Radioactive Waste Management: Practices for Safe and Effective Disposal

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Introduction

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Challenge of Radioactive Waste Management

Managing radioactive waste safely is a big challenge.

Radioactive waste can harm people and the environment if not handled properly.

UN’s SDG 12 addresses radioactive waste.

Introduction

Introduction
Magnitude of the Challenge

The annual generation of large amounts of radioactive waste with a long half-life is a concern

Inadequate management of radioactive waste can result in environmental and health risks

Introduction

The purpose of this study is to explore methods for the safe and effective disposal of radioactive waste.

Introduction

Map of Presentation:

Source and Types of Radioactive Waste

Safe Radioactive Waste Disposal Methods

Effectiveness and Practicality Analysis for Efficient Disposal Approach Determination

Management of Radioactive Waste for Environmental Protection and Human Health

Management of Radioactive Waste for Environmental Protection and Human Health

Managing radioactive waste is vital for health and environment

Waste is produced by nuclear power plants and other sources.

Radioactive waste has two main categories: high-level waste (HLW) and low-level waste (LLW).

Management of Radioactive Waste for Environmental Protection and Human Health

High - Level Waste

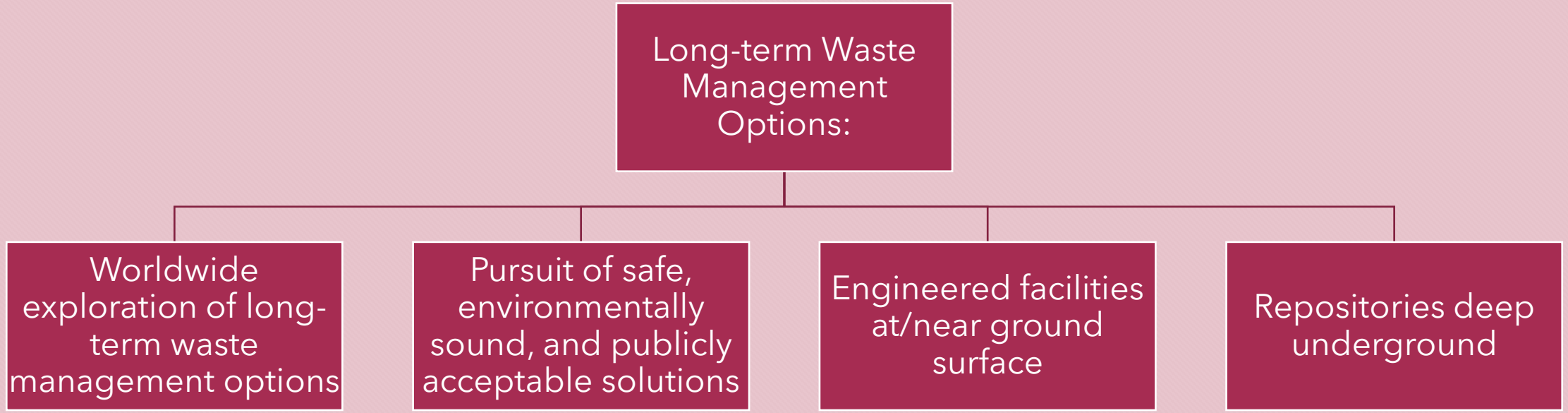
- High-level radioactive waste management is a major challenge
- It emits intense radiation and requires careful handling
- The goal is to isolate it from the environment and prevent leakage

Management of Radioactive Waste for Environmental Protection and Human Health

Low-Level Waste

- Proper management is required to avoid environmental contamination
- It can be disposed of in land-based facilities soon after packaging
- A satisfactory disposal means has been established and is being applied globally

Management of Radioactive Waste for Environmental Protection and Human Health



Safe Approaches to Waste Management

Safe Approaches to Waste Management

Exploring Safe and Effective Management Methods for Various Types of Radioactive Waste:

