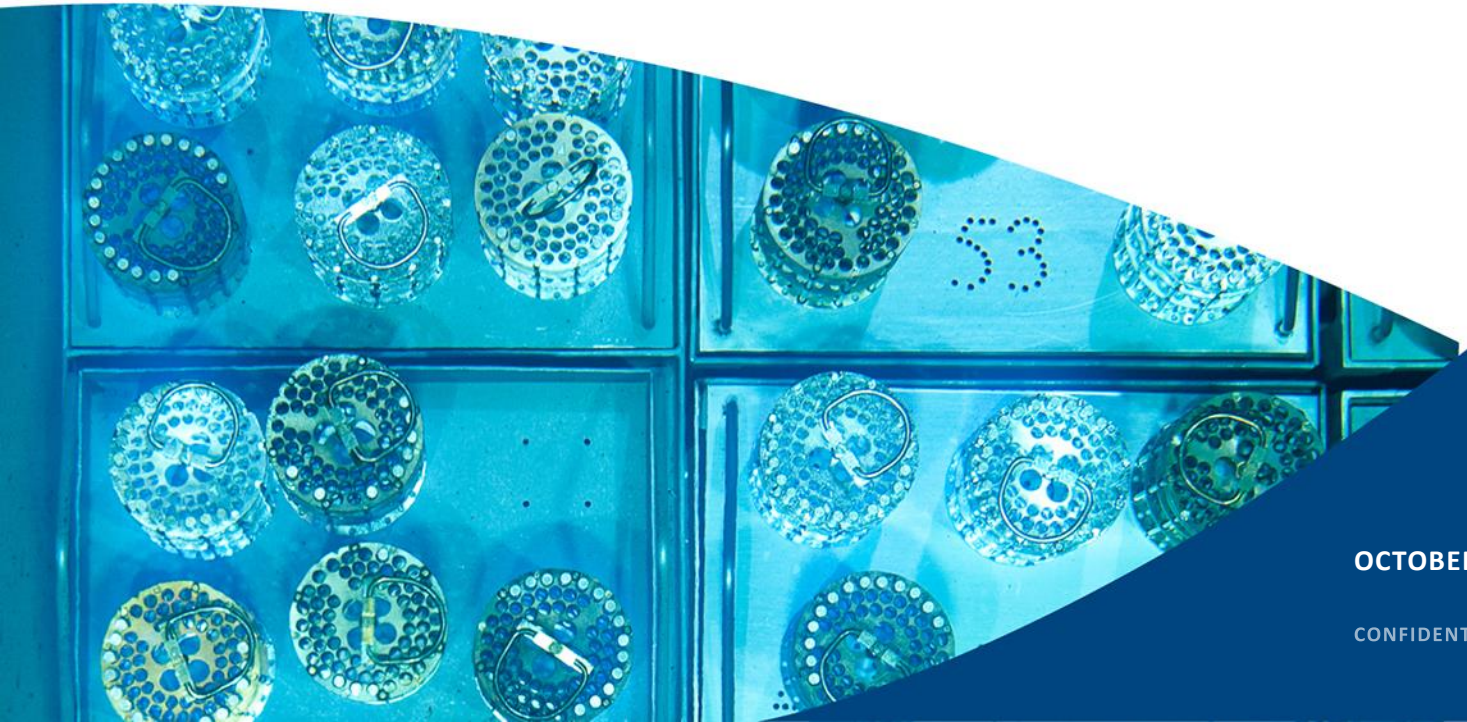
Nordion
A Sotera Health company

Nordion

NATIONAL ACADEMY OF SCIENCES RADIATION COMMITTEE



OCTOBER 2020

Questions by Committee - Nordion

1. Please provide an overview of your company and its market.
2. Please describe the production process of cobalt-60 for radiation therapy versus sterilization or other applications.
3. What were the trends in cobalt-60 supply and demand over the past 10-15 years for different applications? What are the future projections, and will supply be able to meet demand for the foreseeable future? If supply is expected not to meet demand, what are various ways to address a potential shortfall in supply; for example, can new production reactors be brought online and how long would that take?
4. What are, in your view, the factors that led/will lead to those trends?
5. To the extent possible please discuss price-trends of cobalt-60 over the past 10-15 years and reasons for these trends.
6. What is your company's involvement, if any, in recycling and/or disposal of cobalt-60 sources? Please describe a typical contractual arrangement.
7. Do you accept decayed sources on exchange only?
8. What about if a facility closes and there will be no exchange?
9. What about a facility or former customer where your relationship has expired?
10. Please provide any additional information or advice that you think is relevant to this committee's work.

Key Messages for Committee

- Gamma processing is a vital and irreplaceable part of our health care and infection control infrastructure, including Covid-19.
- The industry continues to strengthen protections against terrorist threats throughout the entire cobalt-60 life cycle.
- X-ray is a new technology with limited commercial availability. It currently accounts for <1% of volume.
- Current tightness of cobalt supply is temporary.

Sotera Health Overview

- Nordion is one of three divisions of Sotera Health which operate with one common mission, Safeguarding Global Health®.
- Nordion is a leading global provider of Cobalt-60 sealed sources.

Sotera Health

Safeguarding Global Health®

Sterigenics
A Sotera Health company

Comprehensive Sterilization Services

- Provider of mission-critical and government mandated sterilization services
