



NUCLEAR WASTE  
MANAGEMENT  
ORGANIZATION

SOCIÉTÉ DE GESTION  
DES DÉCHETS  
NUCLÉAIRES



## Nature of the Hazard

Used nuclear fuel is a potential health, safety and security hazard. It will need to be contained and isolated from people and the environment essentially indefinitely.

### Inherent Hazard

Used nuclear fuel is inherently hazardous to human health and the natural environment. It contains radioactive nuclides which can emit radiation in the form of electromagnetic radiation (e.g., X-rays, gamma rays) or high-energy particles (e.g., alpha particles, beta particles) (see NWMO Information Sheet *Health Effects of Radiation and Radioactivity*). Exposure to radiation can damage living tissue at the molecular level, and if the exposure is beyond the body's natural repair processes, it may lead to uncontrolled growth of cells (i.e., cancer) or more serious health effects.

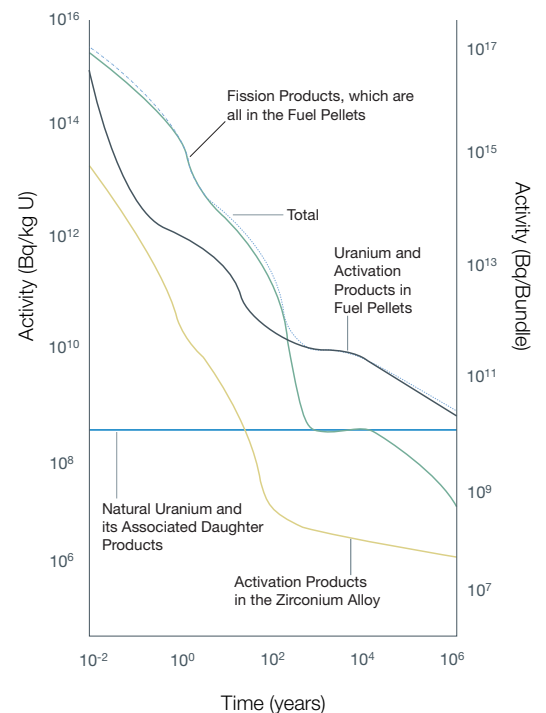
Maximum hazard from used nuclear fuel exists in the short term, and while the hazard does diminish over time, for practical purposes some hazards remain for an indefinite period of time<sup>1</sup>.

### Pathways

The radiological hazard inherent in used nuclear fuel can negatively impact the health of humans, other organisms and ecosystems if it enters into the environment. It can then have impacts through external exposure to the human body or through internal exposure by lesions, ingestion or inhalation. The chemical hazard inherent in used nuclear fuel can impact humans, other organisms and ecosystems through dispersal and uptake into living organisms. Radiotoxicity and chemical toxicity depend on the dose received.

The main potential pathways for internal exposure are through groundwater flow and subsequent entry into the food chain. A potential pathway for both external and internal exposure is through airborne transport of radioactive material.

**Figure 1:** Total Activity of Used CANDU Fuel as a Function of Time Out of Reactor



<sup>1</sup> The total radioactivity in a used CANDU fuel bundle approaches the radioactivity level of natural uranium ore around a million years after discharge from a reactor, as indicated in Figure 1.



## Control and Protection

Used nuclear fuel needs to be contained and isolated as a response to the hazard it poses. There is an established international system for radiation protection to regulate radiation exposure resulting from human activity for both nuclear workers and members of the public. While experts differ over what may constitute a safe level of radiation exposure, it is consistent with international practice to act, in a conservative manner, as if there would be health risks from any exposure to radiation, and a precautionary approach is appropriate for managing used nuclear fuel over the long term.

## Security

Security is required for used nuclear fuel because of the possibility that saboteurs or others could try to defeat the security measures of facilities and use the material to cause harm to people and the environment. Security concerns also relate to the diversion of used nuclear fuel toward the making of weapons.

## Regulation, Standards and Oversight

While implementing Adaptive Phased Management, NWMO will meet or exceed regulatory requirements established by Canadian authorities, including the Canadian Nuclear Safety Commission, consistent with internationally recognized approaches. Canadian regulations generally follow international practices, but Canadian law would take precedence.

## Uncertainty

Much is known about the hazard associated with used nuclear fuel and its implications on long-term management. However, there is also recognition of the scientific uncertainty regarding the effects of low levels of radiation exposure to humans and other living organisms. Canadian and international regulations on radiation effects take this uncertainty into account.

## References

Nuclear Waste Management Organization. 2005. *Choosing a Way Forward, The Future Management of Canada's Used Nuclear Fuel*. Appendix 3 / Nature of the Hazard. Toronto, Ontario. (Available at [www.nwmo.ca](http://www.nwmo.ca))

Nuclear Waste Management Organization. 2003. *Health Effects of Radiation and Radioactivity*. NWMO Fact Sheet. Toronto, Ontario. (Available at [www.nwmo.ca](http://www.nwmo.ca))