
# Investor Presentation

September 2022

BWXT Medical

# Forward-Looking Statements Disclaimer

BWX Technologies, Inc. (“BWXT”) cautions that statements in this presentation that are forward-looking and provide other than historical information involve risks and uncertainties that may impact actual results and any future performance suggested in the forward-looking statements. The forward-looking statements in this presentation include, but are not limited to, statements relating to our 2022 and future strategic priorities, including medical radioisotope industrialization and organic growth opportunities; changes in demand for and our ability to commercialize products; our ability to obtain timely regulatory approvals; expected future capital expenditure levels; disruptions to our supply chain and/or operations, changes in government regulations and other factors, including any such impacts of, or actions in response to the COVID-19 health crisis; our outlook, priorities, growth opportunities in our medical radioisotope business; and guidance for 2022 and beyond. These forward-looking statements are based on current management expectations and involve a number of risks and uncertainties, including, among other things, the receipt and/or timing of government approvals; the extent to which the COVID-19 health crisis impacts our businesses; the impact of COVID-19 on our employees, contractors, suppliers, customers and other partners and their business activities; the extent to which the length and severity of the COVID-19 health crisis exceeds our current expectations; the potential recurrence or subsequent waves or strains of COVID-19 or similar diseases; the actions to contain the impact of such diseases and potential employee unrest; adverse changes in the industries in which we operate; termination, delays and other difficulties executing on contracts in backlog and adverse changes in the demand for or competitiveness of nuclear products and services. If one or more of these or other risks materialize, actual results may vary materially from those expressed. For a more complete discussion of these and other risks, please see BWXT’s filings with the Securities and Exchange Commission, including our most recent annual report on Form 10-K and subsequent quarterly reports on Form 10-Q. BWXT cautions not to place undue reliance on these forward-looking statements, which speak only as of the date of this presentation, and undertakes no obligation to update or revise any forward-looking statement, except to the extent required by applicable law.

# Welcome & Agenda

| | |
|---|---|
| **8:15 am** | **Welcome & Agenda**<br>**Mark Kratz -** *Vice President, Investor Relations* |
| **8:20 am** | **Opening Remarks**<br>**Robb LeMasters** *- Senior Vice President & CFO* |
| **8:30 am** | **BWXT Medical Overview**<br>**Dr. Jonathan Cirtain** *– President & CEO, BWXT Medical* |
| **8:55 am** | **Q&A Session** |
| **9:15 am** | **Safety Brief**<br>**Tim Mahilrajan –** *Director, Nuclear Regulatory & EH&S* |
| **9:30 am** | **Tour & In-Situ Progress Briefing** |
| **11:30 am** | **Post-tour Q&A** |
| **12:00 pm** | **Lunch & Departure** |

# BWXT Medical business overview

**Jonathan Cirtain, Ph.D.**
CEO BWXT Medical and
Chief Development Officer

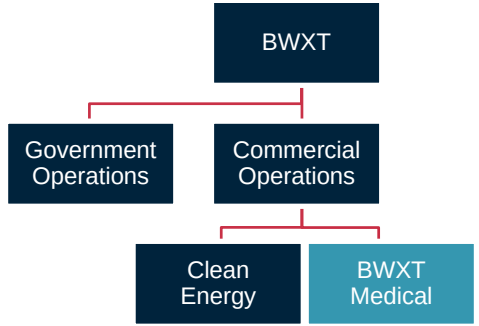
**Bill Riddoch, Ph.D.**
VP, Product Development
and Engineering

**Tamara Mills**
Director, Regulatory
Affairs

**Rachel Pickering**
VP, Operations

**Jeff Embt**
Head, Finance

- ~300 employees
- Broad bench of highly experienced nuclear medicine professionals
- Licenses to handle nuclear medical isotopes
- Decades-long relationships with industry partners
- 40,000 shipments to over 30 countries annually
- Experience across value and product lifecycle chain





**Kanata**

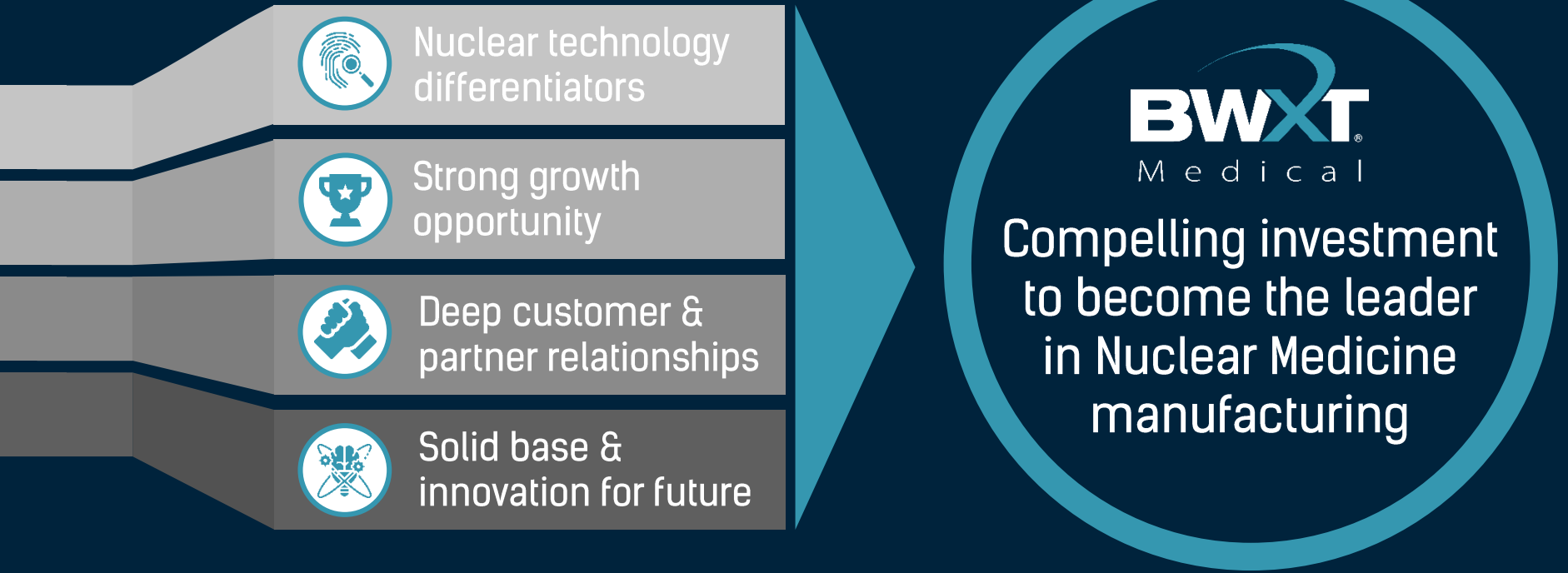
- Fully licensed ~90K ft² facility (CNSC, FDA, Health Canada)
- Broad isotope processing and CDMO infrastructure
- Large, difficult to source fleet of shipping containers
- ~250 employees