  - » 48 facilities in 13 countries
- Offers all major sterilization technologies: Gamma Irradiation (“Gamma”), Ethylene Oxide (“EO”) & Electron Beam (“E-Beam”)
- End markets include Medical Devices, Pharma, and Food
- 2,800+ customers in 52 countries including virtually all leading medical device OEMs, served via multi-year contracts

Safeguarding Global Health – with every product we sterilize.

Nelson Labs
A Sotera Health company

Expert Lab Testing and Advisory Services

- Provider of microbiology and biopharma testing services
  - » State-of-the-art facilities across 13 global lab locations
- Offers 800+ tests across the product lifecycle, from initial product validation to ongoing quality control and extractables and leachables testing
- End markets include Medical Devices, Pharma and Tissue
- 3,500+ active customers including leading medical device and pharma manufacturers

Safeguarding Global Health – with every test we complete.

Nordion
A Sotera Health company

Gamma Technologies

- Global leader in Cobalt-60 (“Co-60”) supply
  - » Co-60 is the key input for Gamma sterilization
- Long-term Co-60 supply contracts with nuclear reactors at multiple reactor sites
- 40 active customers including contract sterilizers and medical device manufacturers, served via multi-year agreements

Safeguarding Global Health – with every critical isotope we supply.

Overview: Nordion and its Markets

Nordion manufactures and distributes Cobalt-60 sealed sources for two main applications:

1) Industrial (or LSA) Cobalt is used:

- To sterilize single use medical products
- To improve food safety
- To facilitate international trade of agricultural products
- To modify properties of advanced materials

→ **40% of medical devices in NA**

→ **One Billion pounds of food products**

→ **700 brain treatment centres**

2) Medical (or HSA) Cobalt is used:

- To treat inoperable brain tumors
- To treat other types of cancers
- In scientific and research application
- HSA = High Specific Activity, typically 2 to 3 times higher ci/g

The global demand for medical cobalt is ~1% of the industrial demand

Overview: Nordion and its Markets

In addition to the manufacture and distribution of Cobalt-60 sealed sources, Nordion also;

