The IAEA's Role in Advancing Radiation Science and Technology

Celina Horak, SH-RCRT

IAEA Medium Term Strategy 2024–2029

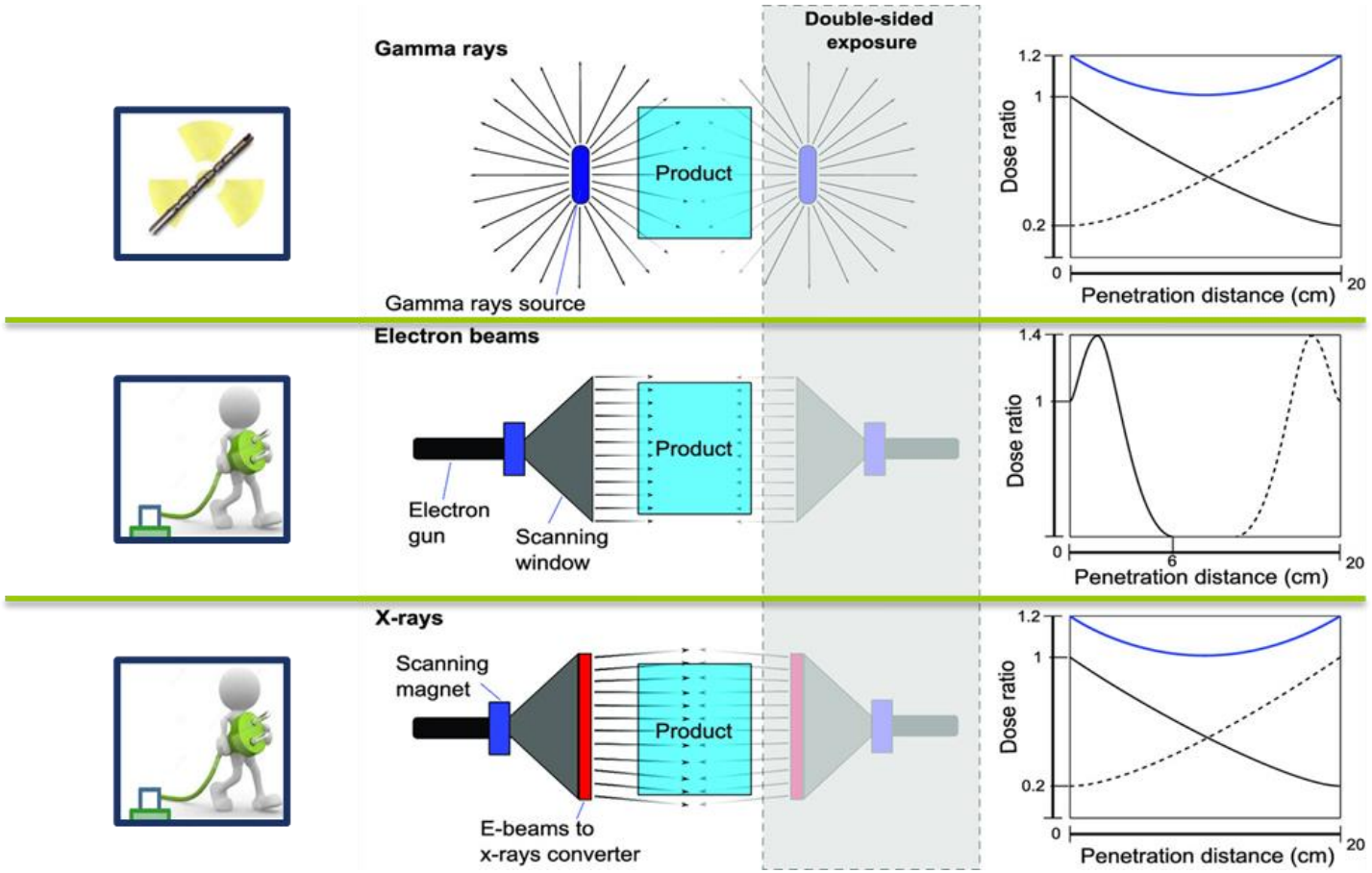
"the Agency will support the building of nuclear science competencies in Member States which chose to use radiation technologies. The Agency will also continue to provide an essential forum for disseminating information on technological developments

*The Agency's strategy for **radioactive sources** aims to enhance global safety, security, and management, ensuring safe use and minimizing risks. It also strengthens control measures to prevent illicit activities.*

*..."the Agency will continue to explore the **use of accelerators** for various radiation technology applications and to promote applications of advanced nuclear/radiation techniques for industrial development..."*

What can the IAEA do?

