



Nuclear @ Ontario Tech – Annual Update to DNHC (June 2022)

Dr. Kirk Atkinson (Director, Centre For Small Modular Reactors)

Background

- Ontario Tech University, officially the University of Ontario Institute of Technology (UOIT) is located in Oshawa, Ontario, in the far east end (70 km) of the Greater Toronto Area. It was founded in 2002 and opened to students in 2003. Enrolment today is around 10,000 (with 9,000 undergraduate and 1,000 graduate students) and growing.
- Is around 30 minutes drive from both OPG's Darlington and Pickering nuclear stations and provides a key regional focus on energy education and research.
- Hosts Canada's **only** accredited B.Eng degree in Nuclear Engineering (144 credit hrs, 48 courses), as well as a unique BASc program in Health Physics & Radiation Science.
- Most recently **ranked #2 in North America** (last three years) in terms of nuclear graduates at the Bachelor's level (over 900 since 2007).
- Hosts MSc, Ph.D., M.Eng & GDip programs in Nuclear Engineering/Technology, and delivers the Advanced Operations Overview for Managers (AOOM) program for OPG.
- Faculty of Energy Systems and Nuclear Science (FESNS) has 14 faculty members with specialties in nuclear engineering, radiation science and energy systems, which include three research chairs (2x Industrial Research Chairs, 1x Canada Research Chair).

Rising in the rankings



Now ranked 187th in the world among research institutions under 50 years old by Times Higher Education (THE) in 2021.



Named one of Canada's research universities of the year for 2021 by Research Infosource, No. 1 in Ontario and No. 3 in Canada among the nation's 21 smaller research universities.

International collaboration

In November 2021, in an international virtual event, Ontario Tech officially launched its **IAEA Collaborating Centre** for integrated energy systems with advanced nuclear power reactors.

Designated in Spring 2021, it is the only **IAEA Collaborating Centre in Canada**.

Activities of the Collaborating Centre include development and deployment of micro and small modular reactors (SMRs); non-electric applications of nuclear energy; and nuclear and renewable integrated energy systems for multi-purpose applications (including hydrogen production, energy storage, and applications of process heat).



International workshops

Following the formal launch of the IAEA Collaborating Centre; in March 2022, Ontario Tech held an **virtual workshop** on Integrated Nuclear-Renewable Energy Systems that brought together **700 energy experts** from academia, industry and international organizations **across 75 countries**.

Technical discussions examined the future of the energy sector in light of growing interest in integrated nuclear-renewable energy systems and their role in the hydrogen economy.





BRILLIANT ENERGY INSTITUTE VISION



The Brilliant Energy Institute (BEI) builds upon the energy research and expertise at Ontario Tech University to meaningfully contribute to Canada's leadership in a clean energy transition *to support deep decarbonization, sustainability, and equitable access to energy for prosperity and quality of life.*

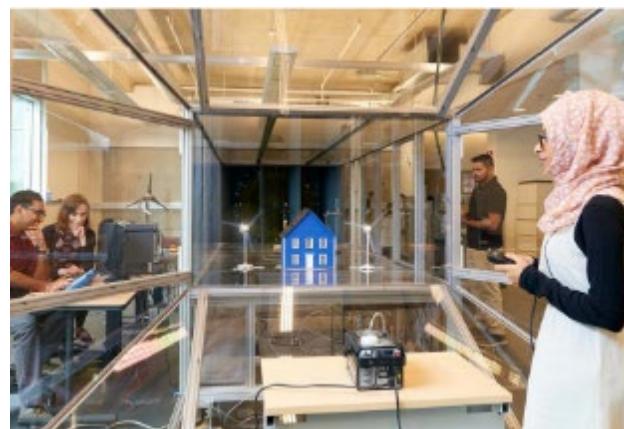
The Brilliant Energy Institute's mission

Three Things

**Develop and Integrate
Technologies in
Clean Energy
Systems**



**Connect
Technical
Solutions to
Social Value**



**Harness the
Power of
Collaboration**



The Brilliant Energy Institute's five pillars

Research and Innovation

Supporting Ontario Tech, pan-Canadian & international R&D technology advancement and integration

Knowledge and Data Centre

Developing the metrics, data, and information necessary to inspire, inform and track the transition to net zero

Workforce Development

Building diverse, effective workforces through strategies, platforms, EDI, education, training and work-integrated learning

