Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 24-H101.1E

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Supplementary Information

Written submission from Ontario Power Generation

In the Matter of

Ontario Power Generation

Ontario Power Generation – Licence amendment application for the Darlington Nuclear Generating Station regarding the commercial production of Cobalt-60

Public Hearing – Hearing in writing based on written submissions

Spring 2024

Renseignements supplémentaires

Mémoire d’ Ontario Power Generation

À l’égard d’

Ontario Power Generation

Ontario Power Generation – Demande concernant la modification de son permis pour la centrale nucléaire de Darlington en vue de produire commercialement du Cobalt-60

Audience publique – Audience fondée sur des mémoires

Printemps 2024

Canada

ONTARIO POWER GENERATION

Sara Irvine
Vice President
Nuclear Regulatory Affairs

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CD# NK38-CORR-00531-25478 P

Ms. Candace Salmon
Commission Registrar
Canadian Nuclear Safety Commission
P.O. Box 1046
280 Slater Street
Ottawa, Ontario, K1P 5S9

Dear Ms. Salmon:

Darlington NGS – OPG Response to the Commission Panel Members Questions Regarding the Application to Amend Darlington NGS PROL to Authorize the Production of Cobalt-60

The purpose of this letter is to provide response to the Canadian Nuclear Safety Commission (the Commission) Panel Members questions (Reference 1) regarding the application to amend Darlington Nuclear Generating Station (NGS) Power Reactor Operating Licence PROL 13.03/2025, to authorize the production of Cobalt-60 (Co-60) radioisotope, CMD 24-H101.

OPG's CANDU reactors, which have produced safe, clean and reliable electricity for decades, have also provided a consistent supply of the radioisotope Co-60, keeping millions of people safe and healthy across the globe.

Co-60 is predominantly used in gamma irradiation for the sterilization of medical equipment and food products. As much as 30-40% of medical devices globally are sterilized using gamma irradiation to reduce the risk of patient infection. Single-use medical devices such as surgical gloves, bandages, syringes and implantable devices can be sterilized in their original packaging. Food products are also treated with gamma irradiation from Co-60 to reduce spoilage and extend shelf life. The irradiation exterminates potential parasites and microorganisms that can lead to foodborne illness, replacing the use of chemical preservatives and pesticides.

Today, Ontario produces almost 50% of the world's Co-60 supply from Pickering NGS Units 6, 7 and 8 and at Bruce B NGS. OPG is committed to ensuring the long-term supply of Co-60. The proposed Darlington NGS Co-60 production will immediately address the impending market shortfall as Pickering NGS commercial operation ceases, pending refurbishment. The Darlington NGS units are to be modified to irradiate cobalt as the market demand grows at a rate of 5% per year. The demand for gamma sterilization has increased due to the aging population, innovation in the development and availability of new medical products, and greater accessibility to healthcare globally. Co-60 production at Darlington NGS is necessary for OPG and Canada to remain a major contributor of this

essential radioisotope with significant health, safety, and social benefits. Co-60 production at Darlington NGS will result in the global need for Co-60 being met now and well into the future.

The proposed Darlington NGS irradiation design is similar to Pickering NGS. Safe removal of the irradiated Co-60 rods will occur during planned outages, approximately every three to three and a half years.

Industry-driven recycling efforts are expected to defer the return shipments of any Co-60 at the end of its commercial life (spent source Co-60) until the mid-2030s, based on current market trends. Currently, 99.5% of spent sources are recycled, resulting in no transportation of spent sources to Bruce B NGS since mid-2020.

Details of the lifecycle and OPG's specific plans for licensed activities associated with Co-60 are provided in the original application submission. Revenue earned from Co-60 sales will be used to fully fund the Darlington NGS Co-60 life cycle. OPG will be responsible for Co-60 production activities at the Darlington NGS site as follows:

- receipt and storage of Co-59 rods,
- irradiation of Co-59 rods in Darlington NGS's reactors, and
- harvesting of the irradiated rods from the reactor core and on-site processing.