Designs and builds Irradiators

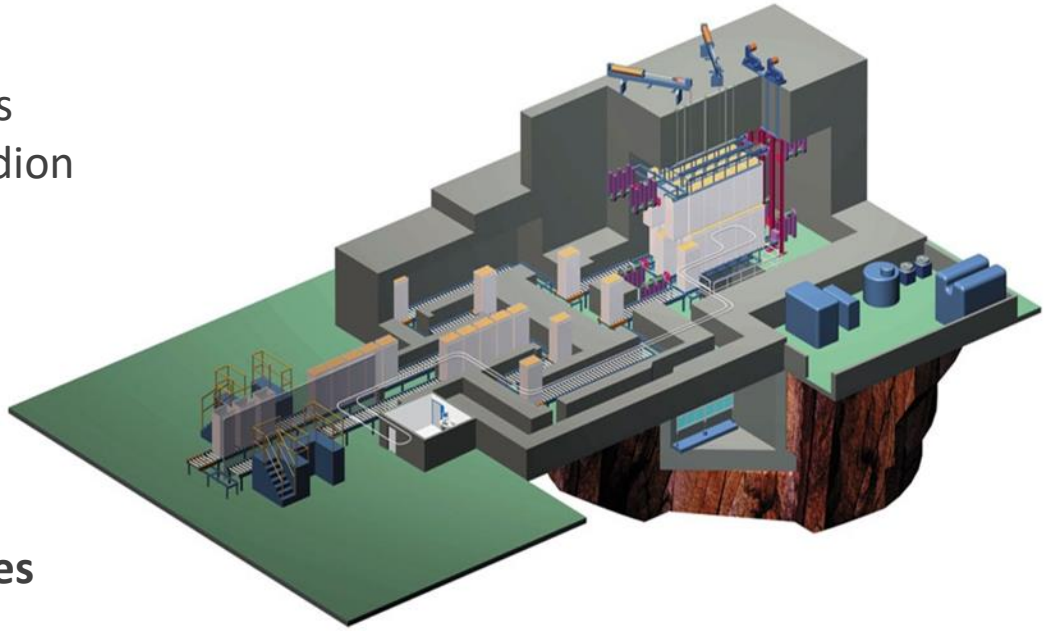
- Over 30% of the 300 irradiators in the world were built by Nordion

Services and optimizes irradiators

- Providing upgrades for enhanced safety and operating efficiency

Provides irradiator training services

- Training of operators and regulators



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Overview: Nordion and its Markets

Industrial Cobalt

- Industry pioneer - 1964
- World's largest provider of Co-60 sealed sources
- Licensed to ship globally
- > 30% of operating irradiators built by Nordion
- 70/30 split; contract sterilizers and meddev mfg'rs
- >80% used for medical device
- ~ 20% used for food and material modifications
- US consumes ~50% of global cobalt-60

Medical Cobalt

Industry pioneer – 1951

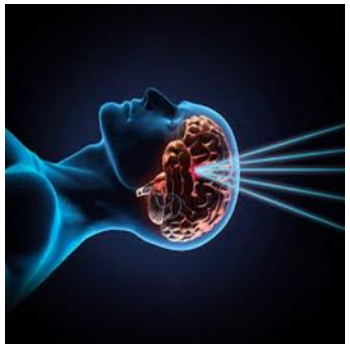
- World's largest provider of cobalt-60 sealed sources for cancer therapy
- Licensed to ship globally

Largest application - Stereotactic Radio Surgery (SRS)

- ~ 700 SRS machines worldwide and growing
- Treating inoperable brain tumours

Secondary application – external beam therapy

- Simple and robust equipment
- Ideally suited for cancer treatment in developing countries



Production process for Cobalt-60

Diverse supply chain for cobalt-60 production, sealed source manufacture and gamma processing;

21 reactors currently producing cobalt

- Canada, China, Russia, Argentina, India

5 manufacturers of sealed sources

- Nordion Canada
- JSC Isotope, Russia
- Dioxitek, Argentina
- BRIT, India
- Tong Xing, China

