Meet the President

John Luxat was elected President of the Canadian Nuclear Society at the beginning of June, 2018 and serves as the 42nd President for the 2018-2019 year. This is a reprise role for him, having served as the 29th CNS President in 2005-2006. He is currently a faculty member of the Department of Engineering Physics at McMaster University in Hamilton, Ontario, where he is a Professor and NSERC/UNENE Senior Industrial Research Chair in Nuclear Safety Analysis and Thermal hydraulics.

John was born in Southern Rhodesia (now Zimbabwe) in 1945, the son of a rugged, peripatetic miner and a mother with immense patience. He was brother to two remarkable sisters, one older and the other younger than him. From an early age until he left for university, he spent the majority of his life in Rhodesian boarding schools where, with time, he successfully completed his Cambridge University "O-Level" examinations, at Jameson High School, in Kadoma, and his Cambridge "A-Level" examinations at Chaplin High School, in Gweru. Twice a year there were school vacations during which he would spend time at home that, invariably, was located at another remote region "in the bush" where there was a prospective mine being evaluated by his father for possible development and exploitation by one of the large mining corporations operating in Rhodesia. During these periods of vacation he developed skills to entertain himself, including a remarkable ability to operate a record player and reading an eclectic range of literature – some of it pulp fiction then, more gradually, moving onto the classical masterpieces, including Dickens, Thomas Hardy, Maugham, Orwell, Dostoyevsky, Tolstoy amongst others. He has continued these interests throughout his life, albeit that he graduated from record players to CD players and iPods and extended his reading to include Mordecai Richler, John Irving, Philip Roth and many more contemporary authors.

In 1964 he enrolled in the University of Cape Town (UCT) where he studied Electrical Engineering – specifically the Electrical Engineering B stream which was considered to be a research preparation program requiring four years of Physics, Pure Mathematics and Applied Mathematics, interspersed with electrical circuits and electronics (the transistor variety which was the state-of the art at that time). He continued his studies in Electrical Engineering at UCT, enrolling in a Master's degree program and specializing in automatic control systems. His time at UCT was filled with many memorable events, four of which were particularly life-defining.

The first event occurred at the end of his first year

when, after spending an extra month slogging through a mandatory machine shop course, he met Gladys, a beautiful young social science student who was travelling on the same student train from Cape Town to Rhodesia and then onward to her home in Zambia. A romantic relationship, initiated on the two day train journey, was cemented five years later when they married in Zambia in 1969 prior to immigrating to Canada.

The second memorable event occurred in 1966 when the apartheid government banned the President of the National Union of South African Students (NUSAS) and placed him under house arrest, one of many abhorrent punishments they imposed on opponents of their apartheid policies. John participated in a major protest on the grounds of the downtown Cape Town St. George cathedral, during which truckloads of cadets from a nearby naval base arrived and attempted to drive the protesters away using military training fire-crackers and tear gas. The protesters stood their ground and the cadets, tiring of their "games", departed. A month later the protesters were rewarded by NUSAS granting them seats in the UCT Great Hall to attend the Annual Day of Affirmation of Academic Freedom lecture presented by Senator Robert F Kennedy. This turned out to be a famously uplifting speech, referred to as his "tiny ripple of hope" speech, derived from a term he used to describe the effect small acts of goodness can impart on large acts of consequence.

The third and fourth events occurred when sons David and Daniel were born, in 1975 and 1978, respectively.

In August 1969 he and his new wife left South Africa and their childhood homes to start a new life in Canada, initially in Windsor, Ontario. He obtained his Ph.D. degree at the University of Windsor, once again in Electrical Engineering but this time researching adaptive control systems. After graduation in 1972 they moved to Toronto where he had accepted a position at computer consultancy named DCF Systems Ltd. Which later became Gellman, Hayward and Partners Ltd. His first contract was at AECL Power Projects, Sheridan Park where he developed a plant simulator that was used to test the Bruce NGS A DCC software before being shipped to site. Thus began his osmotic drift into nuclear engineering. Further nuclear contracts arose at AECL, in large measure the result of the reputation for delivering computer software solutions that Dr. Harvey Gellman and Jim Hayward had established. These included developing control software for the High Current Test Facility, a 1970's Chalk River linear accelerator, and the Spatial Modal Kinetics (SMOKIN) code to analyze spatial control of the 1250 MW(e) CANDU reactor concept that was being studied at AECL under Ontario Hydro funding. The latter project led to a contract at Ontario Hydro's Nuclear Studies and Safety Department (NSSD) to further develop SMOKIN for nuclear safety analysis of accidents involving 3-D reactor kinetics behaviour. Six months later, in 1977, he was offered a full-time position at NSSD by then department manager, Dan Meneley.