The full lifecycle of the Co-60 radioisotope that will be produced at Darlington NGS is a collaborative effort between OPG, Nordion, Bruce Power and the NWMO. Each party has accountabilities under licences issued by the Commission.

OPG notes that elements of questions #1 and #2 are about licensed activities undertaken by (or which will be undertaken by) Nordion, Bruce Power and the NWMO under their own licences from the Commission. OPG respects the relationships these licencees have with the CNSC as well as with Indigenous Nations and Communities that have interest in their operations. As such, OPG requested these parties respond to the panel's questions where appropriate. These responses are provided as Enclosures 1, 2 and 3 to this submission.

Responses to the Commission panel members questions #1 and #2, are provided as follows:

- Enclosure 1, NK38-CORR-00531- 25479, Memorandum, "*Response to CMD 24-H101-Q.A question*", provides responses to questions #1 and #2, with specific details regarding the lifecycle and commercial lifespan of a Co-60 source, including transportation to Nordion's facilities, processing into sealed sources, transportation of sealed sources, information about security regulations that limit consultation/engagement regarding shipping routes, recycling and detailed plans for interim storage until there is sufficient inventory to make a shipment to Bruce B NGS.

- Enclosure 2, NK38-CORR-00531-25480, Memorandum "*Bruce Power's Interim Storage of Spent Cobalt Sources*", provides responses to questions #1 and #2, with specific details regarding the interim storage of spent Co-60 sources in the Bruce B NGS Secondary Irradiated Fuel Bays.

- Enclosure 3, NK38-CORR-00531-25481, Memorandum "*Re: CMD 24-H101-Q.A-Response from NWMO*", provides responses to questions #1 and #2, with specific details regarding the eventual disposal of spent Co-60 sources in a deep geological repository.

Regarding Commission's question #3, OPG is asked to describe its engagement activities with Saugeen Ojibway Nation regarding the proposed licensed activities as well as the transportation, interim storage and potential final disposal of Co-60. OPG can only respond regarding its engagement on its own licensed activities. As noted above, production of the Co-60 radioisotope at Darlington NGS is a collaborative effort between OPG, Nordion, Bruce Power and NWMO, and each party has accountabilities under licences issued by the Commission. OPG's accountabilities, and the subject of Darlington NGS PROL 13.03/2025 amendment, are for isotope production at Darlington NGS which is in the traditional territory of the Williams Treaties First Nations. Engagement with these Nations, as well as the Métis Nation of Ontario, were detailed in OPG's responses to the previous Commission Panel members' questions (Attachment 1 of Reference 2). OPG respects the relationship the other licencees have with Indigenous Nations and communities who are rightsholders or who have interest in their licenced activities related to the transportation, interim storage and final disposal of Co-60.

Sincerely,

Sara Irvine

Sara Irvine
Vice President
Nuclear Regulatory Affairs
Ontario Power Generation Inc.

Encl.

Cc: CNSC Site Supervisor - Darlington
forms-formulaires@cnsc-ccsn.gc.ca

References:

1. Registry/Registrar, email, C. Salmon to C. Axler, “CMD 24-H101-Q.A - Questions from the Panel of the Commission: Hearing in Writing - OPG - Application to amend the Darlington NGS Power Reactor Operating Licence to authorize the production of Cobalt-60”, May 9, 2024, e-Doc# 7279382, CD# NK38-CORR-00531-25477.

2. Email, S. Irvine to Registry, “OPG Response to Questions from the Panel for OPG Staff – CMD 24-H101-Q – OPG’s Licence Amendment Application for the DNGS regarding the commercial production of Cobalt-60 – CMD 24-H101”, May 3, 2024, CD# NK38-CORR-00531-25214P.