~300 irradiators worldwide, 65 in USA*

*includes smaller/research irradiators

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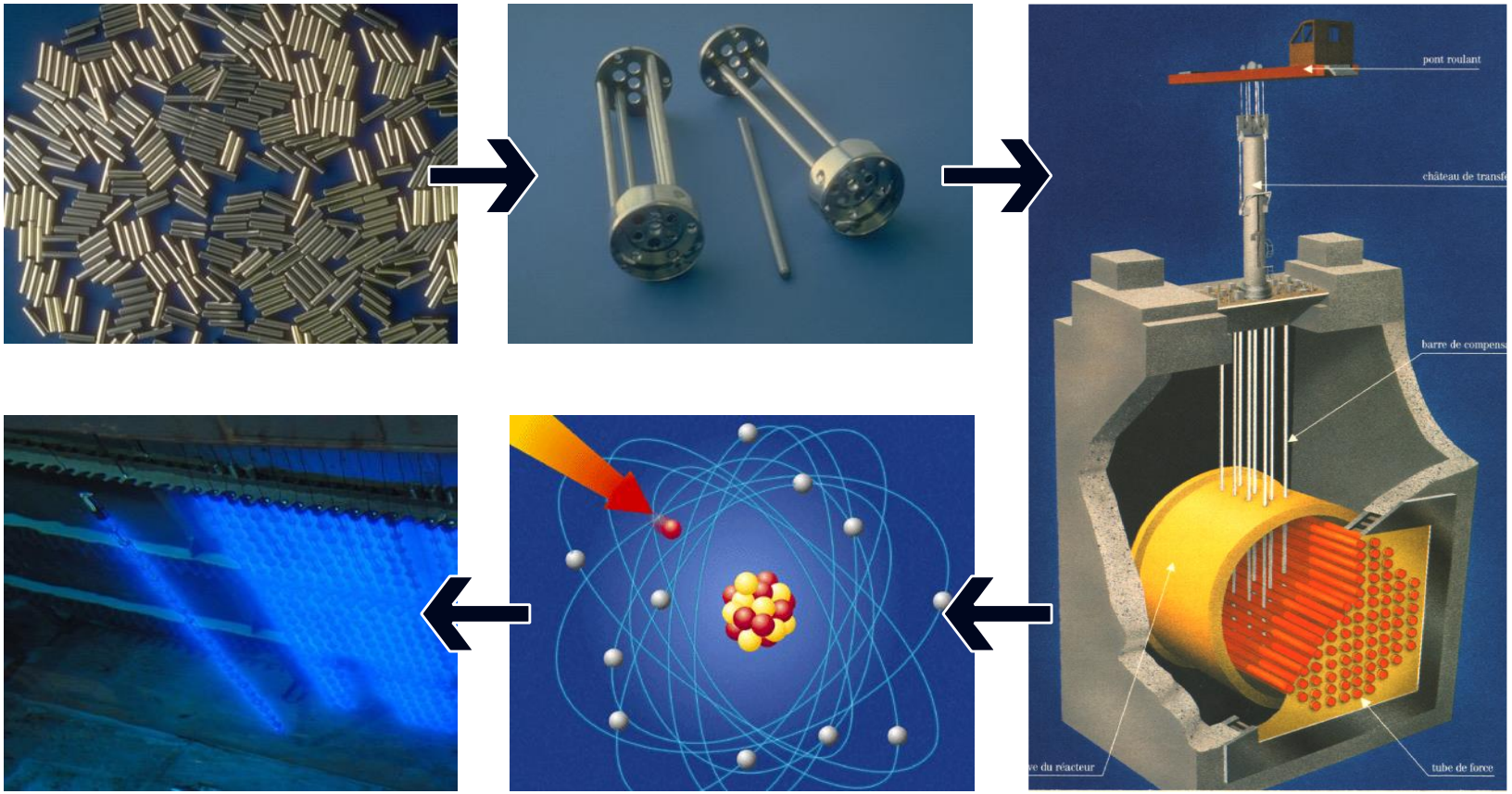
The production process for cobalt-60

