

Waste Minimization

- ❖ A goal for waste minimization is to reduce the impact to the environment from nuclear energy or applications by reducing the final volumes and activity of waste that requires storage, and, ultimately, long-term disposal.
- ❖ The Canadian Nuclear Safety Commission (CNSC) requires that waste owners in Canada minimize the generation of radioactive waste to the extent practicable.
- ❖ Canada has adopted a set of guiding principles, referred to as the waste hierarchy, for minimizing waste, particularly from decommissioning activities.
- ❖ As you read this discussion paper, please focus on and consider the following questions:
 1. What are your views on waste minimization? Should Canada continue to use the concept of the waste hierarchy?
 2. What should be the role of government, the regulator and waste owners with respect to minimizing radioactive waste?
 3. Are there other principles, beyond those identified by the International Atomic Energy Agency, that you feel are important to consider when designing and implementing a waste minimization program?

Why is waste minimization important?

Radioactive waste should be minimized in terms of quantity and activity. Minimizing the generation of radioactive waste means decreasing the volume of produced waste quantities to be transported, stored, and dispositioned. This, in turn, reduces the impact to the environment.

Waste Minimization in Canada

Radioactive waste management in Canada is based on the 'polluter pays' principle which means that it is the responsibility of waste owners to manage their waste in a safe and secure manner, to follow all regulatory requirements, and to protect the public and environment from the hazards of radioactive waste.

One of the key principles in International Atomic Energy Agency (IAEA) guidance on radioactive waste management is that the waste owner must minimize radioactive waste. This has been incorporated by the CNSC, Canada's nuclear regulator, into Regulatory Document REGDOC-2.11 [Framework for Radioactive Waste Management and Decommissioning in Canada](#). CNSC's REGDOC 2.11 further states that the waste owner must minimize the generation of radioactive waste to the extent practicable.

It is the responsibility of waste owners to develop a waste management program that considers the overall volume of radioactive waste requiring long-term management. Furthermore, they are also

expected to investigate and implement new radioactive waste management technologies and techniques to reduce their environmental footprint so that disposal volumes are minimized. Some of these strategies include:

- Reusing and recycling materials by separating radioactive components from non-radioactive components;
- Preventing contamination by restricting the amount of materials in radioactive areas; and
- Assessing technology advances in waste minimization, and implementing improvements to waste-handling facilities that reduce the volume of radioactive waste.

In every instance, methods used to minimize radioactive waste must ensure that the health and safety of persons and the environment are protected.

Waste minimization is important for decommissioning, as the process generates large quantities of radioactive waste in various forms such as solids, liquids and gases.

When is waste minimization appropriate?

In general, countries with a nuclear program have incorporated the requirement of radioactive waste minimization. For example, some countries, including Canada have adopted a waste hierarchy, an internationally recognized waste management approach, which defines a ranked list of management options, from most favoured to least favoured, based on factors including environmental impact. This hierarchy provides guidance to encourage waste producers to opt for waste management options with the lowest possible environmental impact. The waste hierarchy states that **prevention, reduction (minimization), re-using, and re-cycling**, should be favoured before disposal. Disposal is the only appropriate strategy if all other options have been exhausted.

How is waste minimized?

Waste minimization refers to reducing the physical volume and activity of waste through special practices as well as treatment and conditioning technologies, which could include some of the following steps:

Waste Segregation

Waste segregation refers to an activity where radioactive and non-radioactive materials are separated, after waste has been generated at the source. Through segregation, radioactive waste is separated based on physical, chemical, biological, or radiological properties, which facilitates its handling and processing. The main benefit of waste segregation is that separating non-radioactive waste from radioactive waste at the source reduces the volume of radioactive waste requiring storage or treatment. Furthermore, segregating different types of radioactive wastes will lead to more efficient waste processing and packaging.

Decontamination

Decontamination refers to the complete or partial removal of contamination from the surfaces of facilities or equipment by physical, chemical or biological processes. Decontamination is particularly important to minimize environmental impact by reducing the level of contamination of components or structures such that they can be disposed of at a lower treatment and disposal category.

Processing

Waste processing refers to any operation that changes the characteristics of waste, including pre-treatment, treatment, and conditioning. Processing can reduce the hazard potential and the volume of the waste and can occur in different stages. However, consideration should be made for early processing of waste to convert it to a passively safe form or to otherwise stabilize it. Options available for processing previously untreated or pretreated radioactive waste include incineration and compaction. These technologies are commonly practiced internationally to reduce the volume of mostly low-level and intermediate-level wastes.

The IAEA provides members with guidance material on the development of a fundamental and practical radioactive waste minimization strategy. Below is an overview of the waste minimization principles and guidance provided by the IAEA. The waste hierarchy is a guiding principle for waste minimization and aligns with the IAEA waste minimization fundamentals listed below.

International Context

As was discussed earlier, the waste hierarchy highlights the order of priority when it comes to practicing or implementing a waste minimization strategy. Similarly, the IAEA echoes the waste hierarchy in their breakdown of the fundamental principles of waste minimization. Outlined below are the fundamental principles that the IAEA states should be considered when designing and implementing a waste minimization program:

- Keep the generation of radioactive waste to the minimum possible or practicable;
- Minimize the spread of radioactivity leading to the creation of radioactive waste as much as possible by containing it to the greatest extent possible;
- Optimize possibilities for recycle and reuse of valuable components from existing and potential waste streams;
- Minimize the amount of radioactive waste that has been created by applying adequate treatment technology.

As an IAEA member state and in keeping with international requirements, Canada is committed to developing policies based on international best practices and IAEA guidance for radioactive wastes in Canada, including waste minimization.

We need to know

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