Summaries of CNS Conferences, Seminars and Workshops

International Conference on CANDU Fuel

Delegates from the international nuclear fuel community met at Chalk River 6–8 October 1986 to discuss CANDU fuel technology. Sponsored by the Canadian Nuclear Society and the American Nuclear Society, and utilizing the facilities of Atomic Energy of Canada Ltd. Research Company, the first International Conference on CANDU fuel attracted about 100 participants from Argentina, India, Japan, Korea, Pakistan, the U.S., and West Germany, as well as Canada. Canadian representatives were affiliated with the provincial utilities supporting nuclear programs, with fuel fabricators, with the AECB and AECL. The opening keynote address was given by J.B. Slater, Director of Planning, Reactor Development, at Chalk River, who stressed the importance of co-operation in all phases of the fuel cycle in the success of CANDU. Dr R.E. Green, Vice-President, Reactor Development, at Chalk River, made the conference banquet presentation. Green described the newly restructured AECL Research Company, its mission, and highlights in the research and commercial areas.

The 45 technical papers contributed fell into the categories of international programs and experience, production and fabrication, performance and modelling, fuel handling and storage, fission product behaviour and fuel cycles. Technical highlights of these sessions were:

International Programs and Experience

Argentina (R. Cirimello, CNEA) has a well-equipped CANDU fuel fabrication plant, though the indigenous fuel has suffered defect problems. Redesign is thought to have eliminated the cause, and the plant is gearing up for full-core capability. Canadian fuel is performing well in Embalse, with a bundle defect rate around 0.1%. The Indian program (G.V.S.R.K. Somayajulu) is moving ahead ambitiously. About 42,000 fuel bundles have been fabricated for the current program, which is planned to expand to 10,000 MWe by the year 2000. The Indian fuel design has evolved to an all-welded 37-element bundle for their projected 500 MWe reactor series.

In the CANDU 600s, Korea (M.S. Yang) and New Brunswick (M. Shad) detailed the excellent performance of their respective units. Yang highlighted the QA/QC aspects of Korean fuel technology. P.T. Truant, A.J. Hains, and H.J. Underhill spoke on Ontario Hydro experiences: more than 145 reactor-years, 420,000 bundles irradiated with station incapability charged to fuel, less than 0.1% over the stations' lifetimes. Most impressive was the significant performance database that Ontario Hydro has generated, particularly for fuel power ramp performance up to 200 Mw.h/kgU. Truant also discussed the CANDU Owner's Group (COG), a cooperative venture to further improve CANDU fuel technology. M.J.F. Notley (AECL, CANDU Operations) looked at the CANDU of the future, showing the potential for further uprating and cost reduction, and emphasizing the potential for fuel cycles other than natural uranium. This latter topic was also taken up later in the session on Fuel Cycles.

Production and Fabrication

R.T. Tanaka and T.W. Kennedy traced the development of UO_2 powder production at Eldorado's Port Hope facilities. Pelleting experience with that powder was outlined by M.R. Hoare (Westinghouse Canada Inc.), in particular the effects of powder agglomerates and chemical impurities. T.J. Carter described Chalk River's glove-box fabrication facility and its capability to produce alpha-active fuel $(U,Pu)O_2$, $(Th,Pu)O_2$, and $(Th,^{235}U)O_2$. In normal fabrication techniques, C.W. Turner (AECL, Chalk River) reported preparation of thoria microspheres via external gelation of sols.

Performance and Modelling

Advances in modelling CANDU behaviour under normal operating conditions were presented by M. Tayal (AECL, CANDU Operations) and W. Hwang (KAERI, Korea). ELESIM and ELESTRES are the performance codes that form the basis for these studies. ELOCA is the code describing accident conditions; J.A. Walsworth (AECL, Chalk River) and P. Richinson (AECL, CANDU Operations) described the model and showed that its calculations compared well with measured data from a LOCA test on CANDU fuel performed at the Power Burst Facility, Idaho Falls. M. Tayal also used ELOCA to

estimate axial variation in sheath strain during a hypothetical large-break LOCA; maximum plastic loop strain was 2.5% for a maximum sheath temperature of 1050°C. H. Sills (AECL, Chalk River) showed how fuel and thermal-hydraulics codes are being integrated into the CANSIM code system, which allows easy substitution of improved versions of either code type. P.J. Fehrenbach (AECL, Chalk River) reviewed CANDU fuel behaviour during LOCA transients. In a series of in-reactor LOCA tests with sheath temperatures up to 1050°C, fuel behaved in a manner predicted by existing codes. Sheath strains were less than 5% and release of short-lived fission products via on-line monitoring was acceptably small. In an associated paper, L.R. Lupton (AECL, Chalk River) described a tomographic technique for non-destructive examination of fuel assemblies. This capability is particularly valuable in characterizing the distribution of previous molten U-Zr-O alloys in fuel assemblies subjected to accident-simulation tests.

