AECL-CRNL	1-23
Equilibrium Fuel Management Simulations for 1.2% SEU in a CANDU 6 M.H. Younis, AECL-CANDU Operations, P.G. Boczar*, AECL-CRNL	1-33

#### SESSION 2

##### SMALL REACTOR DEVELOPMENT I

Chairman: J.W. Hilborn, AECL-CRNL

The Small Pressurized Light-Water Reactor - A Well-Optimized Marine-Propulsion Power Source P. Gumley, F.N. McDonnell*, AECL-CRNL	2-1
The AMPS-1000 - An Advanced Reactor Design for Marine Propulsion A.F. Oliva, ECS Power Systems Inc.	2-8
The Nuclear Battery Program: Progress and Future Possibilities K.D. Kozier*, J.V. Donnelly, W.G. Mathers, AECL-WNRE	2-18
Recent Initiatives at the IAEA and Within Canada to Develop Small Reactor Safety Criteria P.M. French*, AECL, P.C. Ernst, McMaster University, D.J. Axford, V.G. Snell, AECL-CRNL	2-24

	<u>Page</u>
SPORTS-M Prediction of the Transient Behaviour in a MAPLE Heat Transfer Test Facility P.J. Mills, S.Y. Shim, J.E. Kowalski, K.O. Spitz, AECL-WNRE	2-33

### SESSION 3

#### CANDU PERFORMANCE & IMPROVEMENTS

Chairman: D.W. Bredahl, AECL-CANDU Operations

Oxygen Addition to the Annulus Gas Systems of Pickering NGS A, Units 3 and 4 J.M. Kenchington*, M. Ng, D.G. Meranda, Ontario Hydro	3-1
Some Aspects of Darlington Status Schedule and Complexity V. Austman, Ontario Hydro	3-6
CANDID - Integrated Design System T.H. Prescott*, C.D. Sayles, E.D. Wessman, AECL-CANDU Operations	3-8
New Approaches to Alarm Annunciation for CANDU Power Plants R. Olmstead, J. Pauksens*, AECL-CANDU Operations, W. Goddyn, Hydro-Québec	3-15
CANDU 3 - Single-Ended Refuelling R.K. Nakagawa, R.A. Mansfield*, W.H. Buchan, AECL-CANDU Operations	3-22
Circumferential Cracking of the End Cap Welds - Case Analysis R. Sejnoha*, M. Tayal, P.N. Singh, AECL-CANDU Operations, B.A. Surette, AECL-CRNL, C.K. Chow, AECL-WNRE	3-29

### SESSION 4

#### FUEL CHANNEL DESIGN, PERFORMANCE & MONITORING

Chairman: G.J. Field, CANDU Owners Group

Irradiation-Induced Deformation in CANDU Fuel Channels Roger Dutton, C.H. Woo, AECL-WNRE	4-1
Pickering NGS A: Assessment of Calandria Tube Integrity Following a Sudden Pressure Tube Failure P.S. Kundurpi*, A.P. Muzumdar, F.B.P. Tran, Ontario Hydro	4-10
Design Features of the Fuel Channel to be Used in the Retubing of Pickering 3 & 4 R. DeGregorio*, AECL-CANDU Operations	4-19
The Evolution of Pressure Tube Sampling Tools for Life Assessment R. Joynes, C.A. Kittmer*, AECL-CRNL	4-24

	<u>Page</u>
Remotely Operated Inspection Systems for the CANDU Fuel Channels K.S. Mahil, G.N. Jarvis, D.W. Donnelly, Ontario Hydro	4-29
Comparison of Measured and Calculated Dose Rates and Activities During Pressure Tube Replacement in Pickering Units 1 and 2 K.M. Aydogdu*, C.R. Boss, AECL-CANDU Operations, D.W. McKean, Ontario Hydro	4-36