**Vancouver**

- 3 BWXT-owned cyclotrons
- Preferred access to TRIUMF's large cyclotron
- Manufacturing suites for sterilized products & early clinical production
- ~40 employees

**Lynchburg**

- R&D development hub
- Dedicated ~11K ft² laboratory space
- Broad isotope processing licenses
- Radiochemists and broad engineering support


Nuclear technology differentiators
Strong growth opportunity
Deep customer & partner relationships
Solid base & innovation for future
BWXT Medical
Compelling investment to become the leader in Nuclear Medicine manufacturing

# Nuclear medicine evolution: journey toward personalized medicine

## DIAGNOSIS

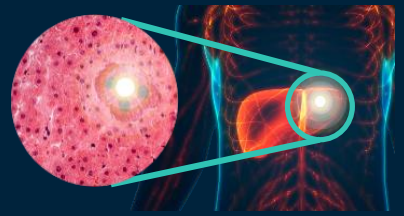
Diagnostic products use highly penetrating gamma emitting radiation that is detectable by cameras to image key areas

Patients are imaged, allowing clinicians to identify the location of the disease and organ defects.

Patients can then be selected for targeted therapies.

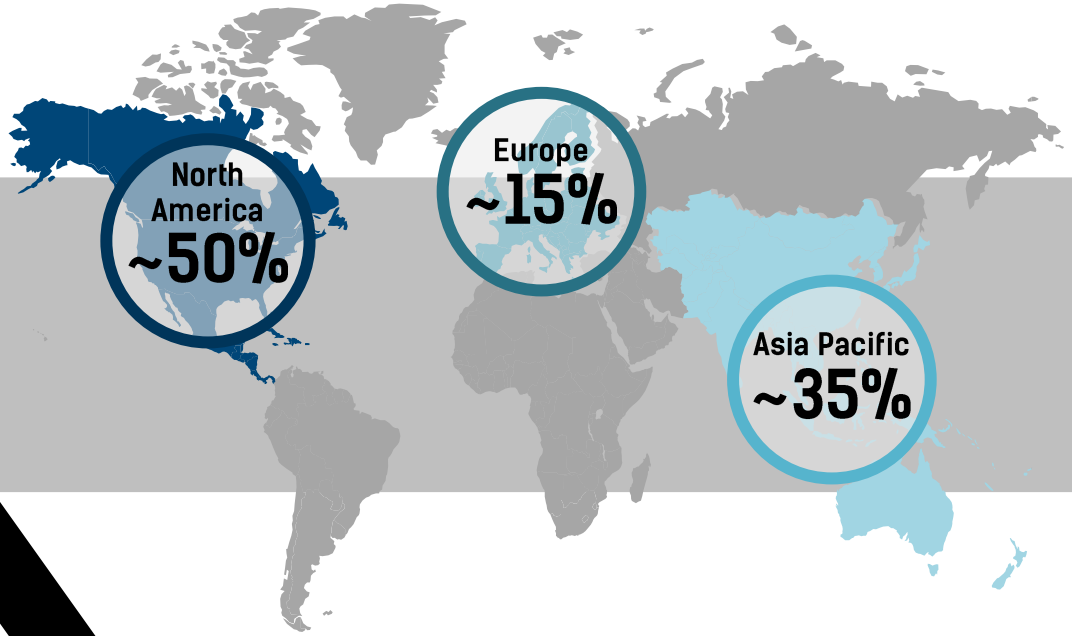
Emerging opportunities exist for combinations of diagnostic drug and therapeutic drugs called theranostics. Many are in clinical trials now.

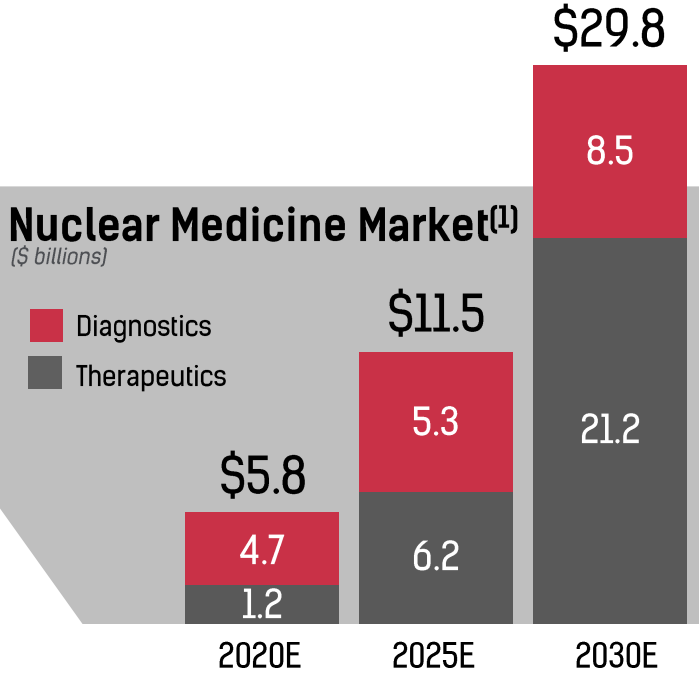
## THERAPY



Therapeutic products use low penetration beta or alpha emitting radioisotopes with high energy deposition to kill cancer cells

# Nuclear medicine: a growing global market driven by therapeutics




| | Diagnostics | Therapeutics | Total |
|---|---|---|---|
| CAGR 2020–2030 | 6% | 33% | 18% |

1) ©MEDraysintell Nuclear Medicine Report & Directory Edition 2020, www.medraysintell.com