Engagement and Collaborative Learning

Working together through early engagement, energy literacy and learning opportunities as we build a clean energy future

Energy Sustainability

Creating energy that powers Canada's socio-economic goals, protect our ecosystems, and builds healthy communities

The Brilliant Energy Institute's recent activities

- **Thought leadership** speaking at events and online events including Globe Forum Vancouver, Canadian Nuclear Society Annual Conference and Ontario Tech's Pi Day of Giving.
- **Intervenor** at recent New Brunswick Power and Canadian Nuclear Laboratory license hearings.
- Partnership with Canadian policy think tank in Calgary – Canadian Global Affairs Institute.
- Collaboration with other energy institutes, academia, governments and communities on initiatives to forward a people-centred approach to the Net Zero Transition.



Expert commentary & nuclear advocacy



Faculty members were interviewed on national TV about the events at the Zaporizhzhia and Chernobyl NPPs in Ukraine earlier this year. They provided **expert commentary** to counter more alarmist voices by explaining how safe nuclear reactors really are.



Dr. Atkinson, Associate Professor and Director of the Centre for SMRs, was a **witness** before the Parliamentary Standing Committee on Science and Research in Ottawa on the topic of Small Modular Reactors in June 2022. ¹⁰

Net-zero needs all types of low-carbon energy

In early 2022, a 500 sq metre (5,400 sq ft) solar photovoltaic façade was installed on the south side of the ACE building.

Comprising 224 individual panels rated at 425 watts each, the system will produce 112,000 kilowatts of electricity **annually** for the Ontario Tech campus, enough energy to power ten homes for an entire year.

Recognising the need for **apples-with-apples** comparisons of benefits and consequences of low-carbon energy sources, the university is undertaking a package of work to generate **consistent** life cycle assessments of renewable and nuclear energy solutions.



Making strides to be equal by 30

Bruce Power has teamed up with Ontario Tech University in an effort to attract more women into post-secondary education in engineering and careers in the nuclear sector.

Annually, the **Bruce Power Engineering Internships for Women program** will offer four-month internships for up to 15 nuclear engineering students who identify as women.

Candidates will participate in the program for three consecutive summers, pending maintenance of academic standards and successful employment reports, with the potential for a full-year internship between their third and fourth academic years.



Building TALENT



To reach net-zero by 2050 requires a **just transition** to clean energy solutions for many existing workers and significant new hiring in order to meet the workforce needs in coming years. **We cannot wait** as, without people, neither nuclear or renewable energy will be ready in time.



OVERVIEW

Launched in the Fall of 2020, TALENT partners with employers in the Energy sector, using our workforce planning capabilities, to identify current and anticipated talent shortages and skills gaps.

Using this proprietary data, we partner with employers, through a consortium model, to rapidly co-design and deploy workforce development solutions to reskill and upskill their existing workforce and attract new talent from the wider labour market.

As a wholly owned subsidiary of Ontario Tech University, TALENT is backed by one of Canada's most innovative accredited institutions and is already working with Canadian employers from coast to coast to coast.

TALENT is bold, connected, and empowered to meet global digital transformation head on. As an ecosystem of learners and employers, we are building resiliency into key economic sectors, enabling organizations to evolve and individuals to thrive. We are transforming together and for the future, in step with emerging needs and for a lifetime of meaningful employment for all.

ontariotechtalent.ca

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INITIATIVES



WORKFORCE PLANNING

SKILLS & COMPETENCY FRAMEWORK

Development of a skills and competency framework for graduate engineering roles in the sector.



WORKFORCE PLANNING

CAPACITY & CAPABILITY BUILDING

Development of a suite of microcredentials in workforce planning and skills based hiring for the sector.



WORKFORCE PLANNING

INTERNATIONAL TALENT PIPELINE

Employer partnership program to deliver a more diverse candidate pool, who can demonstrate greater job readiness at a lower cost of acquisition.



WORKFORCE DEVELOPMENT

PROJECT MANAGEMENT

Development of a suite of microcredentials to develop workforce skills in project management (PMP and Non-PMP Pathways available).



WORKFORCE DEVELOPMENT

CYBERSECURITY

Development of a suite of microcredentials to develop workforce skills in cybersecurity (General and Specialist Pathways available)



WORKFORCE DEVELOPMENT

DATA ANALYTICS

Development of a suite of microcredentials to develop workforce skills in data analytics, data visualization and Python.