Radiation Technology



Radiation Sources:

- Radioisotope sources (Gamma ray)
- Radiation Generators (EB, X ray)

Quality Management:

- Inter-Comparison Dosimetry
- IQ, OQ, PQ

Guidelines:

- Setting-up facilities
- Feasibility studies

Training program for E-beam processing:

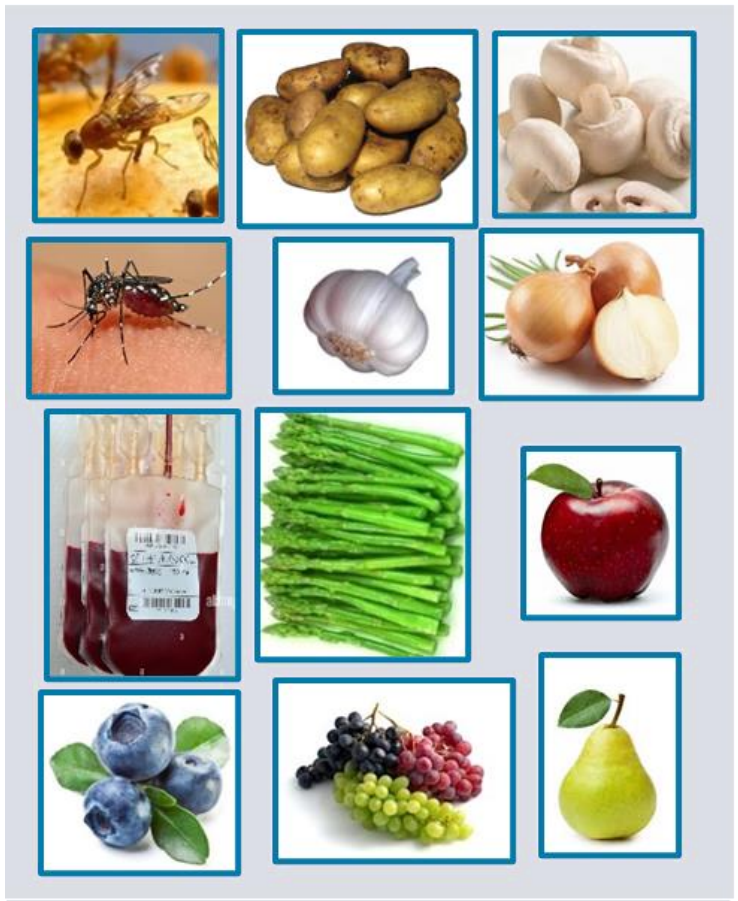
Fundamentals, Advanced, Operational, Quality Management, and Simulation

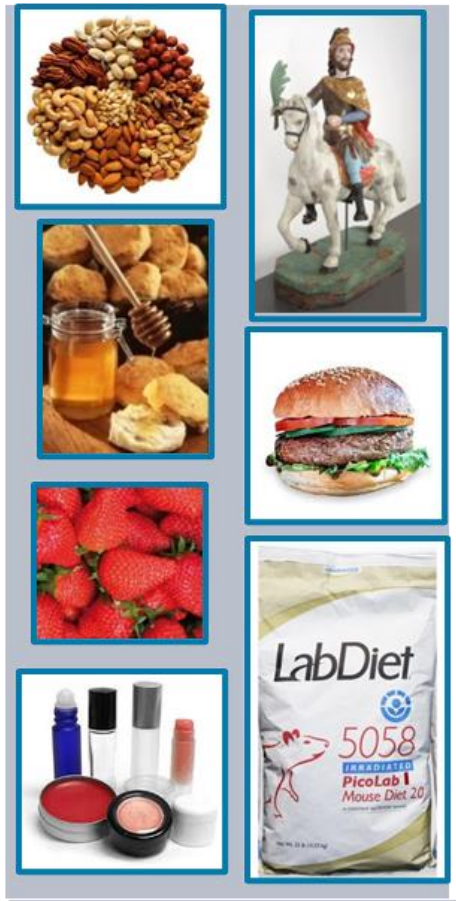
Safety and Securities:

