# Land Acknowledgment

*Ontario Tech University acknowledges the lands and people of the Mississaugas of Scugog Island First Nation. We are thankful to be welcomed on these lands in friendship.*

*The lands we are situated on are covered under the Williams Treaties and the traditional territory of the Mississauga, a branch of the great Anishinaabeg Nation, including Algonquin, Ojibway, Odawa and Pottawatomi.*

*These lands remain home to a number of Indigenous nations and people. We acknowledge this land out of respect for the Indigenous nations who have cared for Turtle Island, also called North America, from before the arrival of settler peoples until this day.*

*Most importantly, we remember the history of these lands has been tainted by poor treatment and a lack of friendship with the First Nations who call them home. This history is something we are all affected by as we are all treaty people in Canada. We all have a shared history to reflect on, and each of us is affected by this history in different ways. Our past defines our present, but if we move forward as friends and allies, then it does not have to define our future.*

OntarioTech UNIVERSITY

Prepared for OPG CAC: June 20th and June 27th, 2023

# Enhancing our High-Tech Nuclear Facilities: The Subcritical Assembly Project (Preliminary Phase)

Jennifer Freeman, Executive Director of Research Services & License Authority
Francis Arnaldo, Radiation Safety Officer & Project Lead

# Ontario Tech University

## Foundation in technology, the sciences and professional practice

**11k**

Graduate and undergraduate students

**300+**

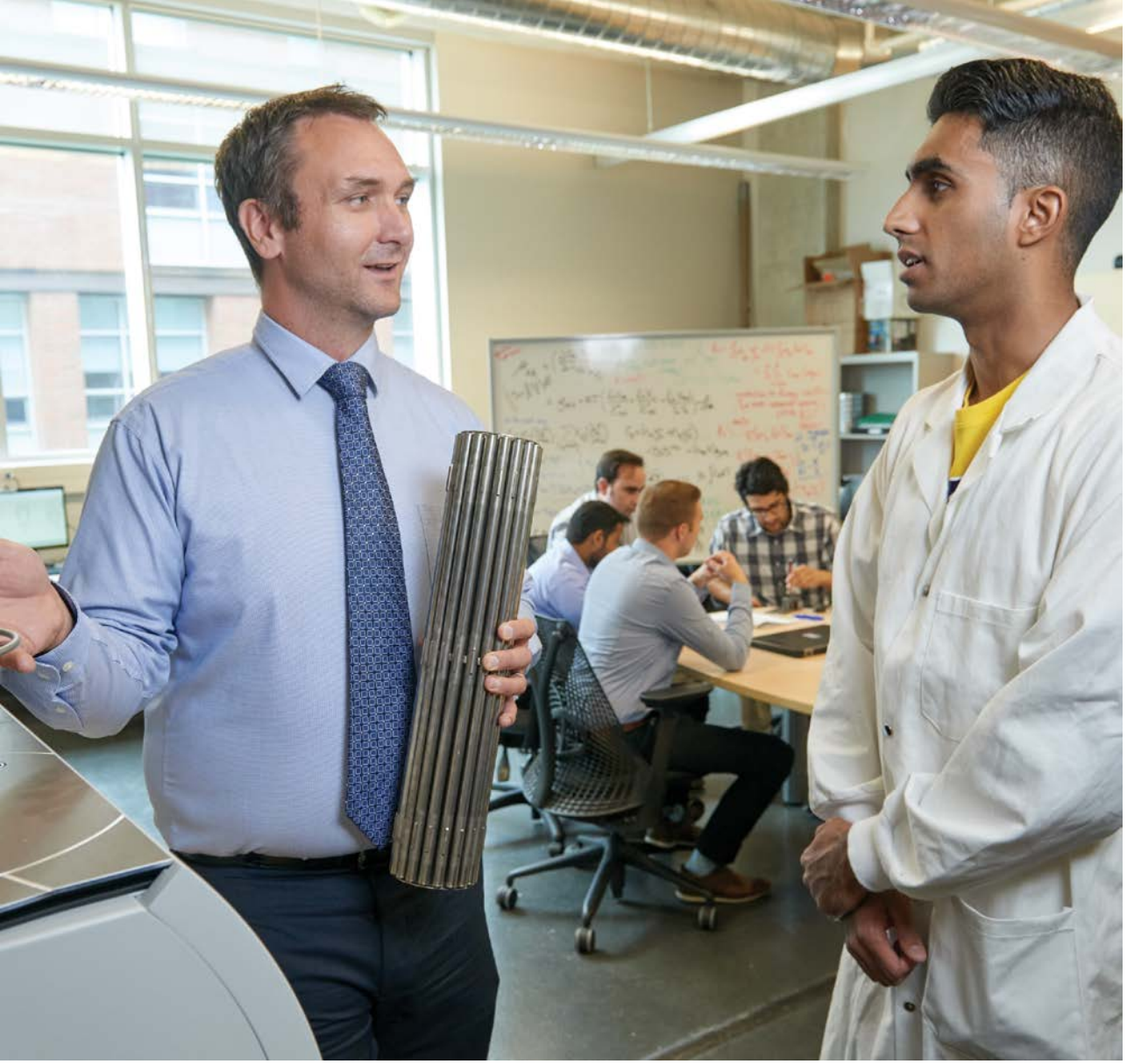
Faculty Members

**$26+**

Million Annual Research Funding

**90**

Specialized research labs and facilities



## Faculties

- **Engineering and Applied Science**
- Business and Information Technology
- Science
- Health Sciences
- Social Science and Humanities
- Education

