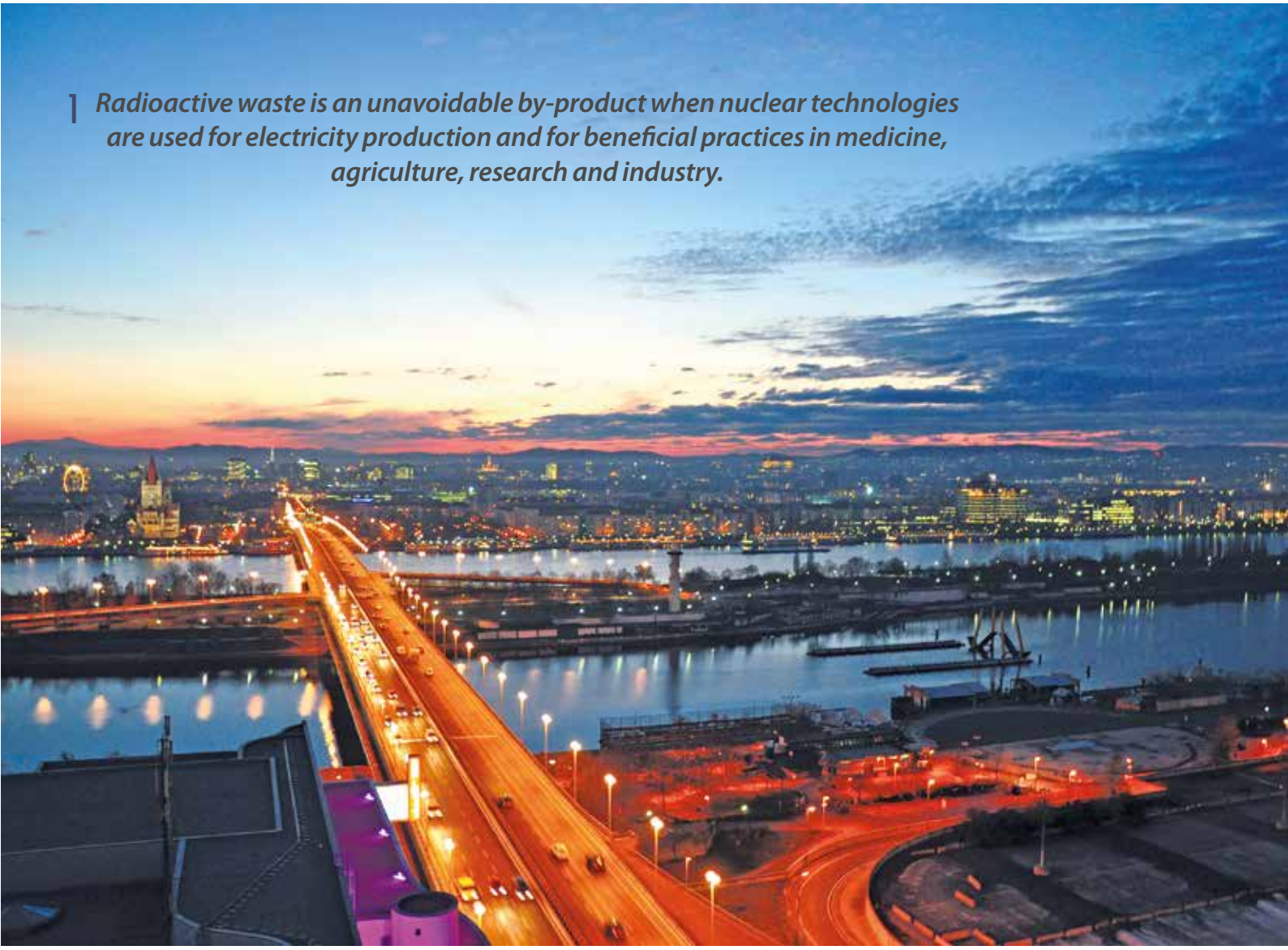
STEP-BY-STEP: LIFE CYCLE RADIOACTIVE WASTE MANAGEMENT

1 *Radioactive waste is an unavoidable by-product when nuclear technologies are used for electricity production and for beneficial practices in medicine, agriculture, research and industry.*



(Photo: Magdalena Ablanedo Alcala)

When the radioactivity of the waste is above a certain threshold, the waste requires special disposal methods. Through extensive research, standards and approaches have been developed for safely and securely preparing for and managing radioactive waste disposal.

In the course of its journey from the point of generation to disposal, radioactive waste undergoes a number of predisposal management treatment steps to transform it into a safe, stable and manageable form suitable for transport, storage and disposal.

Passive Active Neutron Differential Die-Away System (PANDDA™), a drum-monitoring high resolution gamma spectroscopy system

(Photo: Pajarito Scientific Corporation, USA)

Sorting box for waste segregation

(Photo: Dounreay Site Restoration Ltd and Nuclear Decommissioning Authority (NDA), UK)

2 Characterization

Characterization is a technique that provides information on the physical, chemical and radiological properties of the waste in order to identify appropriate safety requirements and potential treatment options, and to ensure compliance with accepted storage and disposal criteria. X-ray and other tomographic methods are also used to confirm the presence of or look for hazardous materials or prohibited items.

3 Pretreatment

Pretreatment activities prepare the waste for processing and may include sorting and separating different types of waste, as well as size reduction or shredding to optimize treatment and disposal. Decontamination techniques reduce the volume of waste requiring treatment thereby minimizing the disposal costs.

Supercompactor for solid waste drums

(Photo: Teollisuuden Voima Oyj (TVO), Finland)

Cement-encapsulated Magnox fuel-cladding at Sellafield

(Photo: Sellafield Sites, UK)

4 Treatment

Treatment activities focus on waste volume reduction, radionuclide removal from the waste, and often changing its physical and chemical composition. There are technologies to treat both liquid waste and solid waste.

5 Conditioning

Conditioning puts the waste in a safe, stable and manageable form for transport, storage and disposal. Common forms of conditioned waste for disposal are encapsulated or solidified waste in cement, bitumen or glass. Conditioning techniques are designed to slow the release of radionuclides from the disposed waste package into the environment.

Long term storage facility for low level waste
(Photo: Central Organization for Radioactive Waste (COVRA), Netherlands)

Low level waste disposal at the Centre de l'Aube facility
(Photo: National Radioactive Waste Management Agency (Andra), France)

Underground exploration to demonstrate feasibility of deep geological disposal for high level waste
(Photo: Posiva Oy, Finland)

6 Storage

Storage of untreated and treated waste must be safe, retrievable and secure. The storage requirements depend on the type of waste and may be short term to allow for radioactive decay or long term until the waste can be safely transferred to a suitable disposal site.

All waste storage facilities are required to have a regime to monitor the integrity of waste packaging to ensure the safety and protection of the environment.

7 Disposal

The appropriate disposal option and the extent of isolation and containment needed depend on the properties of the waste and the length of time the waste remains radioactive.

The suitability of waste for disposal in a particular facility must be demonstrated by the safety case and supporting safety assessment of the facility.

Text: IAEA Division of Nuclear Fuel Cycle and Waste Technology