Ms. Salmon

CD# NK38-CORR-00531-25478 P

ENCLOSURE 1

OPG letter, S. Irvine to C. Salmon, “Darlington NGS– OPG Response to the Commission Panel Members Questions Regarding the Application to Amend Darlington NGS PROL to Authorize the Production of Cobalt-60”
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CD# NK38-CORR-00531-25478 P

Memorandum: Response to CMD 24-H-101-Q.A question

NK38-CORR-00531-25479

Nordion
A Sotera Health company

MEMORANDUM

DATE: May 14, 2024

TO: Ms. Sara Irvine, OPG - VP Nuclear Regulatory Affairs

FROM: Mr. Richard Wassenaar, Director, Regulatory & EHS

CC:

RE: Response to CMD 24-H101-Q.A question

Cobalt-60 is produced by subjecting Cobalt-59 adjustor assemblies to neutron bombardment from the nuclear reaction, which converts some of the Cobalt-59 to Cobalt-60. The Cobalt-59 is in the form of solid metal slugs that are placed inside of metal capsules. The metals capsules are then assembled to create an adjuster assembly. The adjuster assembly is inserted into the reactor. When the reactor is shut down for regular maintenance (approximately every 24-36 months), the adjuster assemblies containing the now Cobalt-60 slugs are removed from the reactor and placed in the spent fuel pool, where the adjuster assemblies are disassembled into the capsules and placed into F-231 shipping containers. This work is undertaken by the reactor licensee under their respective Class 1A licence. The F-231 shipping container is a Nordion shipping container that is certified as a Type B package under CNSC certificate CDN/2077/B(U)-96. The F-231 shipping container is transported to Nordion. Nordion is responsible for arranging the shipment with dedicated carriers under the Nordion Transport Security Plan. For shipment, the solid metal Cobalt-60 slugs remain within the capsules.

At Nordion, a combination of pools and hotcells are used to unload the Cobalt-60 capsules from the shipping containers and the Cobalt-60 slugs are removed from the capsules and mixed with Cobalt-60 slugs from other reactors (or Cobalt-60 slugs that have been returned from the field) to create a double-encapsulated sealed source. These sealed sources are typically placed into Nordion's F-168 shipping containers and transported to irradiation facilities around the world. The F-168 containers are licensed by the CNSC for transportation of radioactive materials under certificate CDN/2081/B(U)-96. Nordion's Class 1B license, NSPFOL-11A.01/2025, issued by the CNSC, allows for the activities that take place at the Nordion site. Nordion sealed sources are designated special form, under CNSC certificate CDN/0010/S-96 which means they meet a high standard for containing the radioactive material over their lifecycle, and beyond.

Although no shipments of spent Cobalt-60 sources to Bruce Power has occurred since 2020 due to the high rate of recycling, spent sources that were previously sent to Bruce Power for long-term storage were sent using the same F-231 shipping container that is used for transport of new Cobalt-60 from the reactors. The spent sources are placed in a special holder that fits into the shipping container, and the holder with the sources is placed in the spent fuel pool.

Nordion
A Sotera Health company

Information related to the detailed timing and routes for specific shipments is security-protected information due to the nature of the shipments and only shared on an extremely limited basis. Shipments are generally made along major transportation routes. Transport security is in compliance with REGDOC-2.12.3 and details of that program fall under Section 21 of the General Nuclear Safety and Control Act. Nordion has provided overviews of the transport safety and security program to various Indigenous Nations and other interested parties and would welcome providing that to other Indigenous Nations that may have an interest. Cobalt-60 production at Darlington does not change the current programs that have successfully provided for the protection of people and the environment and does not introduce any new risks.

Nordion's sealed sources are typically used by irradiation facilities for approximately 20 years before they are returned. At this point, their level of radioactivity is only 7% of what it was when the source was manufactured (recycled Cobalt that returns to the field for another 20 years only has 0.5% of its original activity after 40 years). Sources are returned using the F-168 shipping containers, which are unloaded at Nordion. The spent sources are stored in a pool at Nordion until such time that they can be recycled. At this point, the sealed sources are cut open within hot cells and the retrieved decayed Cobalt-60 slugs are used with new Cobalt-60 slugs for the production of a new sealed source. These activities are managed under Nordion's Class 1B license from the CNSC, NSPFOL-11A.01/2025. The shipping container used to transport spent sources is typically the F-168 used to ship new sources and is licensed by the CNSC, as previously noted. If the Cobalt-60 within a source can no longer be recycled, then the special form sealed sources containing the Cobalt-60 material would be shipped to a properly licensed location per OPG's direction. This is currently Bruce B NGS for interim storage and further end-of-life-management by OPG.