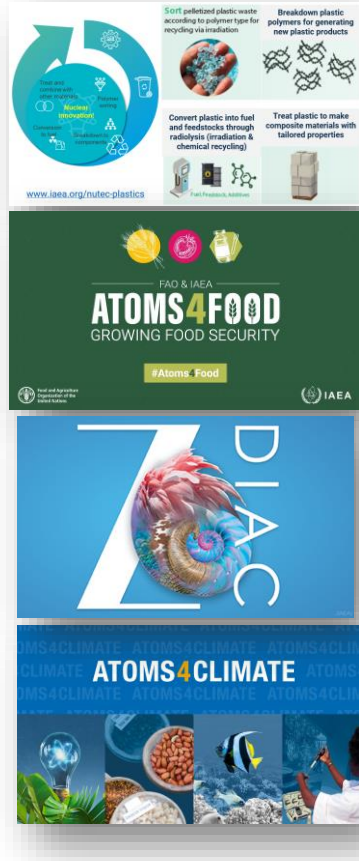
- Maintenance and Upgrade
- Safety program implementation

What can the IAEA do?

Radiation Applications



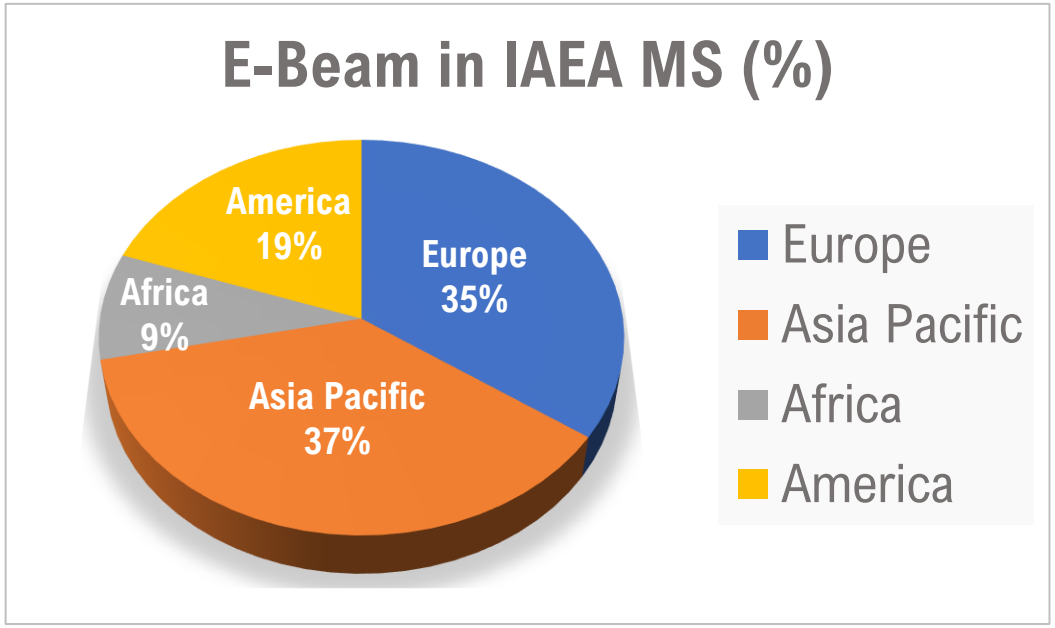




Current trend on radiation technologies:

Increased demand on E-Beam technology!!

Region	MS	Ms with EB (2024)
Europe	48	15
Africa	52	4
Asia Pacific	46	15
America (N & S)	34	6
Total number of EB	**180**	**40**



What can the IAEA do more to help?