- *Temporary Storage*
- *Conditioning and encapsulation*
- *Final Disposal*
- *Transmutation*

Safe Approaches to Waste Management

Temporary Storage:

Special Facilities: Designed for waste storage

Environmental Isolation: Waste is kept separate from surroundings

Placement: Facilities can be situated above or below ground

Decay Period: Time for waste to cool and reduce radioactivity

Post-Cooling Process: Treatment or disposal of waste

Future Planning: Development of long-term disposal strategies

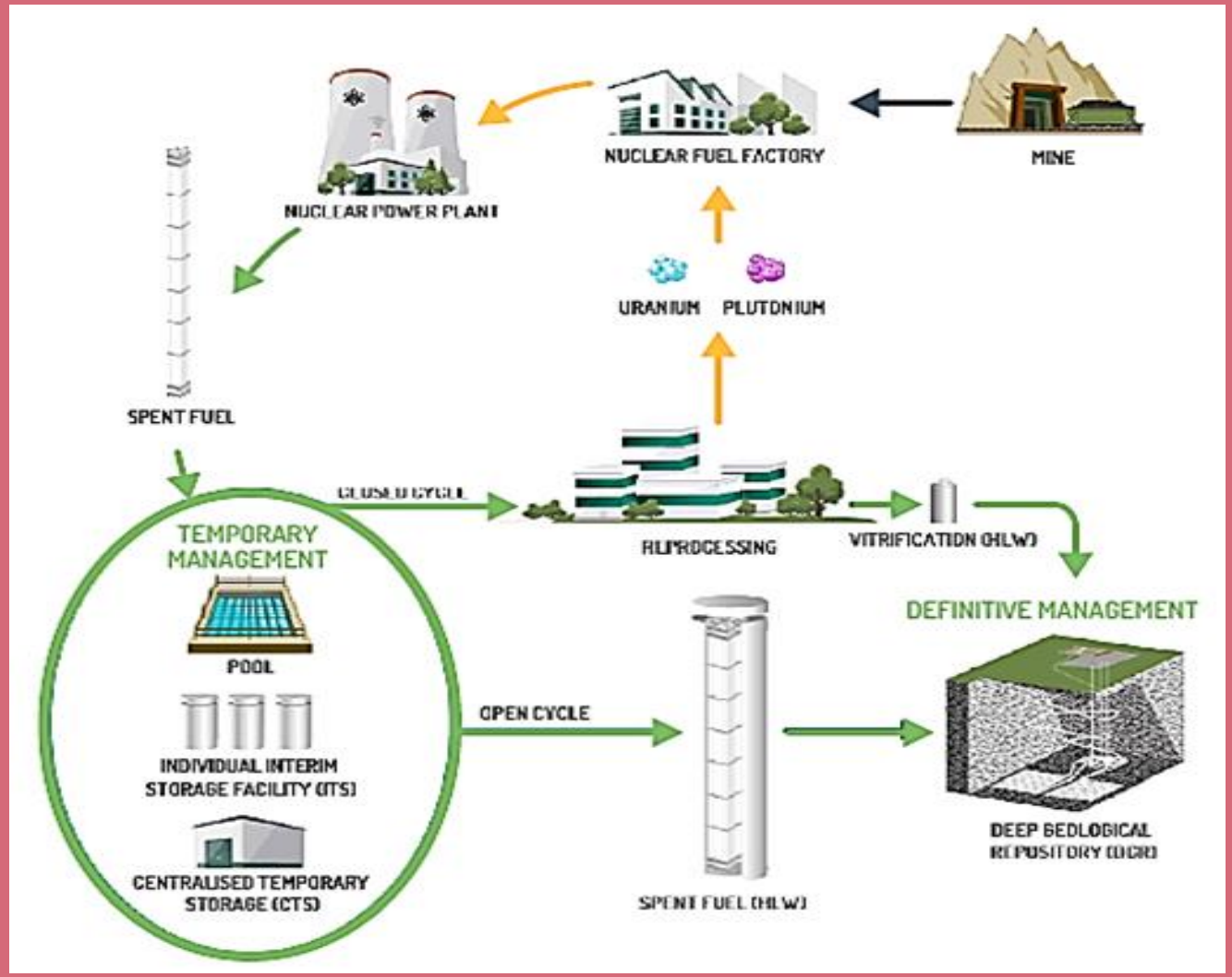


Fig. 1. Temporary Management [5]