Similar process for both industrial and medical cobalt cobalt-60



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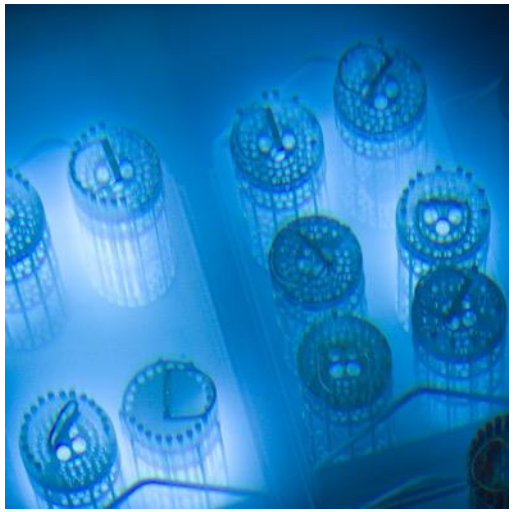
Trends in Cobalt-60 demand over past 10 to 15 years

Demand for industrial cobalt has increased in the low single digit % annually, driven by:

- Increasing demand for sterile single use medical products
- Increasing acceptance of food irradiation
- Increasing applications of high-performance polymers



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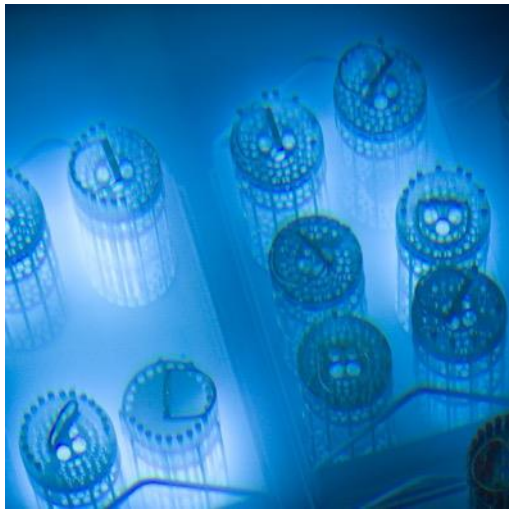
Trends in Cobalt-60 supply over past 10 to 15 years

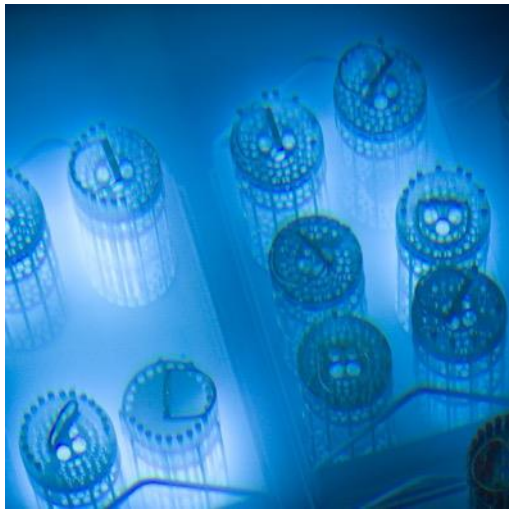
Global supply of cobalt-60 has seen a net increase, resulting from:

- Additional reactor capacity in Canada, China, India and Russia
- Reduction of output from one Russian site
- Temporary shutdown of Embalse reactor for refurbishment



Future projections for supply and demand

- Demand for cobalt will likely continue to increase in the low single digits annually.
- Future supply will meet or exceed demand however in the near term, supply remains tight.
- Nordion is investing heavily in additional reactor capacity to meet continued market demand.



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Trends: Supply & Demand

If supply is expected not to meet demand, what are various ways to address a potential shortfall in supply; for example, can new production reactors be brought online and how long would that take?