## Department of Energy and Nuclear Engineering

- **The only** Undergraduate Nuclear Engineering program in Canada.
- **Third** in North America for Nuclear Engineering graduates produced at the Bachelor's level.
- **Internationally recognized** faculty members and experts in their field.

Ontario Tech is proud of our highly recognized Nuclear Engineering program

# Enhancing our High-Tech Nuclear Facilities

- We are proposing the Addition of a **Subcritical Assembly**
  - A subcritical assembly – a type of subcritical reactor – is much smaller than power reactors.
  - The primary purpose of a subcritical assembly is research, testing, training, and teaching.

| Reactor Model | Capacity (Megawatts) | # of Units in Canada |
|---|---|---|
| CANDU (OPG, Bruce Power) | 600+ (electricity) | ~20 |
| Small Modular Reactors (SMRs) | < 300 (electricity) | 0 |
| McMaster Nuclear Research Reactor | 5 (thermal) | 1 |
| SLOWPOKE-2 Research Reactor | 0.02 (thermal) | 2 |
| ZED-2 Research Reactor | 0.0001 (thermal) | 1 |
| **Proposed Subcritical Assembly** | **0 (thermal)** | **0** |

More information: ontariotechu.ca/subcritical

## Tech with a Conscience: It will support research for the nuclear industry as it delivers next-generation solutions to global challenges.

- Enrich Research and Teaching Opportunities.
  - Only facility of its kind in Canada
  - Will support student recruitment efforts and grow the nuclear industry talent pool

- Expand Experiential Learning Possibilities.
  - Hands-on experience that will provide the expertise needed to work in a Class 1 Nuclear Facility
  - Produce career-ready graduates

- Engage Partners within the Community.
  - Provide independent validation of nuclear industry data
  - Be a hub for nuclear awareness through community engagement

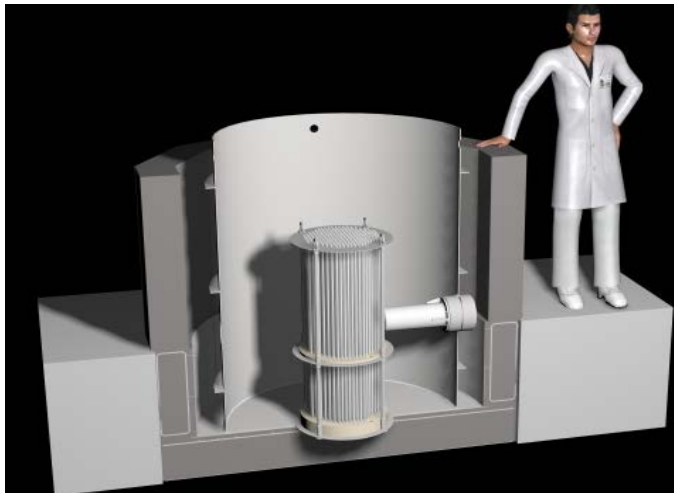
Researchers removing a graphite moderator rod

# Subcritical Assemblies Around the World

Montreal (decommissioned)