Safe Approaches to Waste Management

Conditioning and encapsulation

Conditioning: Waste trasnformation

Encapsulation: Container storage

Stability: Solid, stable form

Processes: Compaction, incineration, vitrification, cementation

Barrier: Metal or concrete containers

Example: Vitrified waste treatment

Fig. 2. The process of compaction [6]

Safe Approaches to Waste Management

Final Disposal:

Final Disposal: Placement of waste in designed facilities

Isolation: Maintenance of waste separation from environment

Location: Choice of surface, intermediate, or deep underground

Long-term Safety: Assurance of no need for human surveillance or maintenance

Example: reference to Finland's Deep Geological Repository

Repository Features: Description of 400-450 meters deep, 70 km of tunnels and shafts

Waste Reception: Expectation to receive waste for about 100 years

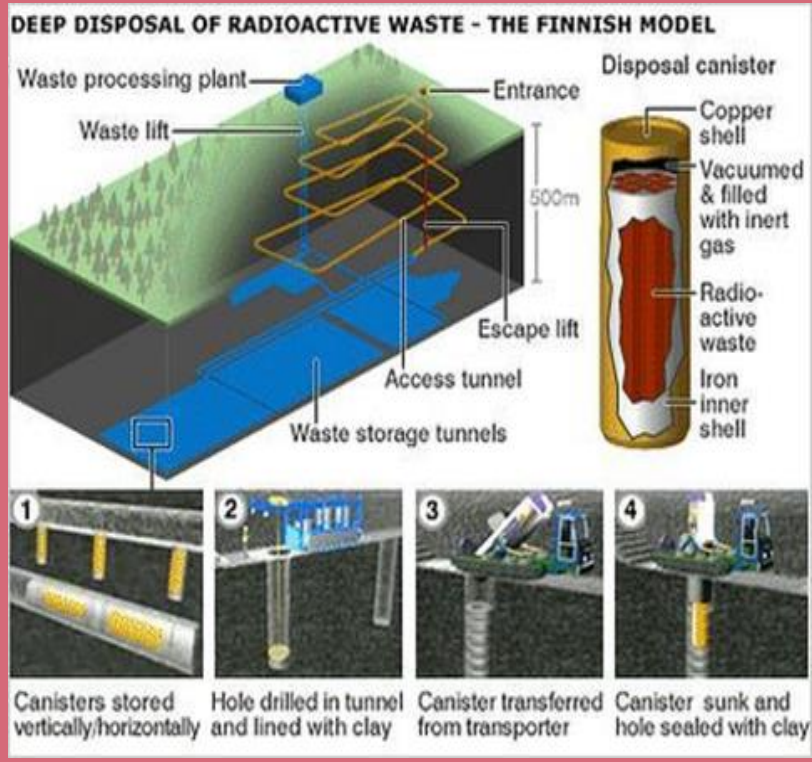


Fig. 3. Deep Disposal of Radioactive Waste [8]

Safe Approaches to Waste Management

Transmutation:

- **Transmutation** - Changing radionuclides
- **Nuclear Processes** - Using reactors, accelerators, neutron sources
- **Aim** - Decreasing waste amount and danger
- **Time Reduction** - Reducing time for final disposal
- **Example** - Introducing MYRRHA project
- **Feasibility Study** - Carrying out a technical and economic analysis