Handling and Storage

Fuel handling at the generating stations and during the back-end of the fuel cycle is attracting current attention. J. Novak and G. Miller (Ontario Hydro) described fundamental studies on the oxidation behaviour of defected fuel, and experience during actual reactor situations, in particular of a bundle without sufficient cooling in the fuel transfer mechanism, two hours after discharge. K.M. Wasywich (AECL Whiteshell) gave the current status of the Canadian experimental dry storage program. Defected and undefected, irradiated CANDU bundles have been stored in concrete canisters at 150°C up to four years in a variety of environments without significant degradation of fuel or sheath. P. Sermer (Ontario Hydro) gave an analytical model for heat transfer of a CANDU bundle residing in air, while R. Beaudoin (Hydro Quebec) described the technical and cost aspects of storing 67 Mg of spent fuel at Gentilly I. The fuel is stored in concrete canisters, and a similar approach will be applied in the decommissioning of Douglas Point. Ontario Hydro's discharged fuel is currently stored in water pools at the reactor sites. C.R. Frost discussed the 85 water-pool-years experience; data suggest the irradiated fuel will maintain integrity underwater for at least 50 years.

Fission Product Behaviour

Two major topics were addressed in this session: fission product release from defected fuel and behaviour under accident conditions. B.J. Lewis (AECL, Chalk River) presented two papers. One showed how the magnitude of the iodine 'spike' on reactor shutdown can provide information on fuel failures in the core; the second presented a model for release behaviour of depositing fission products (cesium, iodine) and noble gases, from defected fuel. J. Judah (Ontario Hydro) and A.M. Manzer (AECL, CANDU Operations) gave practical examples of defected fuel behaviour. Judah discussed the application of dry sipping to the 1984 Bruce NGS-A Unit 3 fuel defect excursion involving 41 defected bundles. Manzer outlined transport mechanisms of uranium released from fuel defects to the coolant, with examples from CANDU 600 reactors. Iodine-134 coolant activity data is a good indicator of uranium release.

C.E.L. Hunt and D.S. Cox (AECL, Chalk River) gave results of laboratory experiments on fission product release from UO_2 under a variety of oxidizing conditions, the data being used for model verification. At 400–1100°C, in air, UO_2 oxidizes to U_3O_8, and xenon, iodine and cesium releases were measured. The lowest test temperature at which cesium was observed was 750°C. Papers by T. Ogawa (JAERI, Japan) and R.A. Verrall (AECL, Chalk River) outlined experiments on fission product behaviour in oxide fuel utilizing ion-implantation techniques. Ogawa showed the 'trapping' effect on noble gas diffusion is a complex function of dose. An interesting feature of Verrall's paper was the observation that iodine forms bubbles in oxide fuel, the first time this has been reported.

Fuel Cycles

Apart from one paper on the prospects of a once-through thorium cycle in CANDU (M. Milgram, AECL Chalk River), this session was devoted to studies on slightly-enriched uranium (SEU) fuel in CANDU reactors at Chalk River. This is generally seen as the next logical fuel cycle for CANDU. A.D. Lane summarized the incentives for SEU, leading to improved economics and performance in existing and future CANDUs and the establishment of the technology for future fuel cycles. G.M. MacGillivray followed up with SEU performance experience and the existing database, and M. Younis (AECL, CANDU Operations) outlined a novel 'checkerboard' fuel management scheme for SEU in CANDUs. P.G. Boczar described an advanced CANDU core with improved location of reactivity devices, applicable to natural or enriched fuelling.