1. Organization of strategic Meetings

2. Transportable E-Beam for training, promotion, on-site demonstration

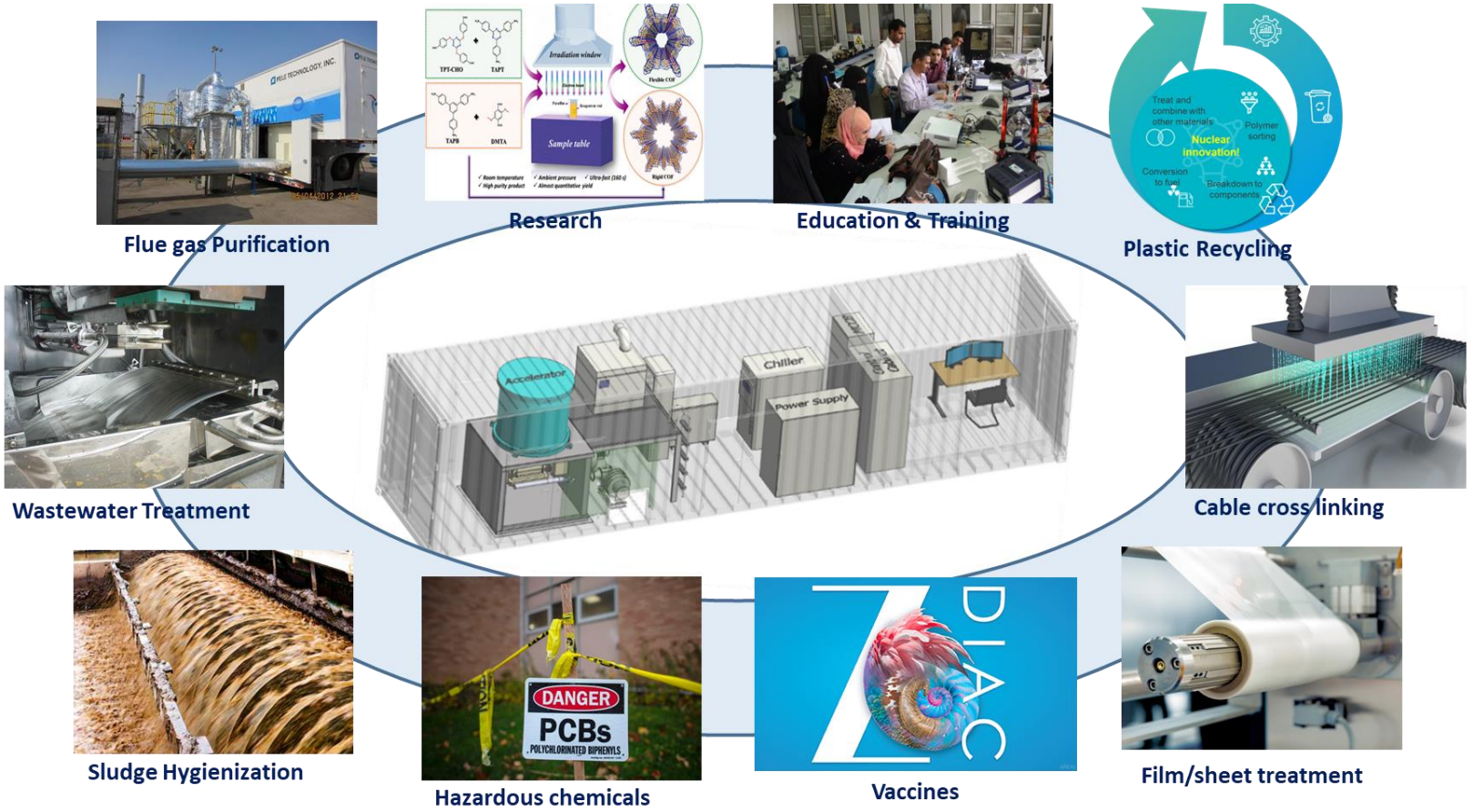
3. Making electron accelerators technology accessible to Member States

- to find the best solution to MS
- to share the technology advancement, from concept idea
- to provide the optimal radiation sources/configuration to IAEA initiatives: + NUTEC Plastic Recycling,
  + Atoms for Climate,
  + Atoms for Food,
  + Zodiac.

What can the IAEA do more to help?

2 **Train countries on the required roadmap for establishing the technology, provide hand-on training and potential applications;**

Transportable Electron Beam in IAEA



What can the IAEA do more to help?

2 **Train countries on the required roadmap for establishing the technology, provide hand-on training and potential applications;**

Transportable Electron Beam in IAEA

1. **Pilot scale Demonstration**

- Flue gases/VOCs from Power plants, Marine diesel, Industries (2,000 Nm^3/h at 15 kGy max.)
- Water/Wastewater from Industries, Municipal WW plant (500 m^3/d at 2 kGy max.)
- Liquid sludge from Municipal WW plant (200 m^3/d at 5 kGy max.)