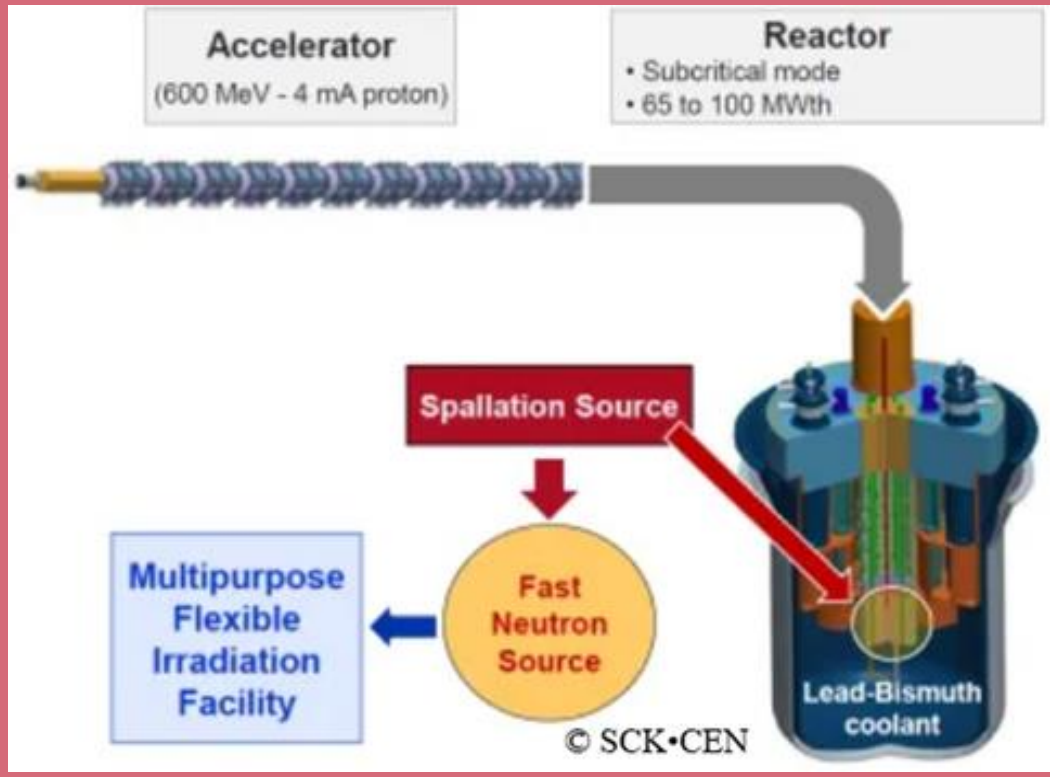


Fig. 4. MYRRHA (Multipurpose Hybrid Research Reactor for High-tech Applications) Project [9]

Radioactive Waste Management: A Sustainable Approach

Radioactive Waste Management: A Sustainable Approach

- **Optimal Approach:** Implementation of safe, effective disposal
- **Containment System**: Provision of secure housing for waste
- **Cutting-edge Materials:** Use of borosilicate glass, synthetic rock, ceramic
- **Surveillance Group:** Prevention of accidents
- **Safe Conveyance:** Enforcement of strict safety protocols
- **Geological Attributes:** Assurance of stable, safe formation
- **System Replacement:** Determination based on waste half-life
- **Outcome:** Achievement of safe disposal, environmental protection

CONCLUSION

CONCLUSION

Radioactive Waste Management : Crucial challenge for nuclear energy and sustainable development

Waste Types and Disposal Methods: Various facets explored, need for safe, long-term solutions

Global Significance: Large amounts of waste, enduring radioactivity, environmental protection and public acceptance

Research and Development : Vital for efficient, sustainable approaches, long-term strategies

Global Frameworks and Goals: Aligns with responsible resource utilization, engineers' responsibility

Outcome: Safe, sustainable solutions, environmental and human well-being

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Thank you!!

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