The following papers were presented:

Programs And Experience

'Developments in CANDU Fuel Technology in Argentina.' R.O. Cirimello, R. Olezza (CNEA, Argentina)

'Development in Design and Engineering of KWU Fuel for Light and Heavy Water Reactors.' R. Holzer, H. Stehle (KWU, West Germany)

'PHWR Fuel Fabrication – Indian Experience.' G.V.S.R.K. Somayajulu, T.S . Krishnan, A. Singh, V.A. Chandramouli, K. Balaramamoorthy, N.P.S. Katiyar, R. Rajendran, A.K. Sridharan, A. Suryaprakash (India)

'Development of QA / QC Technology in Korea.' M.S. Yang, H.S. Kim, H.I. Kwon, Y.W. Lee, K.S. Suh (KAERI, Korea)

'Fuel For Advanced CANDU Reactors.' J.T. Dunn, J.J. Lipsett, M.J.F. Notley, N.J. Spinks (AECL – Chalk River)

'Ontario Hydro Fuel Experience.' P.T. Truant, A.J. Hains (Ontario Hydro)

'Pickering Operations Fuel Performance Review.' H. Underhill (Ontario Hydro)

'Fuel Management and Fuel Performance at Point Lepreau NGS.' M. Shad (New Brunswick Power)

Production and Fabrication

'Ceramic UO_2 Powder Production at Eldorado Resources Ltd. Port Hope Conversion Facility.' R.T. Tanaka, T.W. Kennedy, (ERL, Port Hope)

'UO_2 Pellet Manufacture for CANDU Fuel.' M.R. Hoare (WCI, Port Hope)

'Preparation of Thoria Microspheres by the External Gelation of Low Viscosity Sols.' C.W. Turner, B. Clatworthy, A. Celli (AECL, Chalk River)

'The Recycle Fuel Fabrication Laboratories at Chalk River.' T.J. Carter (AECL, Chalk River)

Performance and Modelling

'Modelling CANDU Fuel Behaviour.' H.E. Sills, F.C. Iglesias, J.A. Walsworth, B.J. Lewis (AECL, Chalk River)

'Improvement of CANDU Fuel Performance Analysis Code ELESIM MOD 10.' H.C. Suk, W. Hwang, J.H. Park, B.G. Kim, K.S. Sim, C.J. Jeong (KAERI, Korea)

'Experience with FRAPCON-2 for the Analysis of CANDU Fuel Performance Under Normal Operating Conditions.' M.J. Richards (Hydro Quebec)

'ELESTRES: Multiaxial Sheath Stresses Near Circumferential Ridges.' M. Tayal (AECL – CANDU Operations)

'ELOCA – A Model for CANDU Fuel Performance During Loss-of-Coolant Accident Conditions.' J.A. Walsworth, H.E. Sills, S. Sagat (AECL, Chalk River); J.D. Allan (Scientific Software Inc., Peterborough)

'CANDU Fuel Behaviour During LOCA: ELOCA-A Predictions.' E. Kohn, V.I. Nath, M. Tayal (AECL, CANDU Operations)

'Estimated Axial Variations in CANDU Sheath Strains During a Hypothetical Large-Break LOCA.' M. Tayal, E. Kohn (AECL, CANDU Operations)

'CANDU Fuel Behaviour Under LOCA Conditions.' P.J. Fehrenbach, J.A. Walsworth, I.J. Hastings, C.E.L. Hunt, J.J. Lipsett, R.D. Delaney (AECL, Chalk River); E. Kohn (AECL, CANDU Operations); J. Lau (Ontario Hydro)

'The Effect of CANLUB Graphite and Siloxane Coatings on UO_2 / Zircaloy-4 Interactions.' C.S. Lim, D.J. Wren (AECL, Whiteshell)

'Tomographic Examination of a Section From the HTBS-004 Bundle.' L. Lupton, P.F. Fehrenbach (AECL, Chalk River)

'The Rating of Element Closure Welds and Its Influence on Fuel Reliability.' R. Sejnoha (AECL, CANDU Operations); G. Valli, G. Ceccotti, L. Magnoli (ENEA, Italy)

Fuel Handling and Storage

'Dry Fuel Handling: Station Experience and Ontario Hydro / CNS Programs.' J. Novak, G. Miller (Ontario Hydro)

'Design Considerations for Water Pool Storage of Irradiated CANDU Fuel.' C.R. Frost, S.J. Naqvi (Ontario Hydro)

'Current Status of the Canadian Experimental Dry Storage Program.' K.M. Wasywich (AECL – Whiteshell); C.R. Frost (Ontario Hydro)

'Commercial Applications of Dry Storage Technology.' D. See Hoye, P. Pattantyus, R. Beaudoin (AECL, CANDU Operations)