## SESSION 5

### PUBLIC INFORMATION NEEDS FOR WASTE MANAGEMENT

Chairman: A.V. Manchee, Ontario Hydro

Public Communication Terry Young, Ontario Hydro Media Relations	5-2
Government Information Needs Brian Finlay, Ontario Ministry of Energy	5-3
Media Perspectives Derek Nelson, Queens Park Columnist, Thomson News Service	5-4
Public Attitudes Toward the Environment Margaret Buhlman, Decima Research	5-5
The Role of Public Consultation Michael Scott, Ontario Waste Management Corporation, Director of Communications	5-6

## SESSION 6

### THERMALHYDRAULICS I

Chairman: V.S. Krishnan, AECL-WNRE

TUF Verification Against Selected RD-14 Experiments J. Pascoe*, A. Tomasone, M. Williams, W.W. Yousef, W.S. Liu, J.C. Luxat, Ontario Hydro	6-1
Verification of CHAN-II (MOD6) Against Experiments M. Bayoumi*, F.B.P. Tran, K.E. Locke, A.P. Muzumdar, Ontario Hydro	6-10
FIDAS: A Three-Fluid Subchannel Code for Dryout Prediction in Rod Bundles Takaaki Sakai, Helene E.C. Rummens*, Satoru Sugawara, Power Reactor and Nuclear Fuel Development Corporation, Japan	6-19
Status of Physical and Numerical Modelling of CANDU Moderator Circulation R.G. Huget*, J.K. Szymanski, W.I. Midvidy, Ontario Hydro	6-25

	<u>Page</u>
Determination of Blowdown Heat Transfer Based on Experimental Investigation of RD14 Experiments. Analysis with the Code SLLOH Jean-Claude Amrouni*, Energie & Analyses Enaq du Québec, Ltée, J.C. Luxat, Ontario Hydro	6-35
CATHENA Simulation of Thermosiphoning in a Multiple-Channel Pressurized-Water Test Facility J.P. Mallory, P.J. Ingham, AECL-WNRE	6-39
Simulation of "Standing Start" Behaviour by the CATHENA Thermalhydraulics Code B.N. Hanna, J.P. Mallory, AECL-WNRE	6-46

## SESSION 7

### CANDU OPERATING EXPERIENCE I

Chairman: H. Chan, CANDU Owners Group

Repair of End Shield of Pressurized Heavy Water Reactor S.L. Kati*, K.S.N. Murthy, A. Krishnan, Nuclear Power Corporation of India Ltd.	7-1
Remote Inspection and Repair of CANDU Reactor Vault Components A.B. Powell, Ontario Hydro	7-8
Turbine Trip Due to Inadvertent Operation of ECI Injection Valves During Routine Testing at Pickering NGS-B N.G. Blair-Johns, Ontario Hydro	7-14
Operating Experience With Mercury-Wetted Relays at Ontario Hydro's Nuclear Generating Stations P.V. Castaldo*, B.A. Rolfe, Ontario Hydro	7-18
Ten Year Performance of Bruce NGS 'A' On-Power Fuelling System S. Jayabarathan, Ontario Hydro	7-23
Un Simulateur Pleine Echelle De Centrale Nucleaire: Un Outil Complexe Conduisant A Une Meilleure Formation Claude Drouin, Denis Delorme, Hydro-Québec (Gentilly)	7-33
Reactor Physics Recommissioning of Pickering NGS Units 1 and 2 J. Judah*, N. Roy, M. Gold, G. Costa, Ontario Hydro	7-43

