



**Written submission from the
North American Young
Generation in Nuclear (NAYGN)**

**Mémoire de la North American
Young Generation in Nuclear
(NAYGN)**

In the matter of

À l'égard d'

Ontario Power Generation

Ontario Power Generation

**Ontario Power Generation -
Application to amend the Darlington
Nuclear Generating Station power
reactor operating license to allow
production of additional medical
isotopes**

**Ontario Power Generation – Demande
visant à modifier le permis
d'exploitation d'un réacteur de
puissance pour la centrale nucléaire de
Darlington en vue d'obtenir
l'autorisation de produire des isotopes
médicaux supplémentaires**

Public Hearing – Hearing in writing based
on written submissions

Audience publique – Audience fondée sur
des mémoires

March 2025

Mars 2025

February 7th, 2025

Tribunal Officer, Secretariat
Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
Ottawa, Ontario K1P 5S9
Email: cnsc.interventions.ccsn@canada.ca

Re: Application to amend Darlington Nuclear Generating Station power reactor operating license to allow production of additional medical isotopes

Salutation President and Commission Members

To preface, we'd like to thank you for allowing us to contribute an intervention on behalf of the North American Young Generation in Nuclear (NAYGN) - Durham Chapter, in support of Ontario Power Generation's (OPG) application to amend their Darlington Nuclear Generating Station power reactor operating license to allow for the production of additional medical isotopes.

NAYGN –Durham Chapter is the local branch of NAYGN and represents roughly 1500 members studying and working across Ontario's Durham Region. As a youth run, youth driven organization, the Durham Chapter is committed to organizing and supporting various professional development and community events such as public advocacy in schools, technical seminars, and community engagement events.

Ontario Power Generation has long since demonstrated their interest in helping supply Ontario's needs, as well as the needs of the greater global community through their work with isotope production and development. Isotopes are a critical tool in diagnostic medicine, cancer treatment, surgical grade disinfection technology, food preservation technologies, quantum computing, and beyond. NAYGN supports OPG's work towards increasing Canada's domestic and exportable supply of life saving and equipment critical isotopes.

NAYGN actively supports the application to amend the Darlington Nuclear Generating Station power reactor operating license for the following reasons:

1. The benefits of domestic production of Yttrium-90 (Y-90), Lutetium-177 (Lu-177), and other medical isotopes.
2. The safety and legacy of the proposed design.
3. Ontario Power Generation's project completion and operation record.

The benefits of domestic production of Y-90, Lu-177, and other medical isotopes.

Medical isotopes have been playing a role in saving the lives of patients around the world for almost 125 years, and Canada has held a key leadership role in the development and utilization of innovative treatments for the past 70 years. Canada's intro to isotopes commercialization began with the production of Cerium-144 in 1947 by the Chalk River research reactor. Today, Canada can now boast of its ability to produce over 250 isotopes from various commercial and research reactors - many of which are used in the nuclear medical industry. Canadian isotopes are used around the world to treat a variety of illnesses and cancers. Today, North America accounts for approximately 40% of the global market for medical isotopes; increasing domestic production would give Canada significant opportunities to serve its own demand.

Though Canada has been a strong leader in the production of medical isotopes over the decades, unexpected interruptions have led to devastating consequences for the global supply of isotopes. One instance of such interruptions can be seen in the 2009 Chalk River facilities shut down, which resulted in over a year-long supply chain shortage of Molybdenum-99 (Mo-99). Mo-99 is a precursor to Tc-99m, one of the most widely distributed isotopes in the world. The interruption exposed major weaknesses in Canada's supply chain of medical isotopes. As a result, not-for-profit advocacy organizations such as the Canadian Nuclear Isotope Council (CNIC) have begun to call on Canada to pursue redundancy and robustness in the Canadian medical isotope supply chain. The CNIC, among other actions, advocates for the diversification of isotope sourcing facilities to mitigate the risks of future shortages and protect Canadian and international patients.

Yttrium-90 (Y-90) has held a place of significance within Canada's isotope portfolio for over three decades since its initial use in the late 1980's. Y-90 is mainly used in the field of nuclear medicine to treat both liver cancer and metastases via radioembolic therapy. Liver cancer, which affected over 866 000 new patients in 2022 alone, is the 6th most common cancer globally. These sobering numbers, along with a projection for the market demand to almost double from 2020 to 2031, reflects a growing global need for increased supply of Y-90. Y-90's supply chain, specifically its sourcing, is one example of the fragility in Canada's medical isotope supply chain. Historically, Y-90 has not been generated in Canada. Though the inactive source material (Ytterbium-176 and Yttrium-89) is generated domestically, the irradiation step has had to be completed externally. After irradiation, the isotope is re-imported to complete all subsequent steps from processing to distribution of the Y-90 microspheres. OPG's application to produce Y-90 from its Darlington facility would result in Canada finally having its first internal supplier of the Y-90 isotope,

eliminating a critical weakness in its supply chain. Internal production would strengthen the country's ability to ensure Canadian citizens who are suffering from liver cancer always have a reliable supply of this life saving isotope.