Sincerely,

Richard Wassenaar

Digitally signed by Richard Wassenaar
Date: 2024.05.14 13:54:29 -04'00'

Mr. Richard Wassenaar,
Director, Regulatory & EHS
Nordion Canada Inc.

Ms. Salmon

CD# NK38-CORR-00531-25478 P

ENCLOSURE 2

OPG letter, S. Irvine to C. Salmon, “Darlington NGS– OPG Response to the Commission Panel Members Questions Regarding the Application to Amend Darlington NGS PROL to Authorize the Production of Cobalt-60”

CD# NK38-CORR-00531-25478P

Memorandum: Bruce Power’s Interim Storage of Spent Cobalt Sources

NK38-CORR-00531-25480

PUBLIC

Memorandum

To Sara Irvine
Vice President Nuclear Regulatory Affairs
Ontario Power Generation

From Maury Burton
Senior Director Regulatory Affairs
Bruce Power

Date May 10, 2024

Subject Bruce Power's Interim Storage of Spent Cobalt Sources

As per the Used Fuel Waste and Cobalt 60 Agreement between Bruce Power and Ontario Power Generation, Bruce Power shall accept and store cobalt-60 in accordance with the following provisions: cobalt-60 is returned in the appropriate configuration and condition; the leak tightness is inspected and certified in writing to Bruce Power; and Bruce Power shall inspect upon arrival and it is only stored in the Bruce B Secondary Irradiated Fuel Bay (described as the Used Fuel Pool in the Agreement).

When Bruce Power receives sources, they are declared to the CNSC through the Government of Canada's Sealed Source Tracking system. While under Bruce Power's control, the material remains within the Bruce B Secondary Irradiated Fuel Bay and is managed in accordance with Bruce Power's governance.

Following interim storage in the Bruce B Secondary Irradiated Fuel Bay, Bruce Power shall upon OPG's request: package all cobalt-60 to be collected and transported to the Waste Management Facility by OPG; load all dry storage containers, packages or containers used in connection with the collection and transportation to the Waste Management Facility of cobalt-60 by OPG and complete all administrative activities.

Bruce Power's current licence authorizes the possession and storage of cobalt-60. This was initially included in the Bruce B Power Reactor Operating Licence granted in 1991, where the supporting submission stated that the prescribed substance included used cobalt-60 that had reached the end of its service life and was generated from CANDU power reactors in Canada.

Bruce Power identified Saugeen Ojibway Nation (SON) was not engaged regarding the intent to produce Cobalt-60 at Darlington which will eventually be stored in Bruce B. Recognizing SON has expressed interest in nuclear waste that would come into their Treaty territory, on April 12, 2024, Bruce Power notified the SON of this matter, including the fact that Bruce Power is currently authorized to accept this material under the existing licence.

Ms. Salmon

CD# NK38-CORR-00531-25478 P

ENCLOSURE 3

OPG letter, S. Irvine to C. Salmon, “Darlington NGS– OPG Response to the Commission Panel Members Questions Regarding the Application to Amend Darlington NGS PROL to authorize the Production of Cobalt-60”

CD# NK38-CORR-00531-25478P

Memorandum: **Re: CMD 24-H101-Q.A- Response from NWMO**

NK38-CORR-00531-25481

NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

NK38-CORR-00531-25481

Karine Glenn
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Tel. 437.233.7928
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NWMO-CORR-07351-302347

May 15, 2024

Sara Irvine
Vice President, Nuclear Regulatory Affairs
Ontario Power Generation
sara.irvine@opg.com

Dear Ms. Irvine:

Re: CMD 24-H101-Q.A - Response from NWMO

In response to your request for NWMO to provide further information regarding NWMO's plan to accommodate Co-60 spent sources in a DGR, including information on engagement with Indigenous Nations and communities, the NWMO provides the following information.