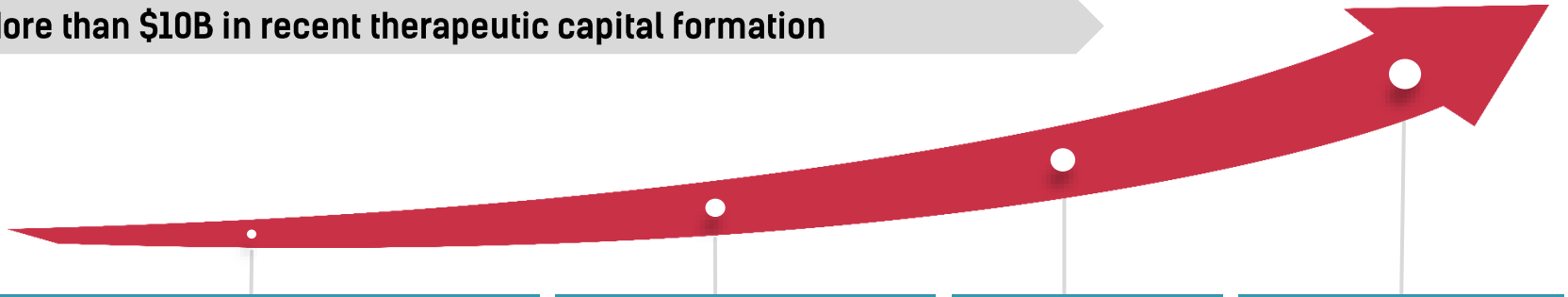
BWXT Medical

# Uniquely positioned between pharma and traditional nuclear medicine

| Irradiation process | Nuclear medicine manufacturing | Drug development and distribution |
|---|---|---|
| **Nuclear reactors**<br>ANSTO, Bruce Power, NTP Radioisotopes, Ontario Power Generation<br>BWXT partnership | **Isotope processing & production**<br>BWXT Medical, Jubilant Radiopharma, Curium, Lantheus Medical Imaging | **Drug development**<br>Bayer, Point Biopharma, Novartis, Fusion Pharmaceuticals |
| **Cyclotrons**<br>BWXT Medical, TRIUMF, Curium, GE Healthcare | **Radiopharmaceutical & contract drug manufacturing**<br>GE Healthcare, Jubilant Radiopharma, BWXT Medical, Curium, Lantheus Medical Imaging | **Radiopharmacies**<br>Cardinal Health, PharmaLogic, Jubilant Radiopharma<br>**Hospitals, physicians, technologists, patients** |
| **Global nuclear medicine market** | | |
| Share of selling price | One-Third of selling price | Two-Thirds of selling price |
| Financial risk | Low to Medium | High |

# Investor appetite across nuclear medicine landscape

## More than $10B in recent therapeutic capital formation



### Venture Capital (Companies)

RadioMedix · onco invent · NuView Life Sciences · RayzeBio · PRECIRIX · Philogen · D&D pharmatech · Radionetics · reflexion · MEVION · curie · NorthStar · SHINE

### Venture Capital (Investors)

BVF Partners L.P. · DEERFIELD Advancing Healthcare · EcoR1 Capital · FARALLON · Johnson & Johnson · SURVEYOR · OrbiMed · Perceptive Advisors · RA Capital · venBio · venrock · VIVO Capital · VERSANT ventures · VIDA · Viking

### Strategic Investments

ALGETA acquired by BAYER

Nordion A Sotera Health company acquired by BWXT

Advanced Accelerator Applications acquired by NOVARTIS

ENDOCYTE acquired by NOVARTIS

### Private Equity

CURIUM

PharmaLogic Take The Lead

### Public Companies

BWXT · Lantheus Holdings · TELIX Pharmaceuticals · POINT Biopharma · Eckert & Ziegler · AlphaTAU · Fusion Pharmaceuticals · CLARITY Pharmaceuticals · NORDIC NANOVECTOR



BWXT Medical

# Timeline of BWXT's presence in nuclear medicine

**1950-1960's**
Canadian Nuclear Labs allows distribution of isotopes for commercial purposes

**1970-1980's**
Canadian Nuclear Labs establish research facilities and begin producing Mo-99

**1990's**
TRIUMF and Nordion enter into long term irradiation agreement

**1991**
Nordion (a conglomeration of Canadian facilities and capabilities) acquired by MDS Health Group

**2014**
Nordion purchased by Sotera Health for $805 million

1950 1960 1970 1980 1990 2000 2010

**Nordion**

Producing Mo-99 with sporadic industry disruptions

**BWXT**

Producing and handling nuclear isotopes

1950 1960 1970 1980 1990 2000 2010

**1950's**
Begins making nuclear systems for US Navy

**1999**
Begins producing uranium targets for Mo-99 production

**2016**
BWXT begins Neutron Capture R&D

Nordion. A Sotera Health company

**2018**
BWXT acquires Nordion medical isotopes business for $213 million

FDA

**2022**
BWXT Medical files for FDA approval of Tc-99 generator

BWXT Medical

**2019-2022**
BWXT Medical stands up Tc-99m production effort and builds product portfolio

**2021**
Regulatory approval to install Darlington irradiation system

Global Leader in **Nuclear Medicine Manufacturing**



BWXT Medical

# Legacy Nordion platform and BWXT depth enabling right to win

**~130K sq. ft.**
Production Space

BWXT Medical

**~300**
Qualified Personnel

## Acquired Assets (Nordion)

+

BWXT

| | Kanata | Vancouver | Lynchburg |
|---|---|---|---|
| **Facilities** | Headquarters / Manufacturing | Manufacturing | Research & Development hub |
| **Irradiation** | **Cyclotron Irradiation** | **Radiation Safety and Handling** | **Nuclear Reactor Irradiation Services**; **CANDU Nuclear Expertise & Relationships** |
| **Capabilities** | Radiochemical Quality Control; Qualified Shipping Containers; Sterile Manufacturing; Radiochemical Manufacturing Capacity | | Complex Nuclear Radiochemistry Expertise; Vertically Integrated Manufacturing; Complex Nuclear Waste Management |
| **Relationships** | Health Canada; FDA; CNSC CCSN | | U.S.NRC; CNSC CCSN |

# BWXT Medical: three distinct platforms

## Tc-99m generator commercialization

- Differentiated Tc-99m technology
- State-of-the-art manufacturing & automation
- Tc-99m phased go-to-market
- Comprehensive diagnostic strategy

## Base Expansion: Utilize industry-leading capabilities

- Irradiation services
- Unique facilities and assets
- Leveraged BWXT capabilities
- Established nuclear medicine platform to enable growth

## Therapeutics: Innovate and leverage early lead

- Nuclear therapeutics revolutionizing medicine
- Significant investment and development for emerging drugs
- Building a nuclear therapeutic portfolio for growing demand

# Tc-99m generator commercialization: uses in diagnostic nuclear medicine

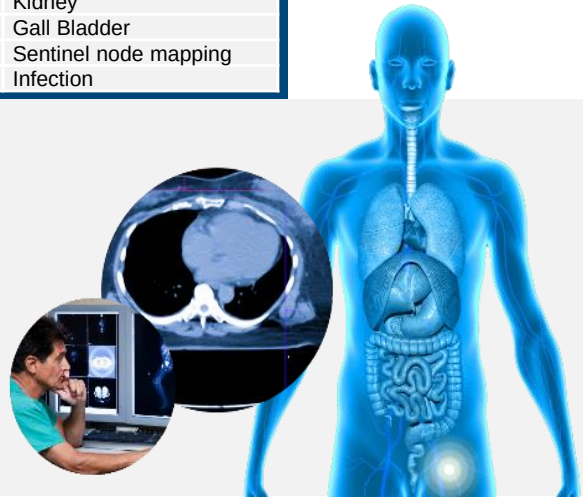
Cold Kit

| Product | Imaging target |
|---|---|
| Cardiolite<br>Myoview Pyp Ultratag | Cardiac |
| MAA/DTPA | Lungs |
| MDP/HDP | Bone |
| Mag-3 | Kidney |
| Mebrofenin | Gall Bladder |
| Sulfur Colloid Lymphoseek | Sentinel node mapping |
| Ceretec | Infection |

