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## Safeguards by Design for Storage and Disposal of Nuclear Waste

The concept of safeguards by design (SBD) is important in ensuring nuclear facilities are designed to effectively and efficiently support IAEA safeguards implementation, without placing undue constraints on operations. There has been much work on SBD for nuclear production facilities (particularly enrichment and reprocessing plants) and for new reactor designs, but little at the very back-end of the fuel cycle. SBD is important at the very back-end of the fuel cycle as design decisions for disposal facilities need to consider the context for an extended period of institutional (operational and regulatory) controls following site closure. Unlike other facilities, disposal sites cannot be 'decommissioned' as waste will remain in situ even after the supporting surface infrastructure is removed. Instead, disposal sites enter a post-closure phase, where institutional controls are maintained for an extended timeframe until free-release of the site. This may initially include active measures such as ground water monitoring and site surveillance until radiation hazards have diminished enough to allow for passive-only measures, such as land-zoning restrictions. Engineered and geological barriers are also necessary for providing safety functions for hundreds of years at low-level waste repositories through to 100,000s years for intermediate and high-level waste repositories.

In some cases, it may be possible to achieve termination of safeguards by diluting or conditioning nuclear material into a practicably irrecoverable state, but this can have significant volumetric impacts. In cases where termination is not appropriate, facility designers and national authorities need to consider how to manage requirements for safeguards, security, safety and environmental protection.

Australia is establishing a low-level waste repository and co-located intermediate-level waste store at a volunteer site for its relatively small holdings of radioactive waste. This paper looks at the safeguards requirements for both storage and disposal facilities and discusses Australia's experience in considering the impact of different safeguards strategies in integrating with other regulatory requirements. In particular, the paper considers the type and extent of institutional controls for disposing of nuclear material in low and intermediate-level waste repositories.

### Which "Key Question" does your Abstract address?

NEW2.3

### Which alternative "Key Question" does your Abstract address? (if any)

NEW2.4

### Topics

NEW2

**Primary author:** Ms STOHR, Rebecca (IAEA Safeguards Section, Australian Safeguards and Non-Proliferation Office)

**Co-authors:** Dr EVERTON, Craig (Australian Safeguards and Non-Proliferation Office); Dr ROBERTSON, Kalman (IAEA Safeguards Section, Department of Foreign Affairs and Trade)

**Presenter:** Ms STOHR, Rebecca (IAEA Safeguards Section, Australian Safeguards and Non-Proliferation Office)

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