'An Analytical Model for Heat Transfer Within a CANDU Fuel Bundle Residing in Air.' P. Sermer (Ontario Hydro)

'The Effect of Fuel Power on The Leaching of Cs and I from Used Fuel.' S. Stroes-Gascoyne, L.H. Johnson, E.R. Vance, D.M. Sellinger, A.P. Snaglewski (AECL, Whiteshell)

'Characterization of Used CANDU Fuel By Non-Destructive Radiochemical Analysis.' J.D. Chen, R. Taylor, H.G. Delaney, D. Bell, D.G. Hartrick, N.L. Pshyshlak, K.M. Wasywich, A. Rochon, D.G. Boase (AECL, Whiteshell); K.I. Burns, J.J. Leppinen (AECL, Chalk River); C.R. Frost (Ontario Hydro); P.A. Beeley (Queens University, Kingston)

Fission Product Behaviour

'Iodine Release From Defective CANDU Fuel After Reactor Shutdown.' B.J. Lewis, D.B. Duncan (AECL, Chalk River); C.R. Phillips (University of Toronto)

'Determination of Release Rate From Measured Activity of Depositing Fission Products.' B.J. Lewis, D.B. Duncan (AECL, Chalk River)

'Defected Fuel Location by Dry Sipping.' J. Judah (Ontario Hydro)

'Transport Mechanisms of Uranium Released to the Coolant From Fuel Defects.' A.M. Manzer (AECL, CANDU Operations)

'Fission Product Release During UO_2 Oxidation.' C.E.L. Hunt, F. Iglesias, D.S. Cox, N.A. Keller, R.D. Barrand, R.F. O'Connor, J.R. Mitchell (AECL, Chalk River)

'UO_2 Oxidization Behaviour in Air and Steam With Relevance to Fission Product Release.' D.S. Cox, F.C. Iglesias, C.E.L. Hunt, R.F. O'Connor (AECL, Chalk River)

'Dose Effect on Release of Ion-Implanted Noble Gases From Oxide Fuel.' T. Ogawa (JAERI, Japan); R.A. Verrall, D.M. Schreiter, O.M. Westcott (AECL, Chalk River)

'Iodine Release and Bubble Formation in Oxide Fuel.' R.A. Verrall (AECL, Chalk River); T. Ogawa (JAERI, Japan); Hj. Matzke (Karlsruhe, West Germany)

'Gamma Scanning of CANDU Fuel.' H.G. Delaney, J.D. Chen (AECL, Whiteshell)

Fuel Cycles

'Once-Through Thorium Cycles in CANDU Reactors – A Review.' M.S. Milgram (AECL, Chalk River)

'Improved Location of Reactivity Devices in Future CANDUS Fuelled With Natural or Enriched Uranium Fuel.' P.G. Boczar, M.T. vanDyk (AECL, Chalk River)

'Predicted Performance of High Burnup CANDU Fuel Using the Checkerboard Fuel Management Scheme.' M.H. Younis, A.R. Dastur, P.S.W. Chan (AECL, CANDU Operations); I.J. Hastings (AECL, Chalk River)

'Incentives for Slightly-Enriched Uranium in CANDU.' A.D. Lane, F.N. McDonnell (AECL, Chalk River)

'Performance Experience With Slightly-Enriched Uranium Fuel.' G.M. MacGillivray, I.J. Hastings (AECL, Chalk River)

Water Chemistry and Materials Performance Conference

The Water Chemistry and Materials Performance Conference, sponsored by the Canadian Nuclear Society, was held in Toronto on 21 October 1986.

The papers presented at this conference addressed the interactions that take place between water and system construction materials during the operation of pressurized water cooled nuclear power plants, and the importance and impact of these effects on system design and developmental research. The papers covered aspects of both primary and secondary chemistry during commissioning, operation, and shutdown, and of maintenance, decontamination, and radiation control. Each of these topics has an impact on the day-to-day operation of equipment, and so affects the long term reliability, performance, and life span of the plant.

The conference was attended by 85 people drawn primarily from those Canadian utilities that have operating nuclear power plants, and Atomic Energy of Canada Limited. The keynote address was given by Dr D.A. Meneley, Professor of Nuclear Engineering, University of New Brunswick, and the luncheon address was given by Dr O.J.C. Runnalls, Centre for Nuclear Engineering, University of Toronto.