Tc-99m generator

$^{99}$Tc

Hot Kit



- Elute the generator to extract doses of Tc-99m pertechnetate
- Radiolabel Tc-99m with a cold kit – creates a “hot kit”
- Use hot kits to individually dose as requested at the hospital
- Inject into patient for imaging

*An irradiated element is separated in to a highly-chemically pure radiochemical (e.g. Mo-99). The radiochemical decays into the desired isotope (e.g. Tc-99m). Eluting will extract the Tc-99m from the Mo-99 that’s not yet decayed.*

# Tc-99m generator commercialization: BWXT's differentiated technology

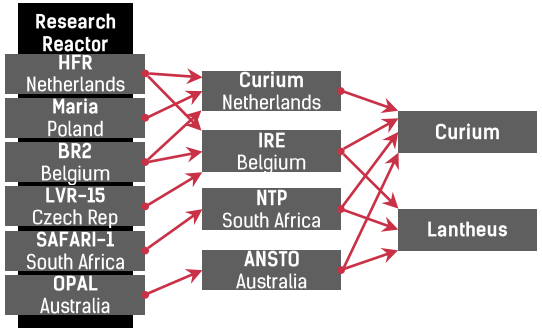
## Current supply dynamics

Use of enriched uranium

Aging reactors

Complex nuclear waste

***Complex supply chain***



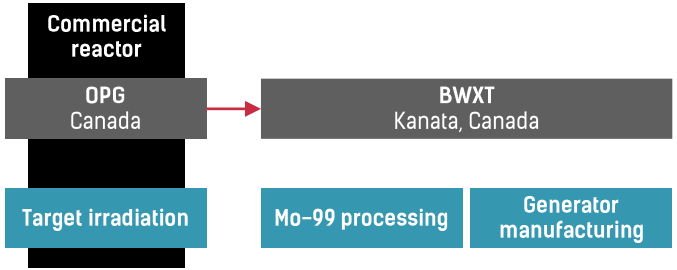

| *Fabrication* | *Irradiation* | *Processing* | *Facilities* |
|---|---|---|---|
| Transport | Transport | Transport | Transport |
| Proliferation risks | Unreliable sources | Fission waste (94%) | Not integrated |

## BWXT supply dynamics

Natural Molybdenum

Dependable reactors

Minimal, low-level waste




| *Fabrication* | *Irradiation* | *Processing* | *Facilities* |
|---|---|---|---|
| No proliferation risk | Highly reliable sources | No fission or costly waste | BWXT co-located |

**Lower Cost**

**More Reliable**

**Drop-in Replacement**



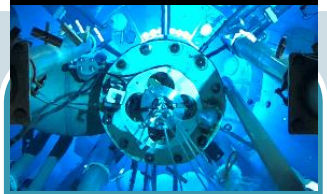
BWXT Medical

# Tc-99m generator commercialization: BWXT's manufacturing process

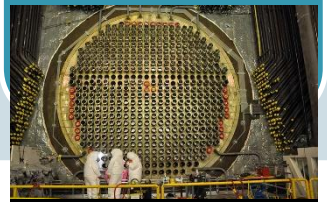
**Molybdenum target manufacturing**

**Molybdenum target irradiation**

**Various research reactors**



OR



**Ontario Power Generation's Darlington Commercial Power Reactor**

**Radiochemistry**
*(Drug Substance Manufacturing)*

- Target Receipt/Processing
- Chemistry process
- Filtration & drying
- Sizing & transfer to drug substance container

**Radiopharmacy**
*(Drug Product Manufacturing)*

- Drug substance dosing
- Elution/conditioning
- Antler installation & sealing
- Sterilization
- Generator assembly
- Labeling

**Packaging**

- Generator packaging/boxing
- Shipping labels
- Palletizing

# Tc-99m generator commercialization: Key phases of go-to-market strategy

**FDA Approval (MURR Production)**

**FDA Approval (OPG Production)**

**Inform market to establish access**

- Market to North American customers
- Secure multi-year supply agreements
- Develop order processing and delivery capabilities

**Enter Market & Prove Capability**

- Enter market with small-sized generators
- Establish multiple customers
- Demonstrate quality and delivery performance
- Expand small generator market share

**Scale-Up Production & Sales**

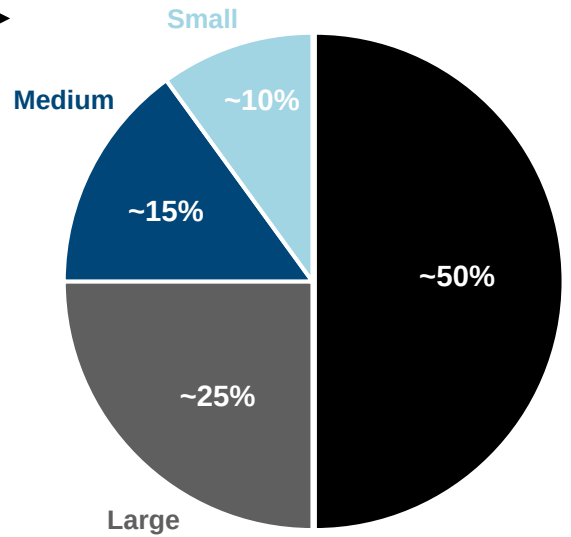
- Demonstrate production capacity and reliability from OPG's higher production irradiation
- Enter medium and large size generator market segment
- Secure agreements for increased supply
- Establish BWXT as a major market player

**Go Global**

- Supply Global Medical Solutions (Asia)
- Seek Potential Future Partners (Europe)