There are 3 ways to add capacity, each with different time horizons;

1. Increase output of existing suppliers
2. Access cobalt produced in isolated regions
3. Invest in new reactor capacity

1. Increase output of existing suppliers

- **a)** Mayak currently operating at (est.) 40% of normal output. A return to 100% would rebalance supply and demand. Timing: unknown.
- **b)** Embalse (Argentine reactor) off-line since 2016, has returned to service after major component replacement. It will now operate until 2050. First harvest timing: March 2021.
- **c)** 3 reactors at Pickering Canada, currently scheduled to shutdown in 2024. The Ontario government has indicated a willingness to operate these units for another year, producing millions of additional curies. Timing: 2025.
- **d)** 4 reactors at Bruce Power – a technical feasibility study is underway to evaluate a concept called "heavy adjusters' which could increase production by 10% to 20%. Timing: Feasibility results expected Q1 2021.
- **e)** Adding productive capacity to RBMK reactors in Russia by replacing Boron rods with cobalt-59. These reactors have a 5 year "cook" cycle. Timing: 2027

Bruce Power
Innovation at work

ROSENERGOATOM

ONTARIO POWER GENERATION

2. Access cobalt from isolated regions

India

- produces more cobalt than needed domestically
- limited ability to export
- Successful collaboration with Nordion since 2018

Argentina

- produces more cobalt than needed domestically
- limited ability to export
- collaboration discussion underway anticipating 2021 harvest

China

- produces cobalt in two CANDU reactors
- no ability to export
- moving cobalt to global markets since 2018 under multi-year agreement with Nordion

3. Invest in new reactor capacity

Opportunities for global expansion:

	Producing Cobalt	Total Operating
CANDU	13	31
RBMK	6	10
LWR*	0	359

*LWR = Light Water Reactor.

3. Invest in new reactor capacity

CANDU Reactors

- Darlington, Canada. 4 Units. In detailed equipment design stage. Irradiation of cobalt expected in mid-2020s
- Cernavoda, Romania. 2 Units. In technical and environmental assessment stage. Irradiations anticipated in mid-2020s
- Pt Lepreau, Canada. 1 Unit. In preliminary discussion stage. Too early to predict start of irradiations.

3. Invest in new reactor capacity

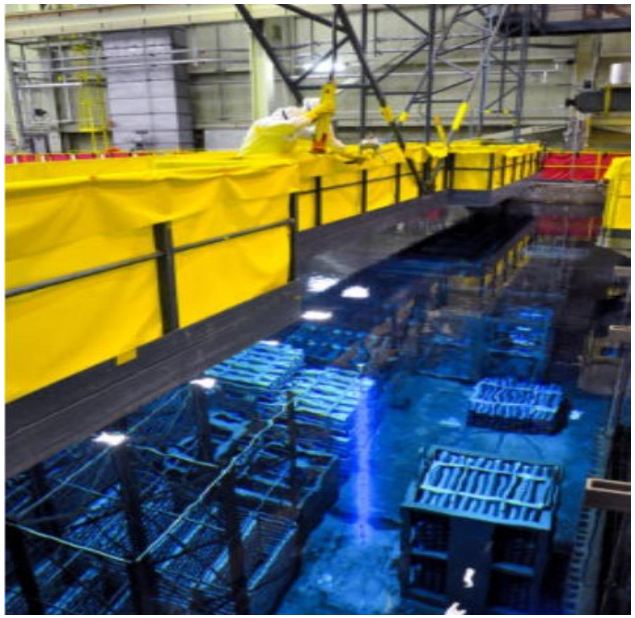
RBMK Type Reactors

- Nordion has been irradiating cobalt targets in 4 RBMK units since 2003
- In 2017, in collaboration with Russian partners, Nordion began irradiations in 3 additional units.
- First harvest from the new units will be 2022

3. Invest in new reactor capacity

Light Water Reactors

- Nordion acquired base technology for LWR cobalt production in 2018.
- In partnership with Westinghouse, Nordion is developing that technology to efficiently produce cobalt in LWRs.
- Cobalt production expected in mid-2020s.



5. Trends: Price

To the extent possible please discuss price-trends of cobalt-60 over the past 10-15 years and reasons for these trends.