2. **Removal of Hazardous industrial Wastes** on the site

PCBs, Pesticides, POPs in limited storage

Remediation of contaminated environment from disasters

3. Demonstration of **Polymer Modification and Recycling**

Cross-linking of Wire/Cable.

Films/sheet for industrial uses.

Treatment of plastic wastes

What can the IAEA do more to help?

3 **Making electron accelerators accessible for Member States for both research and industrial applications.**
Generic specifications at an appropriate price through group (bulk) purchasing – long-term procurement

Concept Note

Electron beams for Development

Enhance the capabilities of interested Member States in using electron accelerators to bridge the gaps between advanced and developing countries
in the adoption of radiation technologies for both research and industrial applications.

What can the IAEA do more to help?

3 **Making electron accelerators accessible for Member States for both research and industrial applications.**
Generic specifications at an appropriate price through group (bulk) purchasing – long-term procurement

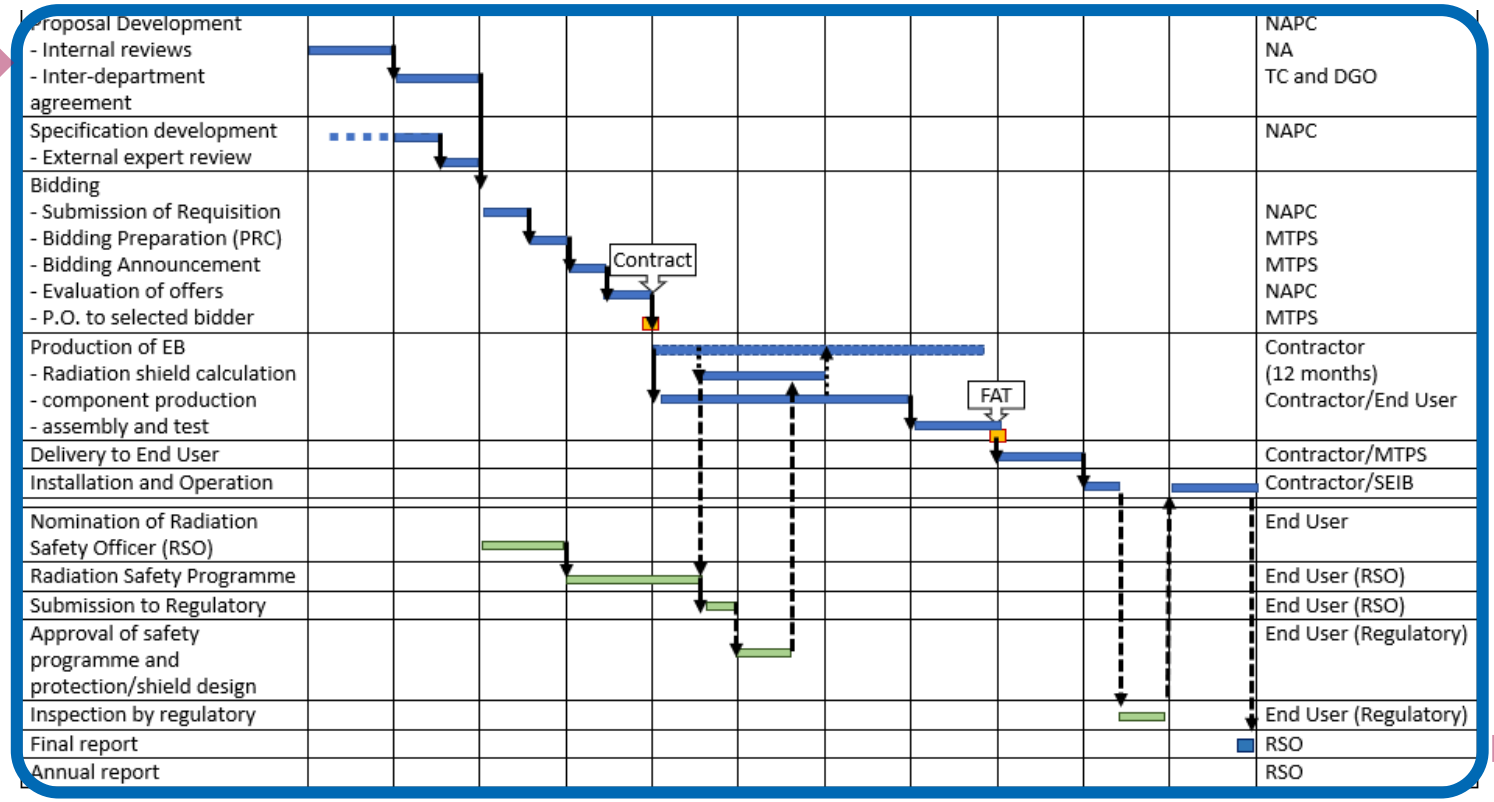
Baby Project:	**Purpose**	**- Alternative to small self-contained gamma irradiators** **- To introduce the radiation technologies to the developing countries**
	Specification	Beam energy: up to **2 MeV** max. Beam power: **1-2 kW** Beam extraction: **40 cm scanner** (single scan) Shielding: **self-shielded** (or partial shielded)