His career at Ontario Hydro progressed over the years from 1977 to 1993 with increasing involvement in diverse technical areas of nuclear safety analysis, ranging from reactor physics, conceptual design and assessment of special safety systems, thermal hydraulics, fuel and fuel channel behaviour and beyond design basis accidents. This broadened technical involvement was accompanied by increasing responsibilities, moving from Supervising Design Engineer to Thermal Hydraulics Engineer, supervising approximately 30 technical staff, During this period, he became involved in a number of interesting technical activities and challenges which included: attending, as a member of the Canadian delegation, the

IAEA post-Chernobyl accident review meeting held in August 1986; directed a study, including the work performed by Argonne National Laboratory in the U.S.A. and was and was lead author of the report *Analysis of the Consequences of Failure to Shutdown Following a Large Loss of Coolant Accident in a Pickering NGS A Unit*, submitted to the post-Chernobyl Ontario Nuclear Safety Review (the Hare commission) in 1986; spent a year of his life as a member of the Darlington Unit 2 fuel failure investigation team and edited the report *Darlington NGS: Report on the Investigation into Fuel Damage Causes Following the Unit 2 N12 Event*, which was submitted to the AECB in 1992.

In 1993 a major reorganization of Ontario Hydro occurred which resulted in the disbanding of the much admired Design and Development Division which had led the licensing of Pickering B and Bruce B stations, as well as the design and licensing of the flagship Darlington station. As a result of the reorganization he was appointed Senior Technical Consultant in the newly created Nuclear Technology Services Division – an individual contributor position with little formal responsibility in the operational support role of the division. Undeterred, he focused his efforts on advanced nuclear initiatives, and providing leadership within Ontario Hydro in the development of novel, state-of-the-art methods and solutions in diverse nuclear safety technology disciplines. A memorable period occurred between 1994 to 1997 when he was appointed technical lead for nuclear engineering and nuclear safety in a joint AECL Technologies/OH feasibility study for the US DOE and, in a subsequent separate Canada/Russia feasibility study to disposition excess weapons plutonium by utilizing MOX fuel in CANDU reactors (Bruce A was the target station). This led to many weeks-long visits to Washington DC, Moscow and various Russian nuclear laboratories, as well as smoke-filled study contract negotiations with the Russian Ministry of Atomic Energy (MINATOM). This was a very interesting period since it was immediately after the breakup of the Soviet Union, and was referred to by some as the "wild, wild East".

However, the Ontario Hydro Nuclear reorganization was not very effective and a team of American nuclear engineers was hired to conduct a recovery of the nuclear part of the organization. This was a stress-filled time for many in Ontario Hydro Nuclear. However, for John, it resulted in him being brought back in 1998 within the mainstream organizational fold as Manager of Nuclear Safety Technology in the Nuclear Safety Analysis Division. His responsibilities included: development and enhancements of methodology for nuclear safety analysis; developing and implementing governance of nuclear safety analysis and associated engineering and scientific software used in analysis; and technical direction of Ontario Power Generation's nuclear safety R&D program. During this period the formation of Ontario

Power Generation (OPG) occurred.

During 33 years working for Ontario Hydro/OPG he represented the utility on various national and international committees, including: a member of the CANDU Owners Group (COG) Safety & Licensing R&D Technical Committee and various Working Groups; external member of AECL's Products & Services Safety Review Committee; Canadian member of Principal Working Group 2 of the OECD's Committee for the Safety of Nuclear Installations (CSNI) and the subsequent Working Group on Accident Management and Analysis (WGAMA); nominated to the International Atomic Energy Agency (IAEA) working group for the *1997 International Symposium on Nuclear Fuel Cycle: Adjusting to New Realities* and a lead author of a key issue paper on plutonium management.