Significant points from the various papers included the importance of interpreting the results of water chemistry analyses; the effects of boiling primary coolant on both system materials and fuel sheaths; the need for station chemists to be intimately involved with system chemistry during all periods of operation, including construction pressure tests and long shutdowns; and the need for laboratory programs to reproduce as many aspects of the actual station conditions as is possible.

The following papers were presented:

'Water Chemistry – The Key Operating Variable.' D. Barber (AECL, CANDU Operations)

'Chemistry Conditions and their Effects On Boiling CANDU-600 Heat Transport Systems.' S.H. Groom, C. MacNeil (Point Lepreau NGS, New Brunswick Electric Power Commission)

'Chemistry in Nuclear Steam Generators.' P.V. Balakrishnan (AECL Chalk River Nuclear Laboratories)

'Concentration Processes Under Tubesheet Sludge Piles in Nuclear Steam Generators.' F. Gonzalez, P. Spekkens (Ontario Hydro Research Division)

'Chemistry Control at Bruce NGS "B" – From Construction to Commercial Operation.' J.G. Roberts (Bruce NGS, Ontario Hydro)

'Studies of Activity Transport and Fission Product Behaviour in Water-Cooled Nuclear Generating Stations and Consequences for Defective Fuel Removal.' D.R. McCracken (AECL Chalk River Nuclear Laboratories); M.R. Floyd (Central Nuclear Services, Ontario Hydro)

'Corrosion of Heat Exchanger Materials Under Heat Transfer Conditions.' R.L. Tapping, P.A. Lavoie, D.J. Disney (AECL Chalk River Nuclear Laboratories)

'Decontamination of the NPD Fuelling Machine.' B.M. Mitchell, R.A. Speranzini, J. Torok, (AECL Chalk River Nuclear Laboratories); M.S. Hubert (NPD, Ontario Hydro)

'The Effects of Steam Generator Tube Temperature on

the Stress Corrosion Cracking of Alloy 600.' F.P. Vaccaro, G.J. Theus, B.P. Miglin (The Babcock & Wilcox Company); S. Roy (Babcock & Wilcox Canada)

'Lay-up Chemistry during Pickering NGS Units 1 and 2 Fuel Channel Replacement.' G.C. Gillies, M.W. Hersey, D.C. McCool (Pickering NGS, Ontario Hydro)

'Corrosion Product Transport Studies at Point Lapreau.' G. Plume (Point Lepreau, NGS New Brunswick Electric Power Commission); W. Schneider (Babcock & Wilcox Canada); C. Stauffer (The Babcock & Wilcox Company)

Second International Conference on Simulation Methods in Nuclear Engineering

The Second International Conference on Simulation Methods in Nuclear Engineering was sponsored by the Nuclear Science and Engineering Division of the Canadian Nuclear Society.

The conference was held in Montreal, 14–16 October 1986, and attracted an attendance of 85. Fifty papers were presented covering thermalhydraulics, fluid dynamics, reactor physics, control and operation, fuel behaviour, small reactors, maxi and mini computers, and interdisciplinary studies.

The following papers were presented:

Thermalhydraulics 1: System Transients

'Some New Directions in System Transient Simulation.' V.H. Ransom

'The Development and Benchmarking of Integral Thermal-hydraulics Codes.' R.E. Henry

'Thermal Hydraulics of LOFT Large Break Experiments and its Simulations with DRUFAN-02.' A.B. Wahba, W. Pointner

'CATHENA Simulation of Thermosiphoning in a Pressurized-Water Test Facility.' J.P. Mallory, P.J. Ingham

'The GINNA Tube-Rupture Event: A Plant-Transient Benchmark for TRAC' J.F. Lime, R.P. Jenks

Interdisciplinary

'Statistical Approach to Sensitivity Analysis of the Computer Simulation Codes.' S.M. Aceil

'RETACT Models in Link's TMI-1 Advanced Simulator.' K.C. Lea, D.J. Boltz

'Development of a Three-Dimensional Simulator of a DIDO-Type Reactor.' E. Nonbol

'EXPRIME: An Export System to Analyse Primary Heat Transport System Accidents.' P. Tye, J.C. Amrouni

'Scaling Laws for Simulating the CANDU Heat Transport System.' P.J. Ingham, V.S. Krishnan, P. Sergejewich, K.H. Ardron

'PREMIERE: A Model to Calculate the Transfer of Deuterium Between the Moderator Fluid and the Cover Gas Volume in Candu Reactors.' K.K. Fung, M. Garceau, W.I. Midvidy