Star Project:	**Purpose**	Countries with enough experience and regulatory framework, **As alternative to Gamma irradiation facility**
	Specification	Beam energy: **10 MeV** Beam power: **20 kW** Beam extraction: **60 cm scanner** (single or double scan) Shielding: **concrete-shielded** (borne by the Recipient)

What can the IAEA do more to help?

3 **Making electron accelerators accessible for Member States for both research and industrial applications. Generic specifications at an appropriate price through group (bulk) purchasing – long-term procurement**

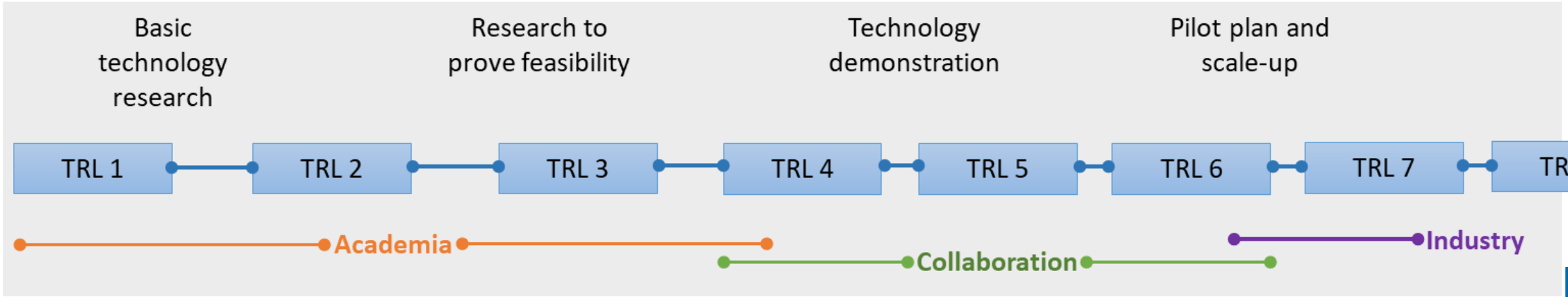
1 → 2 →



→ 4 → 5 →

What IAEA does?

Mechanisms



What IAEA does?

R&D: Coordinated Research Projects (CRPs)

- **Health Applications:**

2 ongoing:

Enhancing the Beneficial Effects of Radiation Processing in Nanotechnology (2019 – 2024)

Radiation Effects on Polymer Materials Commonly Used in Medical Devices (2021 – 2025)

1 planned:

NEW Biomaterials for sustainable health care (2025 - 2029)

- **Material modification**

2 ongoing:

Development of Radiation-Grafted Membranes for Cleaner and Sustainable Energy (2019 – 2024)

Strengthening the Use of Biomass for Synthesis of Bioplastics and Other Compounds (2023 – 2027)

2 planned:

NEW Modelling and Simulations of Radiation Effects in Polymers (2026 – 2030)

NEW: Transforming plastic into a 'renewable' alternative to fossil-based production, with reduced environmental impact

What IAEA does?