## SESSION 8

## REACTOR PHYSICS SIMULATION

Chairman: A.L. Wight, Ontario Hydro

- Coupled Neutronics - Thermohydraulics Simulations of Fast Transients in CANDU 8-1  
B. Rouben, P. Soedijono\*, AECL CANDU-Operations, P.D. Thompson, New Brunswick Electric Power Commission, A. Baudouin, Hydro-Québec
- TRAWA-FEE Simulation of Reactivity Transients in PWR Cores 8-9  
D. Pevec\*, University of Zagreb, D. Grgic, Rade Koncar Electrochemical Institute
- Evaluation of Neutron Resonance Data and Analysis Techniques for CANDU Type Fuel Bundles 8-17  
Francisco Leszczynski, Centro Atomico Bariloche
- The Sudbury Neutrino Observatory (SNO) 8-21  
H.C. Evans, Queen's University, and the SNO Collaboration
- On Factors Contributing to Quality of Nuclear Control Computer Software 8-26  
S. Rannem\*, E. Hung, Ontario Hydro
- Gestion Du Combustible Integree 8-34  
Denis Aubin, Hydro-Québec

## SESSION 9

## REACTOR SAFETY I

Chairman: R.A. Brown, Ontario Hydro

- A Study of the Effectiveness for Response to Loss of Class IV Power of One Standby Class III Generator Operating in a Continuous or Test Cycle Mode 9-1  
A.A. Chowdhury\*, Atlantic Nuclear Services Ltd., A.T. McGregor, J.H. McIntosh, M.G. Frauley, New Brunswick Electric Power Commission
- Emittance of Zircaloy-4 Sheath at High Temperatures in Argon and Steam Atmospheres 9-12  
P.M. Mathew\*, AECL-WNRE, M.H. Schankula, AECL-CRNL
- The Experimental Measurement of Circumferential Temperature Distributions Developed on Pressure Tubes Under Stratified Two-Phase Flow Conditions: Tests 1 to 5 9-18  
P.S. Yuen\*, K.A. Haugen, D.G. Litke, R.G. Moyer, H.E. Rosinger, AECL-WNRE

	<u>Page</u>
Experiments to Determine the Thermal-Mechanical Response when Molten Zircaloy-4 Flows onto a Ballooned Pressure Tube D.B. Sanderson*, K.W. Demoline, AECL-WNRE, K.E. Locke, A.P. Muzumdar, Ontario Hydro	9-26
Overpressures and Time Scales Associated with Hydrogen Combustion G.W. Koroll, R.K. Kumar, C.K. Chan, K.N. Tennankore, AECL-WNRE	9-31

### VOLUME 3: SESSIONS 10 to 17

#### SESSION 10

##### SMALL REACTOR DEVELOPMENT II

Chairman: H.A. Robitaille, DGSEM/DND HQ

The AMPS Reactor Cooling System: The Key to Flexibility in Passive Safety Design J.S. Hewitt, ECS Power Systems Inc.	10-1
Maple-MNR: Preliminary Thermalhydraulics Studies J.S. Chang*, P.C. Ernst, W.J. Garland, H.E.C. Rummens, M. Shoukri, R.J. Wilson, McMaster University, D.K. Baxter, G.E. Gillespie, P.J. Mills, S.Y. Shim, AECL-WNRE	10-14
A CATHENA Study of the Requirement for a Flap Valve in the MAPLE-X10 Research Reactor S.Y. Shim, D.J. Richards, T.E. MacDonald, AECL-WNRE	10-21
Experimental Design Verification of the Hydrodynamic Ports for the AMPS Reactor J.C. Atkinson*, T.C. Currie, R.G. Gray, ECS Power Systems Inc.	10-29

#### SESSION 11

##### REACTOR DECOMMISSIONING & WASTE MANAGEMENT

Chairman: E. Rosinger, AECL-WNRE

Cost Estimate for Decommissioning a CANDU 6MKI Nuclear Generating Station G. Pratapagiri*, AECL-CANDU Operations, A. Lee DeLong, New Brunswick Electric Power Commission, Louis Cloutier, Hydro-Québec	11-1
A Demonstrative Impact Analysis of the Concrete Integrated Container H.P.J. Lee, Ontario Hydro	11-10
Public Opinion on Nuclear Fuel Waste Management in Canada M.A. Greber, AECL-WNRE	11-17