Reactor Physics Simulation

'A Nuclear Criticality Simulator.' R.E. Anderson, W.L. Lesko, R.D. Sachs, H.C. Bachman

'Kinetic Modeling for On-Line Advanced Plant Simulator.' J. Samuels, S. Kaya, S. Anghaie

'Development of the Modal Kinetics Model for the Gentilly-2 G.S.' J. Koclas, S. Alaoui, M.A. Petrilli

'TRIVAC: A Modular Diffusion Code for Fuel Management and Design Applications.' A. Hébert

'Semi-Analytical and Empirical Methods for Local Reactor Reactivity Estimation.' A.P. Muzumdar, R.A. Bonalumi, D.G. Andrews

'Producing Three-Dimensional Nodal Coupling Coefficients.' E.G. Derrick, G.V. Guardalben, A.L. Wight

Thermalhydraulics 2: Complex Geometries

'Fluid Flow Simulations in Complex Geometries.' P.F. Galpin, R.G. Huget, G.D. Raithby

'The Drift Flux Model in the ASSERT Sub-Channel Code.' M.B. Carver, R.A. Judd, J.C. Kiteley, A. Tahir

'Comparison of ASSERT-4 CHF Predictions with Measurements in 28-Element Simulated Fuel String.' J.K. Szymanski, G. Nurnberg, W.I. Midvidy

'The Canonical Form of Turbomachine Characteristics (Four-Quadrants) and Other Three Port Devices.' R.J. Schneck

Developments in Transport and Reactor Calculations

'Multilevel Transport Calculations.' R. Sanchez, J. Mondot

'Acceleration Strategies for the Interface Current Method.' G. Marleau, A. Hébert, R. Roy

'RAVE – A View Factors Code for Arbitrary Geometry with Shadowing.' M.S. Milgram, S.L. Thompson

'Fuel Management Simulation for an Uprated CANDU-600.' D.A. Jenkins

'The Optimization of Cobalt Adjusters with OPTEX-3.' D. Rozon, M. Beaudet

'Poison Injection Model for a CANDU Reactor.' S.G. Lie, G.V. Guardalben, E.G. Derrick, H.G. Austman, A.L. Wight

Fuel and Fuel Channel Behaviour

'Simulation Methodology for Pressure Tube Integrity Analysis and Comparison with Experiments.' G.H. Archinoff, J.C. Luxat, P.D. Lowe, K.E. Locke, A.P. Muzumdar

'Development of the MINI-START Code for Fuel Element / Pressure Tube Contact.' D.B. Reeves, G.H. Archinoff, K.E. Locke, A.P. Muzumdar

'Validation of the Computer Code NUBALL for Simulation of Pressure Tube Asymmetric Ballooning Behaviour.' P.S. Kundurpi

'AMPTRACT: An Algebraic Model for Computing Pressure Tube Circumferential and Steam Temperature Transients Under Stratified Channel Coolant Conditions.' P. Gulshani, C.B. So

'FAIG – A Code for Analysis of Irradiation-Induced Axial Dimensional Change in PWR Fuel Assemblies.' A. Iisuka

Applications of Advanced Computers

'The Use of Super-Computers in University Research.' R.E. George

'Monte Carlo Neutron Transport on the CYBER-205 Supercomputer.' T.A. Tassou, E.M.A. Hussein, V.C. Bhavsar, U.G. Gujar

'Solution of the Few Group Neutron Diffusion Equations on Parallel Architecture Computers.' S.K. Zee, P.J. Turinsky

'Reactor-Physics Computer Codes to Microcomputers.' B. Rouben, K.S. Brunner, D.A. Jenkins

'TOMCAT: A Transient and Operational Micro-Computer Based Analysis Tool.' K.S. Howe, P.E. Meyer

'Evaluation of Algorithms for the Solution of the Drift Flux Equations on Advanced Computers.' E.D. Sills, J.M. Doster

Thermalhydraulics 3: General

'TRAC A Thermalhydraulics Code – Past, Present and Future.' R.A. Nelson, Jr, R.P. Jenks, D.R. Liles, J.W. Spore, J.F. Dearing, R.G. Steinke, M.W. Cappiello, J.H. Mahaffy, Susan B. Woodruff, Manjit S. Sahota

'Best Estimate Analysis of Prairie Island Plant Transients Using Dynode-P.' J.K. Kapitz, D.A. Rautmann, R.C. Kern