## $400M – $500M global Tc-99m generator sales by generator size in N.A.*

**North America** **Rest of the world**




*2022 BWXT Estimate

# Base business expansion: diagnostic isotopes

Developed post BWXT acquisition

| | 82 Sr Strontium-82 | 111 In Indium-111 | 123 I Iodine-123 | 123 I Iodine-123 MIBG | 111 In Indium Oxine | 68 Ge Germanium-68 |
|---|---|---|---|---|---|---|
| **Products** | cGMP PET isotope with DMF | n.c.a. SPECT isotope with DMF | n.c.a. SPECT isotope with DMF | I-123 MIBG generic drug product | In-111 Oxine Drug Product | cGMP PET isotope with DMF |
| **Use** | Parent isotope to produce Rb-82 – a PET isotope for Cardiac imaging | Cancer diagnosis & therapy monitoring | Cancer & neurology imaging | Drug product for cancer tumor imaging, used in pairs with therapeutics | Drug product for infection imaging | Parent isotope to produce Ga-68 for cancer imaging |
| **Customers** | BRACCO, JUBILANT LIFESCIENCES | Fusion, cpdc | CardinalHealth, JUBILANT LIFESCIENCES, UPPI, Small RPs | Commercial sales to start in 2023 | CardinalHealth, JUBILANT LIFESCIENCES, UPPI, Small RPs | itm, IRE |
| **Segment** *(Relative)* | Size: ● Growth: ↑ | Size: ◔ Growth: ↑↑↑ | Size: ◑ Growth: ↔ | Size: ● Growth: ↑ | Size: ◔ Growth: ↔ | Size: ◔ Growth: ↑↑ |

*Abbreviations/Acronyms: Cgmp = Current Good Manufacturing Practice, n.c.a.= non-carrier added, DMF = Drug Master File, SPECT = Single-Photon Emission Computerized Tomography PET = Positron Emission Tomograph, MIBG = meta-iodobenzylguanidine*

# Therapeutics: recognition of clinical breakthroughs

**Fusion Pharmaceuticals Announces First Patient Dosed in Phase 1/2 Study of FPI-1966 In Patients with Advanced Solid Tumors Expressing FGFR3** *(Cision PRNewswire, Aug 29, 2022)*

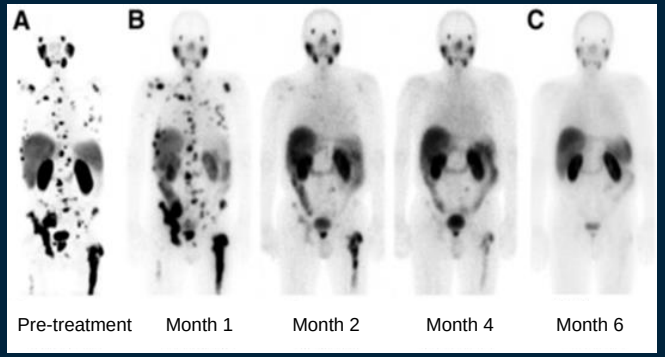
**Radiolabeled Antibodies for Cancer Imaging and Therapy** *(Cancers Journal; 11 March 2022)*

**Novartis announces positive result of phase III study in patients with advanced prostate cancer (**Novartis; 23 March 2021)

**FDA Approves New 68Ga Kit for Prostate Cancer PET** *(Journal of Nuclear Medicine February 2022, 63)*

**Phase III study of lutetium-177-PSMA-617 in patients with metastatic castration-resistant prostate cancer (VISION)** *(Meeting Abstract, 2021 ASCO)*

"Novartis today reported the first interpretable results of the Phase III VISION study evaluating the efficacy and safety of $^{177}$Lu-PSMA-617, a targeted radioligand therapy in patients with progressive PSMA-positive metastatic castration-resistant prostate cancer (mCRPC) compared to best standard of care alone."



# Therapeutics: key products developments and emerging pipeline products

## Companion Theranostic Radiopharmaceuticals

### Key Products

| | |
|---|---|
| LOCAMETZ® Kit for the preparation of gallium Ga 68 gozetotide | 2022 |
| illuccix® | 2021 |
| PYLARIFY® | 2021 |
| Detectnet™ | 2020 |
| NETSPOT® | 2016 |

### Key Pipeline Products

| | |
|---|---|
| F-18 rhPSMA (Ph. 3) | Bracco |
| Zr-89 Df-Crefmirlimab (Ph. 2) | ImaginAb |
| Ga-68 PSMA-R2 (Ph. 1) | Novartis |

## Beta Therapeutic Radiopharmaceuticals

### Key Products

| | |
|---|---|
| PLUVICTO™ lutetium Lu 177 vipivotide tetraxetan | 2022 |
| AZEDRA® iobenguane I 131 | 2018 |
| LUTATHERA® (lutetium Lu 177 dotatate) injection, for intravenous use | 2018 |
| THERASPHERE™ Y-90 Glass Microspheres | 2007 |

BWXT Medical CDMO

### Key Pipeline Products

| | |
|---|---|
| Solucin (Ph. 3) | itm |
| PSMA-I&T (Ph. 3) | Curium |
| PNT-2002 (Ph. 3) | POINT Biopharma |
| PNT-2003 (Ph. 3) | POINT Biopharma |
| LMI-1095 (Ph. 3) | Lantheus Holdings |
| Lu-177 rhPSMA (Ph. 3) | Bracco |

## Alpha Therapeutic Radiopharmaceuticals

### Key Products

| | |
|---|---|
| Xofigo® radium Ra 223 dichloride | 2022 |

### Select Key Pipeline Companies

- Ablaze
- Actinium Pharmaceuticals, Inc.
- AKTIS Oncology
- AlphaTAU
- alpha9 Theranostics
- Bayer
- curie Therapeutics
- Fusion Pharmaceuticals Inc.
- Novartis
- POINT Biopharma
- RayzeBio
- Advanced Accelerator Applications



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# Therapeutics: BWXT's key products

Developed post BWXT acquisition

| | $^{90}$Y TheraSphere™ | $^{225}$Ac Actinium-225 | $^{177}$Lu Lutetium-177 | $^{67}$Cu Copper-67 |
|---|---|---|---|---|
| **Products** | ○ Glass impregnated microspheres of Y-90<br>○ Individual-dosed radiopharmaceutical for Boston Scientific | ○ n.c.a. Ac-225 radiochemical at API cGMP purity<br>○ Could lead to finished Ac-225 radiopharmaceuticals | ○ n.c.a Lu-177 API cGMP radiochemical – requires DMF<br>○ Can be radiolabeled for therapeutic uses | ○ Cu-67 API cGMP radiochemical – requires DMF |
| **Use** | ○ Beta therapy used to treat liver cancer<br>○ Additional indication in clinical trials | ○ Target Alpha Therapeutic<br>○ Used in late stage solid tumor cancers | ○ Targeted beta therapy<br>○ Used for prostate cancer & neuroendocrine therapy | ○ Targeted beta therapy<br>○ Under clinical development for a variety of cancers |
| **Customers** | Boston Scientific | BAYER | Undisclosed | Undisclosed |
| **Recent Progress** | ○ **03/2021** Boston Scientific receives FDA approval for TheraSphere<br>○ **05/2021** BWXT Enters into new long-term, mutually exclusive agreement with Boston Scientific | ○ **12/2021** Demonstrated initial production chemistry method<br>○ **06/2022** Completed supply agreement with Bayer<br>○ **06/2022** Signed TRIUMF irradiation services agreement<br>○ **08/2022** Irradiated 1st target<br>○ **09/2022** Supply first clinical trial | ○ **05/2021** Demonstrated chemistry for pilot plant<br>○ **08/2021** Completed Yb-176 target design<br>○ **2022** Began irradiation project with MURR for radiochemical testing<br>○ **07/2022** Produced API-quality radiochemical and demonstrated Yb-recovery technology | ○ Cu-67 – Parties interested and samples in preparation |