Boston

Ukraine



Czech Republic

Netherlands

Jordan

Philippines

# Subcritical Assembly: Distinct Design Features

Loading fuel into MIT's subcritical assembly

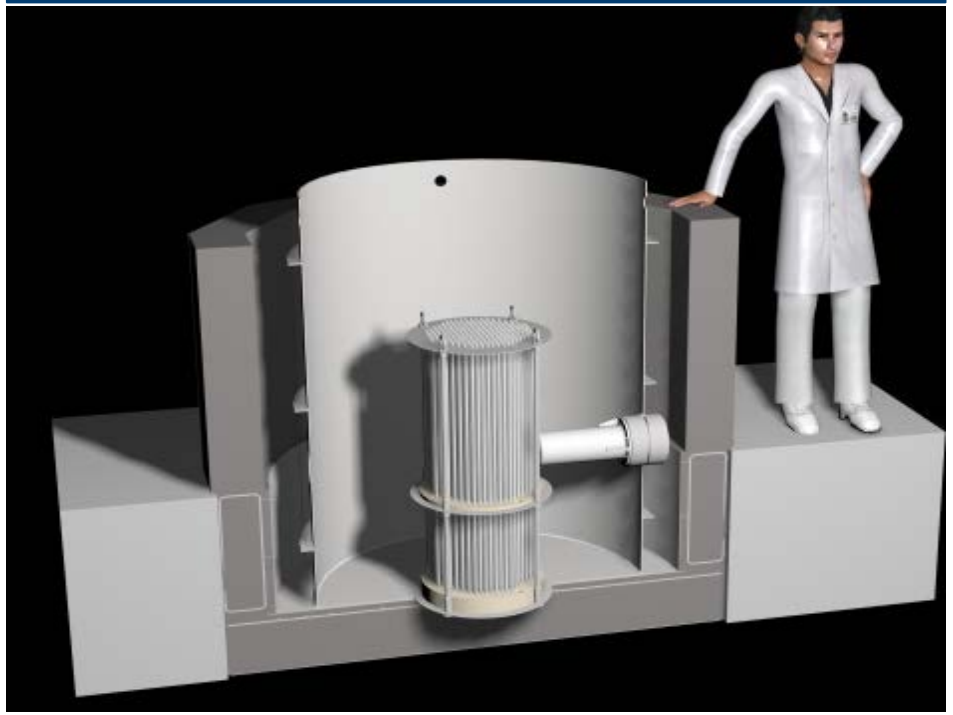
https://news.mit.edu/2017/75th-anniversary-first-nuclear-fission-reactor-mit-re-enacts-seminal-experiment-1204

## Very Simple Design

- No meaningful power can be generated in a subcritical assembly; as a result, there is little to no fuel burn up.
- No measurable heat or pressure is generated in a subcritical assembly; as a result, they do not need cooling systems.
- A self-sustaining fission chain reaction cannot occur in a subcritical assembly; as a result, emergency shutdown systems are not required due to this intrinsic safety by design.

# Subcritical Assembly: Distinct Design Features

VR-2 Subcritical Reactor at Czech Technical University in Prague



http://www.reaktor-vr1.cz/en/about-us/vr-2

## An External Radioactive Source is Required

- A subcritical assembly **only** works if a radioactive source is actively inserted into the core.
- A subcritical assembly “amplifies” the **radioactive source.**
- When the radioactive source is removed, the fission chain reaction process stops naturally: criticality is impossible.
- Can turn off the system like a light switch controlling a bulb.

# Nuclear Facility Complex

**35+**

Authorized Users allowed to work with nuclear substances and radioactive devices

**8**

Faculty Experts using the Facility

**7**

Laboratories are purpose built for nuclear substances and radioactive devices

**14**

On-going nuclear projects requiring regular safety review

- Built and operational in 2011.
- A secure area of laboratories in the basement of Energy Research Centre (ERC) dedicated to nuclear research and teaching.
- Specifically designed to allow the safe and secure use of nuclear substances and radioactive devices (NSRDs) for research and teaching.