'A Dynamic Model of A U-Tube Steam Generator for Real Time Simulation.' B.W. Rhee

'Multi-Rate Integration Methods and Table Lookup Techniques Used in High Speed Dynamic Simulation of Nuclear Power Plants.' H.C. Yeh, W.E. Kastenberg, W.J. Karplus

'The Rate Form of the Equation of State for Thermalhydraulic Systems: Numerical Considerations.' Wm.J. Garland, R. Sollychin

'An Algorithm to Estimate Initial Discharge Rates for Stagnation Feeder Breaks.' C. Blahnik, S. Nijhawan

Thermalhydraulics 4: Multi-Fluid

'Multifield Methods for Nuclear Thermalhydraulics Problems.' S. Banerjee

'Validation of the TREAT Code Against Actual Plant Event Data.' D.F. Holderbaum, R.P. Ofstun

'Calculation of a Steam Generator Tube Rupture Accident Using THERMIT-UTSG.' S.T. Free, I. Schor

'Prediction of Steam Generator Depressurization Transients with the CATHENA Code.' B.N. Hanna, G.R. McGee, T.E. MacDonald

'ATHENA Model for 4 × 350 MW(T) HTRG Plant Side-by-Side Steel Vessel Prismatic Core Concept.' R.G. Ambrosek

'Capabilities of System Codes in Simulating Small Break LOCAS in PWRS.' F. D'Auria, G.M. Galassi, F. Oriolo

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Page titre Cette page spécifiera: le titre du manuscrit, le(s) nom(s) d'auteur(s), les affiliations, adresse postale et numéro de téléphone, nombre de payes de texte, nombre de figures, nombre de tableau.

Résumé Un résumé du manuscrit ne dépassant pas 150 mots sera soumis sur une feuille séparée. Il soulignera de façon concise mais complète les nouveaux résultats de telle sorte qu'il puisse servir de sommaire sans aucune modification. Il devrait s'avérer superflu de lire le manuscrit au complet afin de comprendre le contenu du résumé. On évitera d'utiliser le pronom à la première personne du singulier. Dans un but d'assurer la compréhension et l'exactitude et afin d'accélérer les travaux de production du Journal, les auteurs habilités à le faire sont invités à soumettre leur résumé en français et en anglais. On ne citera pas les références dans le résumé.

Mots-clés Un maximum de 15 mots-clés est recommandé. Ces mots seront listés au-dessous du résumé. Tous les mots-clés (anglais) seront référenciés dans le 'Thesaurus of Engineering Scientific Terms,' publié par le 'Engineers Joint Council' (New York).

Equations et Formules Les numéros des équations et des formules seront placés à la marge droite, entre paranthèses carrées. On prendre soin de bien identifier les caractères inhabituels et les lettres grecques utilisés dans le texte.

Références On citera les références entre paranthèses dans le texte, indiquant le nom de famille de l'auteur et l'année de publication. A titre de modèle – 'Des études (Critoph 1977; Duret 1978; and Notley 1983) démontrent que ... ' Toutes les citations seront listées séparément sur une page 'Notes et références' à la suite du texte. Ces pages ne sont pas numérotées et sont classées alphabétiquement selon les noms d'auteurs selon le format qui suit:

Nom(s) d'auteur(s), suivi des initiales. Titre de l'article, du livre ou de la thèse. Nom de la publication, de l'éditeur ou de l'université. Lieu d'origine. Volume de l'édition. Année. Numéro de la première ou dernière page du texte ou nombre total de pages du livre. (A noter: S'il y a deux auteurs on doit les citer. Par contre, s'il y a plus de deux auteurs, la citation indiquera alors le nom du premier auteur suivi de *'et al.'*).

Tableaux Les tableaux seront dactylographiés sur des feuilles séparées et leur position sera indiquée dans le texte. On utilisera des chiffres arabes pour numéroter les tableaux. On évitera les en-têtes trop compliquées pour la description des colonnes. Les notes descriptives utilisées en bas de page seront en caractères (a), (b), (c), etc. ... et paraîtront sur chacun des tableaux.

Figures Les chiffres arabes seront utilisés pour numérator les différentes figures. Le numéro doit également paraître à l'endos de chacune des figures. Une feuille séparée attachée à l'endos de la figure fournira l'information telle que: nom(s) d'auteur(s), titre du document, numéro de la figure, légende, orientation de la figure sur la page et toutes autres informations appropriée concernant le découpage de la figure. La dimension des caractères utilisés devra permettre une excellente lisibilité après réduction de la figure à une largeur de 8.5 mm. Après leur réduction, les majuscules auront une hauteur de 1.5 éa 2.0 mm. Les photos auront un fini luisant et offriront le meilleur contraste possible.