In 2020, the NWMO was tasked by Natural Resources Canada (NRCan) to develop an Integrated Strategy for Radioactive Waste (ISRW). As part of the development of this ISRW, the NWMO undertook a number of activities and assessments, including international benchmarking, technical assessments and engagement with the public, Indigenous peoples and various stakeholders. The first of its kind for Canada, the Integrated Strategy for Radioactive Waste is informed by more than two years of engagement with Canadians, Indigenous peoples and nuclear waste generators and owners, as well as detailed studies of both technical considerations and international best practices. On October 5, 2023 the Minister of Energy and Natural Resources Canada, the Honourable Jonathan Wilkinson, endorsed the recommendations put forward by the NWMO, giving the NWMO the mandate for the disposal of intermediate-level waste (ILW) and non-fuel high-level waste (NFHLW) in a deep geological repository. The Cobalt-60 used nuclear sources would fall under the NFHLW component of this mandate. At present it is expected that there would be small volumes of Cobalt-60 sources for disposal, between 5.0 m^3 to 10.0 m^3, as reported in the 2019 Inventory of Radioactive Waste in Canada Report produced by NRCan.

The Minister of NRCan also requires the NWMO to report back by March 2025 regarding NWMO's siting plan for disposing of ILW and NFHLW, including funding and details on a communication and engagement plan. The NWMO, as Canada's leading organization for deep geological disposal, will prepare a detailed plan defining the process to select a site for the repository, inclusive of engagement strategy and funding approach, taking into account experience and learnings gained from implementing other siting processes for nuclear facilities. This siting process is separate from the NWMO's work to site Canada's plan for used

nuclear fuel. This plan is to outline the process to determine the technical and social acceptability requirements for siting a repository, consistent with the Policy, and the implementing principles outlined hereafter. This plan is to also include the expected timelines for siting and construction of the repository. The NWMO is currently in the process of drafting theses deliverables and is on target to discuss its plan by March 2025.

The disposal site for ILW and NFHLW is currently unknown, however it will only occur in willing and informed communities and where it is safe to do so. Communities who have participated in the siting process for the deep geological repository for used nuclear fuel may wish to participate in this siting process, but it is important to note it is not required. At this time, the NWMO estimates that a DGR for the disposal of ILW and NFHLW could be in-service in the mid to latter part of the 2050s. This however is subject to change and would depend on a several factors such as the number of communities that want to learn more about the Project, their willingness to be a host community and the safety of the site to contain the ILW and NFHLW for several tens of thousands of years.

While separate from the organization's ongoing efforts to implement a deep geological repository for the long-term disposal of used nuclear fuel, this new work will benefit greatly from the NWMO's expertise and past lessons learned.

The NWMO believes that a siting process is one that is open, transparent, fair, adaptable, inclusive, and flexible. The communities that show an interest in this new repository project, including Indigenous communities will be engaged and listened to as the siting plan discussions begin starting in 2025.

Sincerely,

DocuSigned by:
Karine Glenn
9234662173B7452...

Karine Glenn (she/elle), P.Eng, Ing.
Director, Regulatory Affairs
Nuclear Waste Management Organization

Ms. Salmon

CD# NK38-CORR-00531-25478 P

Summary of Regulatory Commitments, Regulatory Obligations and Regulatory Management Actions Made/Concurrence Requested

CD# NK38-CORR-00531-25478 P

Submission Title: **Darlington NGS – OPG Response to the Commission Panel Members Questions Regarding the Application to Amend Darlington NGS PROL to authorize the Production of Cobalt-60**

Regulatory Commitments (REGC):

No.	Description	Date to be Completed
	None	

Regulatory Management Action (REGM):

No.	Description	Date to be Completed
	None	

Regulatory Obligation Action (REGO):

No.	Description	Date to be Completed
	None	

Concurrence Requested: None.