R&D: Coordinated Research Projects (CRPs)

- Environmental Applications:

2 closed:
- Radiation Inactivation of Bio-Hazards Using High-Powered Electron Beam Accelerators 2018 - 2024
- Radiation Technologies for Treatment of Emerging Organic Pollutants (2019 – 2024)

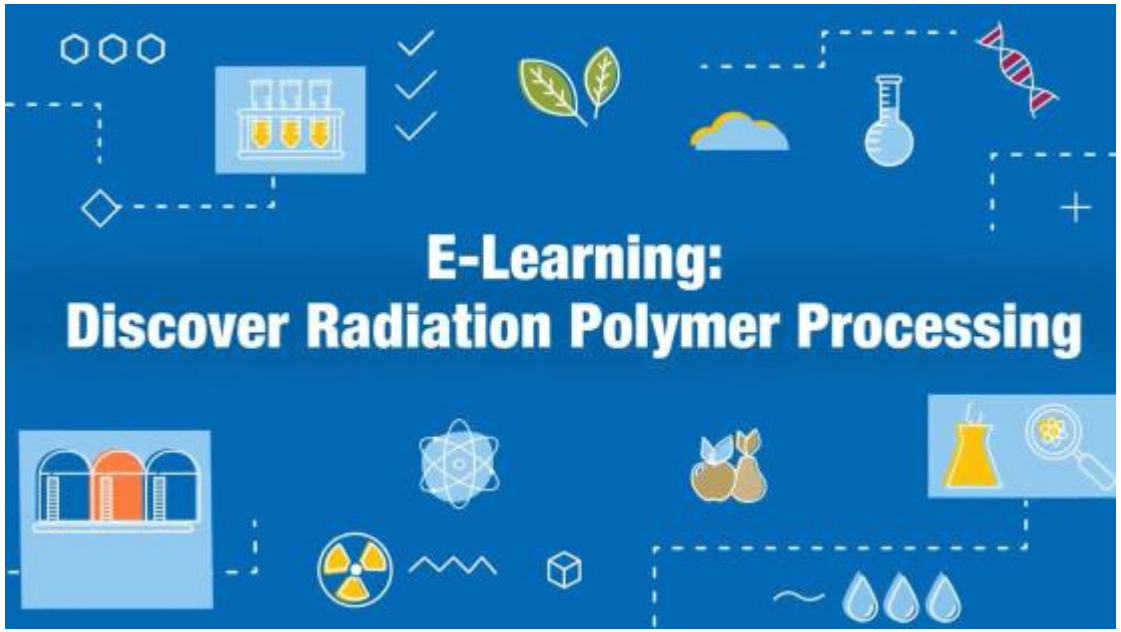
2 ongoing:
- Recycling of Polymer Waste for Structural and Non-Structural Materials (2021 – 2026)
- Mitigating Greenhouse Gases using Radiation (2025 – 2029)

- Cultural Heritage:

1 ongoing:
- Development and Implementation of Cultural Heritage Preservation using Ionizing Radiation Technology (2023 - 2027)

What IAEA does?

Education programme: e-learning



- Fundamentals of Radiation Technology
- Radiation processing of polymers
- Radiation-assisted environmental applications
- Training program for E-beam processing: Fundamentals, Advanced, Operational, Quality Management, and Simulation

What IAEA does?

Education programme: Guidelines/technical publications

Publication	Title	Expected publication
Textbook	• Nanomaterial synthesis and modification by ionizing radiation	1Q 2027
Radiation Technology Series	• Radiation processing: guidance for facility selection and upgrade	on hold
	• Best practices in disinfection of cultural heritage artefacts and archives using ionizing radiation	2Q 2025
	• Mathematical Modelling of Radiation Processing	4Q 2025
	• Guidelines for routine control and quality management of irradiation facilities	4Q 2026
	• Guidelines for Environmental Application of Ionizing radiation	2Q 2026
TECDOC	• Radiation-grafted Membrane for Cleaner and Sustainable Energy	4Q 2025
	• Instructive Surfaces and Scaffolds for Tissue Engineering Using Radiation Technology	on hold
	• Development and Implementation of Cultural Heritage Preservation using Ionizing Radiation Technology	3Q 2025
	• Enhancing the Beneficial Effects of Radiation Processing in Nanotechnology	3Q 2025
	• Radiation Based Technologies for Treatment of Emerging Organic Pollutants	3Q 2025
	• Advanced Electron Beams for Industrial Applications	4Q 2025
	• Quality Management of Irradiation Facilities	3Q 2025

C.Horak@iaea.org