Remerciements Ceux-ci seront rédigés à la troisième personne et réfleteront de façon concise la reconnaissance de l'auteur pour les contribution pertinentes et pour l'assistance financière qu'il aura reçues.

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Epreuves
Des épreuves seront envoyées aux auteurs afin que soient corrigées les erreurs typographiques et non dans le but que l'on apporte des améliorations à ces manuscrits. Les épreuves corrigés seront retournées dans les 48 heures suivant leur réception. Les auteurs sot seuls responsables de l'exactitude technique de leur article tel qu'il paraîtra dans le *Journal*.

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On adressera à l'attention de l'éditeur les livres soumis pour la critique. Ces critiques seront publiées selon les disponibilités d'espace du *Journal*.

Instructions for Authors

Scope of the Journal
The *Nuclear Journal of Canada*, published quarterly, is an international journal devoted to original contributions in all fields related to nuclear science, engineering, and medicine, including related science, engineering and technologies, materials, underlying principles, and social and ethical issues. Original articles, notes, and critical reviews will be considered for publication in the *Journal*. Submissions will be refereed. The Editor reserves the right to reject any submission deemed unsuitable for publication.

Original articles must be of a reasonably broad scope and of significance to the nuclear community. Notes should describe significant work in progress or of a novel nature.

Papers and discussions are published in English or French at the author's preference. The International System of Units (SI) must be used.

Manuscripts
Normal manuscript length is in the range of 5,000 – 15,000 words. The original and four copies should be submitted to the Editor, who will acknowledge receipt. The manuscript will then be sent to an Editorial Board member, who will arrange for independent reviews of the manuscript. Following review, the manuscript will either be approved for publication, or will be returned to the author if judged unsuitable for the *Nuclear Journal of Canada*. Upon acceptance, the Editor will contact the author to advise on the issue in which the paper will appear and the publication deadlines.

The manuscript should be typewritten, or computer printed (NLQ), in black ink, double-spaced, single-sided, on paper 210 × 297 mm (8 × 11 in.) with 25 mm left and right margins. Each page should be numbered starting with the title page. The following items are to be included:

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Abstracts should be not more than 150 words and on a separate page. The abstract should emphasize the new results and be self-contained so that it can be used by the abstract services without change. One should not have to read the paper in order to understand the abstract. The use of the first person singular pronoun must be avoided. Authors able to submit abstracts in both English and French should do so, in the interests of clarity, accuracy and speed of production. References should not be cited in the abstract.

Keywords should not exceed fifteen and should be placed directly below the abstract. All keywords used should be referenced in the 'Thesaurus of Engineering and Scientific Terms,' published by the Engineers Joint Council (New York).

Equations and formulae should be numbered in square brackets flush with the right hand margin. Unusual and Greek characters should be clearly identified.

References should be cited in parentheses in the text, by authors' last names and year of publication. For example: 'Previous studies (Critoph 1977; Duret 1978; and Notley 1983) indicate that ...' All citations should be listed on a 'Notes and References' page following the text. They should appear unnumbered, alphabetically by author, in the format:

Author(s) (names followed by initials). Title of article, book, or thesis. Name of publication, publisher, or university. Location. Volume or edition. Year. First and last page of article, or pages in book. (If there are two authors, both should be named in full; if more than two, the citation should give the first author's name followed by *'et al.'*

Tables should be typed on separate sheets. Their desired location should be indicated in the text. Tables should be numbered with Arabic numerals. Complicated column headings should be avoided. Descriptive footnotes should be indicated by superscripts, (a), (b), (c), etc. and begun anew for each table.

Figures should be numbered with Arabic numerals. The figure number is to be shown on the back of each figure. On a separate piece of paper, attached to the back of the figure, is to be shown the author name(s), the title of the paper, the figure number, the figure caption, the orientation on the page and any instructions with regard to cropping. Lettering should be large enough to be legible after reduction of the figure to a single-column width of 8.5 mm. Capital letters after this reduction should have a height of 1.5 – 2.0 mm. Photographs should be glossy prints and should have maximum contrast.

Acknowledgements should be written in the third person and kept to a concise recognition of relevant contributions and financial support.

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