- **Cobalt-60 price increases have been moderate over both 10 and 15-year periods.**
- **Cobalt price increases are aligned with cost increases of other modalities.**
- **Cobalt price increases are aligned with end market price increases.**

Conventional economic principles apply to the price of cobalt-60

- Supply/demand
- Increased production costs
- Regulated need for product
- Buyer-perceived value increase
- Ability of buyer to pass through increases
- Cobalt is a capital cost, not expense

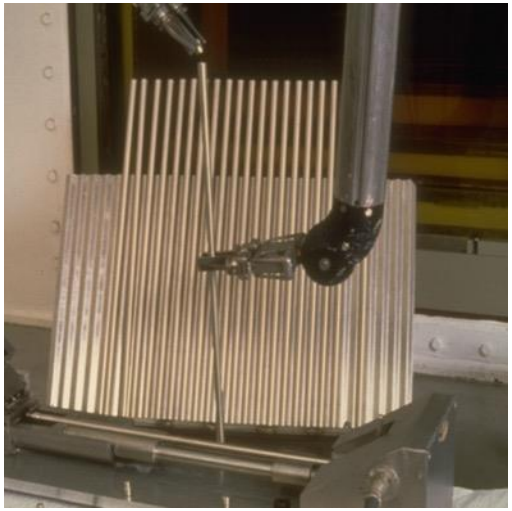
Cost of Investments in new capacity

- Nordion is investing $100M USD in new capacity
- Spending >$1M USD/month on reactor projects.

6. Recycling

What is your company's involvement in recycling and/or disposal of cobalt-60 sources?

- Nordion maximizes recycling and minimizes disposal of spent sources
- We receive 1000's of spent sources/year.
- Spent sources are disassembled and most components are recycled and returned to service in new sources
- We are investing in a new facility that enables recycling of non-Nordion sources
- We have agreements with federal and provincial governments for disposal of sources that can't be recycled



6. Recycling

Please describe a typical contractual arrangement for return/recycling of spent sources.

- Most customers have 3 to 5-year supply agreements which include all T&Cs for return of spent sources
- Typically there is a “per source” fee for return of spent sources
- Sources are returned in the container that delivered fresh sources

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7-9. Additional Questions

Do you accept decayed sources on exchange only?

- No, the purchase of a new source is not a requirement.

What about if a facility closes and there will be no exchange?

- We will work with that facility owner to find a solution.

What about a facility or former customer where your relationship has expired?

- Same as above. We don't want the industry tarnished by the existence of orphan sources.

Cobalt-60 and gamma processing are vital and irreplaceable components of our health care and infection control infrastructure, including Covid-19.

- **40% of single use medical products in NA are sterilized with cobalt 60.**
  - 400 million cubic feet of medical products/year
  - 16 billion medical devices/year
  - Syringes for Covid-19 vaccinations are expected to be gamma sterilized
- **More than one million cobalt cancer treatments/year**
- **Gamma processing improves the safety of > one billion pounds of food annually**

Protection against terrorist threats have been strengthened throughout the entire cobalt-60 life cycle.

We continue to strengthen our robust facilities and process. In collaboration with various government agencies we have improved security throughout the product life cycle. This includes:

- Transportation from the reactor sites to our processing facilities
- The Nordion facilities in Canada and the UK
- Transportation to and from our customers' facilities
- At the irradiators themselves

10. Additional Information

X-ray is a new technology with limited commercial availability. It currently accounts for <1% of medical device sterilization volume.

- There are >60 commercial scale gamma processing facilities in the USA and more than 200 worldwide
- There are no commercial scale X-ray facilities for medical device sterilization in the USA, and only one globally.
- Gamma processing is robust, widely available and reliable.

Current tight supply of cobalt is temporary

- Global supply was reduced by the reduction of Mayak output, and the Embalse refurbishment.
- Many steps have already been taken to bring more cobalt to the market.
- Major investments are in flight to ensure the future availability of cobalt and the continued long-term success of gamma processing.
- The total quantity of cobalt sold in North America has increased in each of the past 3 years.

Thank you for your attention

Questions?