## Therapeutic Innovation

- Leverage inherent unused capacity at facilities to deploy new isotope development and manufacturing opportunities
- Partner with customers to develop radioisotopes for clinical trials and then serve as manufacturer for the finished product



BWXT Medical

# BWXT Medical: three distinct platforms driving financial growth

## Tc-99m generator commercialization

- Near-term FDA approvals
- Phased entry into product sales
- Sales inflection post-OPG FDA amendment
- Expect significant long-term revenue growth

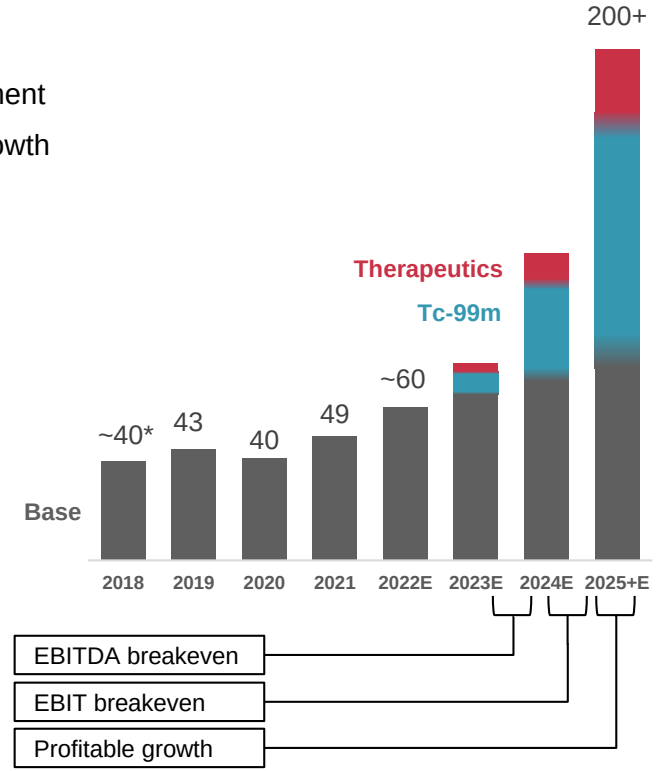
## Base Expansion: Utilize industry-leading capabilities

- Base diagnostics mid-single digit sales growth
- TheraSphere™ global expansion through Boston Scientific
- Expand diagnostic products with personalized medicine evolution

## Therapeutics: Innovate and leverage early lead

- Initial sales for therapeutic clinical trials near-term
- Securing long-term contracts for multiple clinical trials medium term
- Expect long-term demand growth

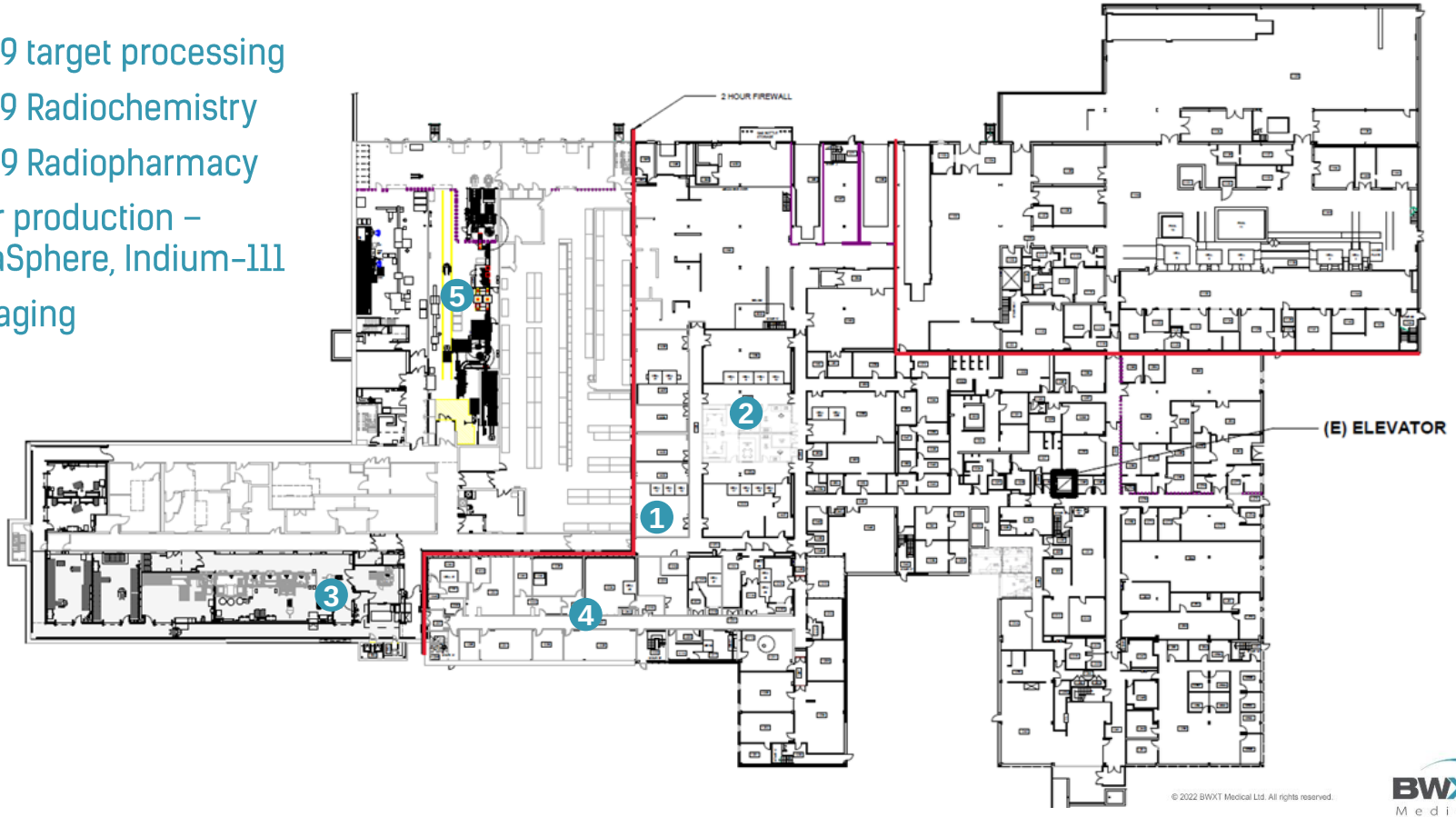
**BWXT Medical revenue** *($ million)*




** run-rate based on acquisition closed Aug. 6, 2018*

# Kanata facility tour

1. Mo-99 target processing
2. Mo-99 Radiochemistry
3. Mo-99 Radiopharmacy
4. Other production – TheraSphere, Indium-111
5. Packaging