Research highlight: Estimating lifetime doses to the public living close to nuclear power plants using EPR measurements on extracted tooth enamel

Principal investigator: Dr. Ed Waller; PhD student: Lekhnath Ghimire (graduated, Spring 2022)

Both Pickering and Darlington nuclear generating stations emit less than 0.1% of the annual regulatory dose limit of 1 mSv/year; far lower than the background dose of 1.338 mSv/year in Durham Region.

Although the public and environment are safe from any harmful effects of radiation exposures from these nuclear stations, there are worries and concerns from local people regarding their total doses from various radiation sources, including the nearby nuclear-generating stations.

Direct dose measurements from human tissues can provide actual radiation doses that humans get from various sources, and this knowledge may lessen their worries and concerns.

Since human tooth enamel is a 'biological dosimeter' (i.e., a highly radiation-sensitive tissue) that can record a dose longer than the human life span, this study used tooth enamel collected from Durham Region, Ontario, to determine the total artificial doses from the various sources in the Region.

Research highlight: Estimating lifetime doses to the public living close to nuclear power plants using EPR measurements on extracted tooth enamel

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The calculated dose rate was 1.9721 mSv/yr.

Natural background dose at Durham Region, Ontario, was 1.338 mSv/yr.

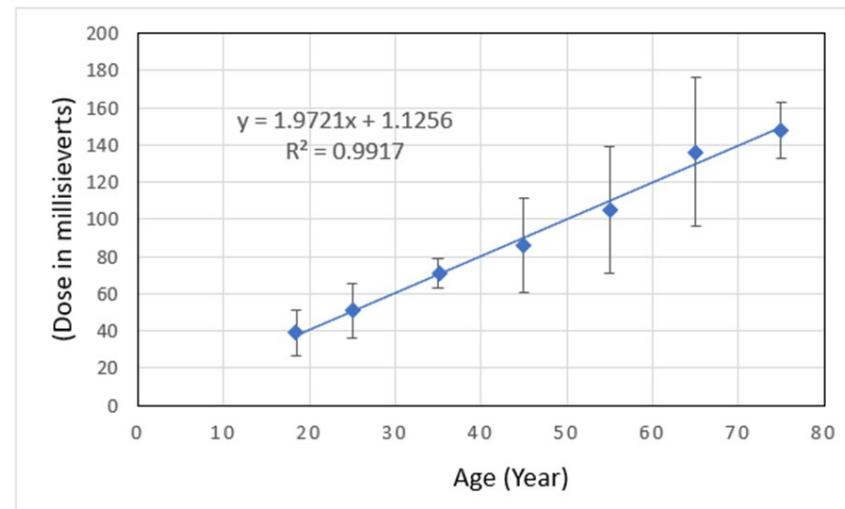
The difference in doses was from anthropogenic sources (i.e., medical, industrial, nuclear power plants, and others):

$$\text{Anthropogenic dose (a)} = (1.9721 - 1.338) \text{ mSv} = 0.6341 \text{ mSv/year}$$

At 0.6341 mSv/yr, the estimated anthropogenic dose was lower than the effective dose limit for the general public in Canada (i.e., 1 mSv/year), the contribution to this from nuclear power being <0.001 mSv/yr.

Age range, average lingual doses, standard deviation, and the number of samples in each age range from Durham Region, Ontario.

Age range (yr)	Number of samples	Averaged lingual dose (mGy)	Standard Deviation (mGy)
16-19	10	39	12
20-29	5	51	14.5
30-39	6	71	8
40-49	8	86	25
50-59	10	105	34
60-69	18	136	40
70-79	7	148	15



Conclusion

- Ontario Tech has had another **hugely successful year**, fulfilling our commitment to provide industry with well-educated and competent graduates, whilst remaining a **trusted voice** in terms of radiation science and nuclear technology, as well as its place in energy policy and national security.
- Hoping that the worst of the pandemic has now passed us by, **moving forward** in 2022/23, expect to see:
 - Further **outreach** and education activities in our local community and beyond.
 - More world-leading research in nuclear engineering, health physics and radiation science, and integrated energy systems, with **SMRs being a key focus**.
 - Exciting developments in terms of **new facilities**.
 - Continued commitment to generating the workforce and talent needs for the future.
 - Thought leadership in clean energy.
- Ontario Tech continues to **safely host and operate** a range of radiation sources for teaching and research.

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