Compared to Y-90, Lutetium-177 (Lu-177) has had a much shorter history. Over the past decade, novel treatments targeting malignant cells have been developed and tested using Lu-177, establishing it as a key medical isotope for modern radiotherapeutic treatments. Lu-177 is primarily used in targeted internal radionuclide therapy for prostate cancer and neuroendocrine tumors, as well as in nuclear imaging. Prostate cancer is the second most common cancer in Canada and the most prevalent form of cancer among Canadian men: accounting for 37.1% of diagnoses. Therefore, increasing domestic production of Lu-177 is of particular interest to Canadians. A significant achievement for the Canadian Medical Isotope industry occurred in October 2022 when Bruce Power became the world's first commercial nuclear reactor to produce Lu-177. With a global market value of \$85 million USD and an annual growth projection of 10.4%, there are industry concerns that global demand may exceed supply in the coming years. OPG's application to produce Lu-177 could greatly mitigate this risk by strengthening Canada's domestic supply and positioning the country to potentially dominate the Lu-177 global market, which could reach \$350 million USD in the future.

Safety and legacy of the proposed design.

OPG's request to modify the Darlington NGS Power Reactor Operating License 13.03/2025 to accommodate for additional isotope production is in line with their earlier accepted application to modify their license to accommodate for Molybdenum-99 production (DEC 21-H107). The proposed amendment uses the same technology, i.e. The Target Delivery System (TDS), also known as the Isotope Irradiation System, to produce the additional isotopes. To achieve this earlier ruling, OPG had proven beyond reasonable doubt they can provide the necessary safeguards and operating ability to effectively implement and utilize the TDS system.

The TDS system is designed to insert and remove target capsules from within the reactor core via Target Elevators (TEL) located on the Reactivity Mechanism Deck (RMD). The capsules remain in-core for the total duration of the irradiation period, and the removal is timed to allow for a dwell period required for short activation decay products. While the duration in-core to produce Molybdenum-99 is approximately 7 days, the irradiation period and dwell time for Lu-177 and Y-90 are still to be determined. The system is operated on an as needed basis, with a turnover time of between two to three hours to remove and reload the TEL.

Since the previous license modification and TDS installation, OPG has consistently demonstrated that the TDS system follows all design requirements and operates as was intended. The system's operational considerations include maintaining the integrity of the containment, upkeeping reactor safety requirements, confirming reactor physics are consistent with projections, protecting worker safety, and ensuring that exposure is as low as reasonably achievable (ALARA).

Ontario Power Generation's push for innovative and successful projects.

Ontario Power Generation has a strong record of leading innovative, challenging, and economically impactful projects to successful completion. The Darlington Nuclear Generating Station (DNGS) Refurbishment is a clear indicator of the company's ability to commit to and complete projects safely, while adhering and even surpassing strict timelines and project funding. The DNGS Refurbishment project is in the midst of completing its fourth and final unit; with completion of its third scheduled unit (Unit 1) five months ahead of schedule.

Other examples of successfully completed projects and overall operational excellence include:

- Over 50+ years of Darlington and Pickering Nuclear Generating Station operations and economic development.
- The successful completion of the Chats Falls Turntables Refurbishment.
- Completion of modifications to DNGS Unit 1 to produce Cobalt-60 isotopes – allowing OPG to produce lifesaving Cobalt-60 for use in sterilization facilities globally.
- The completion of the Niagara Reservoir Refurbishment Project, where OPG safely completed the refurbishment of the reservoir nearly 2 months ahead of schedule, while keeping costs below the original budget of \$60M.

OPG has consistently demonstrated operational excellence and project acumen across various business units, and we at the NAYGN Durham chapter believe that this record is proof of the company's ability to commit to innovative projects, such as isotope production, complete the projects, and successfully operate while adhering to a quality and safety levels above and beyond the minimum requirement.

Thank you,

Calista Jonah, NAYGN Durham Public Outreach Chair
Alexandra Hynes, NAYGN Durham Public Outreach Officer