# Appendix

# Expectations for BWXT's nuclear medicine manufacturing business[1]

| | R&D & acquire to accelerate | Tc-99m construction | Commercialize and ramp | Grow into global leader |
|---|---|---|---|---|
| | 2017 – 2018 | 2019 – 2021 | 2022 – 2024 | 2025+ |
| **Milestones** | • Tc-99m innovation<br>• Acquire facility / personnel | • Construct Tc-99m product line<br>• Expand to 7 active products | • Tc-99m FDA anticipated approval<br>• Expand therapeutic strategy | • 10+ products including therapeutic radioisotopes and finished drug |
| **Investment** | $213M acquisition | ~$300M capex | Modest | Modest |
| **Sales** | $45M acquired | $50M+ enhanced | $60M+ → $125M+ inflecting | $200M+ continued growth |
| **Tc-99m Start-up Costs** | Minimal | ($15M)–($20M) per annum | ($20M) per annum | |
| **Total BWXT Medical EBITDA** | $13M | ($5M)–($10M) per annum | <($10M) → $25M+ | $75M+ |
| **D&A** | ~$6M Nordion amortization per annum | | ~$20M Tc-99m D&A per annum (upon commercialization) | |
| **Value Creation** | ● + ● Innovative Tc-99m IP option + Acquired Business | ● Enhanced business + Tc-99m NPV + therapeutic option | ● Tc-99m and therapeutic portfolio begins generating meaningful profit | ● Significant value inside BWXT of a global nuclear medical mfg platform |

*1) unaudited, pro forma consolidated figures*

# BWXT Medical products


## Indium-111 Chloride Radiochemical Solution

Indium-111 Chloride is a diagnostic agent that can be used for radiolabeling targeted molecules or cells. Applications include the labeling of platelets for thrombus detection, labelled leukocytes for localization of inflammation and abscesses, as well as leukocyte kinetics.

### *Advantages*

- Key supplier to North American market since 1984
- High purity product
- Custom dispensing available for next day delivery

**World-Class Delivery Service**
BWXT Medical has a world-class distribution system and specialized order management system for reliable and flexible delivery throughout North America.

### *Other BWXT Products:*

- Indium (In-111) Oxyquinoline Solution (US Only)
- Indium-111 Chloride Radiochemical Solution
- Iodine-123 Sodium Iodide Radiochemical
- Iodine-123 Sodium Iodide Oral Solution (Canada Only)
- Strontium-82 Chloride Radiochemical Solution

### Process Data

**Nuclear Reaction**
$^{112}Cd\ (p,2n) \rightarrow {}^{111}In$

**Assay**
High resolution gamma spectrometry at 245.4 and 171.3 keV

### Product Specification

**Half Life**
2.8 days

**Normality**
0.05 N ± 0.01 N HCl

**Specific Activity**
≥ 50 mCi/µg (≥ 1.85 GBq/µg)

**Activity Concentration***
≥ 25 mCi/mL
(≥ 0.925 GBq/mL)

**Radiochemical Purity**
In-111 ≥ 95% is present as ionic form
Others ≤ 5%

**Radiopurity***
$^{111}In \geq 99.9\%$
Others ≤ 0.1%

**Chemical Purity***
Composite total metal ion content of Cd, Cu, Fe, Hg, Ni, Pb, Zn is ≤ 20 µg/mL

### Packaging

- Glass V-Vial with crimp cap (1, 3, 5 mL)
- Hypo-Vial with crimp cap (5, 10 mL)

### Product Origin

Vancouver, Canada

*At Noon Pacific Time, two (2) days after shipment.

Please note that the Indium-111 Chloride is not tested for sterility. An endotoxin monitoring program is in place. Verification of suitability for use in humans is the sole responsibility of the purchaser.



BWXT Medical

# BWXT Medical products


## Germanium–68 Chloride Radiochemical Solution

Germanium-68 (Ge-68) can be used in the production of Germanium-68/Gallium-68 (Ge-68/Ga-68) generators to extract the radioisotope Ga-68. Disease-targeting molecules radiolabeled with Ga-68 provide diagnostic images using positron emission tomography (PET) and can be used in direct tumour imaging. Other applications include the production of calibration sources for PET scanners.

BWXT Medical's proprietary manufacturing technology and distillation process produces high purity Ge-68 that can be supplied with high specific activity. Our experts will work together with you to optimize use of this product with your processes and applications.

### *Other BWXT Products:*

- Indium (In-111) Oxyquinoline Solution (US Only)
- Indium-111 Chloride Radiochemical Solution
- Iodine-123 Sodium Iodide Radiochemical
- Iodine-123 Sodium Iodide Oral Solution (Canada Only)
- Strontium-82 Chloride Radiochemical Solution

### Process Data

**Nuclear Reaction**
$^{69}$Ga (p,2n) → $^{68}$Ge

**Chemical Processing**
Wet chemistry separation and concentration of Germanium from dissolved target solutions.
Note: Solvent Extraction is not employed in the chemical processing.

**Assay**
High resolution gamma-ray spectrometry at 1077 keV and 511 keV by daughter $^{68}$Ga at secular equilibrium.

### Product Specification

**Half Life**
270.95 days

**Chemical Form**
Germanium (IV) Chloride in dilute hydrochloric acid

**Specific Activity***
≥ 2500 mCi/mg (≥92.5 GBq/mg)

**Activity Concentration***
≥ 40 mCi/mL (1.48 GBq/mL)

**Radiopurity***
$^{68}$Ge ≥99.9%
Others ≤ 0.1% other nuclides
Note: Excludes $^{71}$Ge

**Chemical Purity**
Co, Cu, Fe, Ni, Pb, Zn and Nb are: < 1 µg /mCi each
Ga is: < 2 µg /mCi

*Specific Activity, Activity Concentration and Radiopurity specifications are at reference date.

Please note that the Germanium-68 Chloride is not tested for sterility or pyrogenicity.

Verification of its suitability for use in humans is the sole responsibility of the purchaser.