In 2002 OPG sold off their Nuclear Safety Analysis Division to a UK company, resulting in the formation of Nuclear Safety Solutions (NSS) Ltd. John joined the new company as Vice President, Technical Methods, where he stayed until 2004 when he received an "offer he could not refuse". He left for McMaster University in Hamilton, where he assumed the position of Professor and NSERC/UNENE Industrial Research Chair in Nuclear Safety Analysis and Thermal Hydraulics. At McMaster he conducts research into safety analysis methods such as: supporting fuel channel integrity during design basis accidents; beyond design basis accidents including severe accident behaviour, accident mitigation and risk assessment; and more recently, research in Small Modular Reactors (SMR).

He and Gladys also relocated their home from North Toronto to Dundas, a small village in the west end of Hamilton (actually amalgamated with Hamilton). This was a fortuitous move since it provided him with an extra 90 minutes of sleep in the morning and the benefit of an extra 90 minutes of hypothetical evening relaxation due to the avoidance of daily commuting between the two cities. In this period their two sons graduated from university and established their careers- older son, David, in the nuclear safety area working in Pennsylvania on severe accident analysis and risk assessment, and younger son, Daniel, a lawyer in the Federal Department of Justice's Toronto office working primarily on aboriginal issues.

He is an active member of the CNS, being one of the earliest members (member #211) and the American Nuclear Society (member for 30 years) serving in leadership roles such as President 2005-2006 and 2018-2019, Executive Chair of the CNS Annual Conference in 2005, 2006 and 2018. He is a member of the Executive Committee of the American Nuclear Society Thermal Hydraulics Division (THD), chairs the THD Conference Planning Committee, a member of the THD Program Committee, and a member of the THD Honours & Awards Committee. He served as General Chair & Chair of Organizing Committee for the 14th International Conference on Nuclear Reactor Thermalhydraulics (NURETH-14) held in Toronto in 2011. Currently, he is General Chair of the ANS Embedded Topical Meeting on Advances in Thermal Hydraulics (ATH 18) at their upcoming Winter Meeting in Orlando, Florida, in November 2018. He also chairs the International Organizing Committee for the 25th Conference on Structural Mechanics in Reactor Technology (SMiRT-25) to be held in Charlotte, NC in August 4 – 9, 2019.

He serves or has served on numerous boards and advisory boards including: the Terrestrial Energy Inc. Advisory Board, the Project Advisory Committee of the Sylvia Fedoruk Canadian Centre for Nuclear Innovation, Saskatchewan, Board of Directors and VP, American Association for Structural Mechanics in Reactor Technology (AASMiRT), the Advisory Board of the International Association for Structural Mechanics in Reactor Technology (IASMiRT), Board of Directors of AECL (2008-2013). He currently chairs the International Nuclear Energy Academy (INEA).

Among his honours and awards are: elected Fellow of the Canadian Academy of Engineering (2012), elected member of the International Nuclear Academy (2012), Technical Achievement Award of the American Nuclear Society Thermal Hydraulics Division (2012), CNS/CNA Canadian Nuclear Achievement Award for "Significant Contributions to the Safety Analysis, Successful Licensing and Safe Operation of CANDU Reactors" (2004), Pakistan Nuclear Regulatory Authority, Award for Contributions to Enhancing Nuclear Safety (2004).

Radiation Health Effects

The primary way radiation affects our health is through breakage of DNA molecules. When it does, three things can happen: **1) The DNA is repaired properly; 2) The DNA damage is so severe that the cell dies (**deterministic effects**); or 3) The cell incorrectly repairs itself, but it continues to live (**stochastic effects**). Stochastic cell damage** could have no further effect, or the effect could show up later in life. Cancer and hereditary effects may or may not take place. Epidemiological studies have not been able to show any excess cancers or other diseases in people chronically exposed to radiation at doses lower than about 100 mSv.

Dose (mSv)	Limit or Health Effect
> 5,000	Dose which may lead to death when received all at once
1,000	Dose which may cause symptoms of radiation sickness (e.g. tiredness and nausea) if received within 24 hours
100	Lowest acute dose known to cause cancer
30-100	Radiation dose from a full body computed axial tomography (CAT) scan
50	Annual radiation dose limit for nuclear energy workers
1.8	Average annual Canadian background dose
1	Annual public radiation dose limit
0.1-0.12	Dose from lung X-ray
0.01	Dose from dental X-ray
0.01	Average annual dose due to air travel

The full article can be found at the CNSC Website.
www.cnsc-ccsn.gc.ca/eng/resources/radiation/introduction-to-radiation/radiation-health-effects.cfm