# Knowledge and Experience: Radiation Safety Program

**2**

CNSC Licenses for teaching and research with nuclear substances and radioactive devices

**14**

On-going nuclear projects requiring regular safety review

**10**

Experts on the Radiation Safety Committee

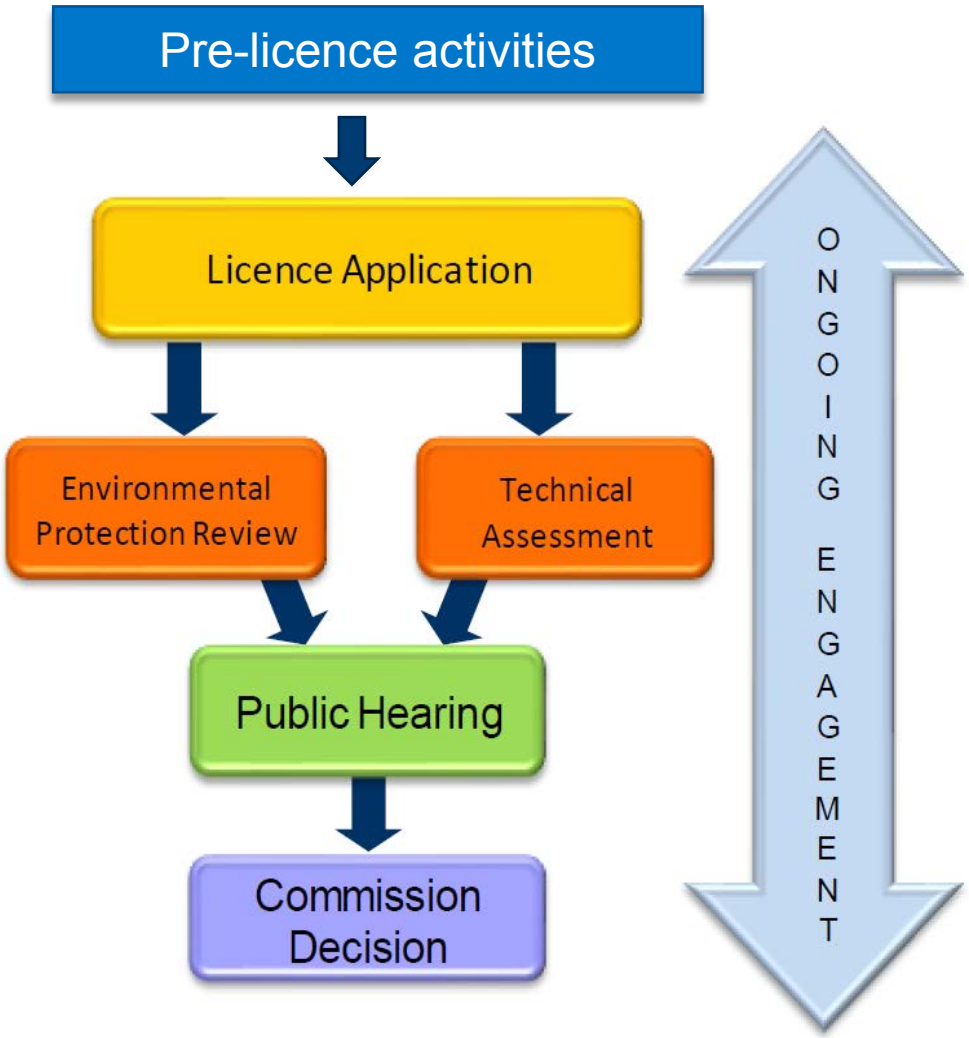
**20**

Years of safety using nuclear substances and radioactive devices

- Program established 2003 to support teaching and research with Nuclear Substances and Radioactive Devices.
- Radiation Safety Committee: subject matter experts who provide program oversight of all work with NSRDs.
- CNSC Certified Radiation Safety Officer: manages program to ensure safety and compliance.

# Many Steps Ahead - CNSC Licencing Required

- Currently in the preliminary planning stage of pre-license activities with many steps ahead.
- Ongoing efforts to engage Indigenous communities, the public, and other interest groups.
- Operating license is required from the CNSC to assemble and operate the device.
- Involves an in-depth review of all safety, technical and environmental data by CNSC technical experts.
- Commission will consider our application at a public hearing. Public has opportunity to participate.




# Thank You

**For More Information:**

**Subcritical Assembly Project**
**ontariotechu.ca/subcritical**
subcritical@ontariotechu.ca

**Feedback Welcome!**