### Packaging

- V-Vial (3, 5 mL)
- Quartz Lined Vial (2, 10, 20 mL)

### *Advantages*

**Our novel distillation and purification process:**
- Uses no organic solvents
- Produces high radionuclidic purity Ge-68
- Allows for high activity concentration

**Our state of the art facility features:**
- High supply capability
- Custom dispensing

**As a collaborative partner we:**
- Share technical expertise
- Strive for mutual success

**World-Class Delivery Service**
BWXT medical has a world-class distribution system - our extensive experience and carefully managed transportation logistics mean products reach your destination on time.



BWXT Medical

# BWXT Medical products

## $^{123}I$ Iodine-123 Sodium Radiochemical Solution

Iodine-123 can be used for a wide range of clinical imaging applications in endocrinology, neurology, oncology and cardiology. It is also an ideal research tool because of its short half-life, clear SPECT images, and ease of handling.

BWXT Medical offers Sodium Iodide in solution and dry forms, with multiple shipment days available per week and next day delivery across North America.

### *Advantages*

- Key supplier to North American market since 1984
- High quality product, preservative free
- Custom dispensing available for next day delivery
- Available in solution and dry forms

**World-Class Delivery Service**
BWXT Medical has a world-class distribution system and specialized order management system. Our extensive experience and carefully managed transportation logistics mean products reach your destination on time.

### *Other BWXT Products:*

- Indium (In-111) Oxyquinoline Solution (US Only)
- Indium-111 Chloride Radiochemical Solution
- Iodine-123 Sodium Iodide Oral Solution (Canada Only)
- Germanium-68 Chloride Radiochemical Solution
- Strontium-82 Chloride Radiochemical Solution

### Process Data

**Nuclear Reaction**
Primary
$^{124}Xe$ (p,2n) $^{123}Cs \rightarrow {}^{123}Xe \rightarrow {}^{123}I$
Secondary
$^{124}Xe$ (p,pn) $^{123}Xe \rightarrow {}^{123}I$

**Assay**
High resolution gamma-ray spectrometry at 159 keV

### Product Specification

**Half-Life:**
13.2 hours

**Solution Form**
Sodium iodide in 0.1N NaOH

**Dry Form**
Sodium iodide in 0.1N NaOH evaporated to dryness under nitrogen.

**Specific Activity***
No carrier added

**Activity Concentration***
At customer request

**Radiochemical Purity**
≥ 95% iodide

**Radiopurity***
≥ 99.8% $^{123}I$
≤ 0.2% total other nuclides

*At noon, Pacific Time, one day after shipment.

Please note that the radiochemicals listed are not tested for sterility or pyrogenicity. Verification of their suitability for use in humans is the sole responsibility of the purchaser

### Packaging

- V-vial with (1, 3, 5 mL)
- Glass vial (6, 10 mL)

### Product Origin

Vancouver, Canada



BWXT Medical

# BWXT Medical products


## Strontium-82 Chloride Radiochemical Solution

Strontium-82 Chloride is used in the manufacturing of Rubidium-82 generators. These generator systems make Rubidium-82 – a Positron Emission Tomography (PET) agent used in myocardial perfusion imaging for patients with suspected or existing coronary artery disease.

Our experts will work closely with you to optimize product and delivery options based on your needs.

### Advantages

- Key global supplier since 1989
- High quality product
- Multiple irradiation partners for highly scalable production
- Work collaboratively with customers to reliably meet changing market needs

**World-Class Delivery Service**
BWXT Medical has a world-class distribution system and specialized order management system. Our extensive experience and carefully managed transportation logistics mean products reach your destination on time.

### Other BWXT Products:

- Indium (In-111) Oxyquinoline Solution (US only)
- Indium-111 Chloride Radiochemical Solution
- Iodine-123 Sodium Iodide Radiochemical
- Iodine-123 Sodium Iodide Oral Solution (Canada only)
- Germanium-68 Chloride Radiochemical Solution

### Process Data

**Nuclear Reaction**
$^{85}Rb$ (p, 4n) → $^{82}Sr$

**Assay**
High resolution gamma spectrometry at 511 and 776.5 keV via the Rb-82 daughter at equilibrium

### Product Specification

**Half-Life:**
25.35 days

**Chemical Form**
Strontium in 0.1 ± 0.05N hydrochloric acid

**Normality**
0.1 ± 0.05N HCl

**Specific Activity***
No carrier added, ≥ 25 mCi/mg
(≥ 0.92 GBq/mg)

**Activity Concentration***
≥ 50 mCi/mL (≥ 1.85 GBq/mL)

**Radiopurity***
≤ 5.0 mCi 85Sr/mCi 82Sr
(≤ 5.0 GBq 85Sr/GBq 82Sr)
≤ 0.0015 mCi 83Rb/mCi 82Sr
(≤ 0.0015 MBq 83Rb/MBq 82Sr)
≤ 0.0015 mCi 84Rb/mCi 82Sr
(≤ 0.0015 MBq 84Rb/MBq 82Sr)
≤ 0.0015 mCi 83Sr/mCi 82Sr
(≤ 0.0015 MBq 83Sr/MBq 82Sr)
≤ 0.0002 mCi 131Ba/mCi 82Sr
(≤ 0.0002 MBq 131Ba/MBq 82Sr)

**Others**
≤ 0.01 mCi other nuclides/mCi $^{82}Sr$

*Radiopurity specifications are at noon Eastern Time, typically seven (7) days after ship date. Activity specification is at noon Eastern Time on ship date.

Please note that the Strontium-82 Chloride is not tested for sterility or pyrogenicity. Verification of its suitability for use in humans is the sole responsibility of the purchaser.

### Packaging

- Hypovial (10 mL, 20 mL)



BWXT Medical

# BWXT Medical products

## TheraSphere™
for Boston Scientific Corporation

Developed for the treatment of patients with hepatocellular carcinoma (HCC), TheraSphere™ treatment is comprised of millions of glass microspheres containing radioactive Yttrium-90, which are delivered directly to liver tumors via catheter and result in minimal exposure to surrounding healthy tissue.

**Product Specifications and Sizes**
TheraSphere consists of Y90 glass microspheres used in radiation treatment for patients with hepatic malignancies.

**TheraSphere**
Insoluble glass microspheres with a mean diameter of 15 to 35 µm
Y90 is an integral constituent of the glass

**Yttrium-90 (Y-90)**
Pure beta emitter
Average energy of 0.9367 MeV
Average tissue penetration range of 2.5 mm (max. 11 mm)

*Source: Boston Scientific Corporation website*

***Advantages***

- Contract manufacturer of TheraSphere™ to Boston Scientific Corp
- Long term manufacturing agreement was executed in May of 2021
- BWXT Medical will invest in automating the production process, thereby significantly increasing capacity and dependability to support growing global demand for TheraSphere