nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Security and Safeguards

The security and safeguarding of used nuclear fuel are fundamental objectives of the Adaptive Phased Management (APM) approach. The Nuclear Waste Management Organization (NWMO) recognizes that people are concerned over the prospect of terrorist action and also with the possibility that used fuel might be used for weapons. Canadian and international experience provide a basis to proceed, incorporating both industry best practices and regulatory requirements.

Introduction

Security provides protection against intentional malicious actions. Nuclear security requires measures to prevent theft of radioactive material, sabotage or damage to used fuel management facilities.

Safeguards are measures to track nuclear materials such as used fuel in order to detect and deter diversion into weapons, either by clandestine theft or diversion by the owners themselves. Safeguards are implemented by the International Atomic Energy Agency (IAEA) and are applied under the international non-proliferation framework.

The security and safeguarding of used fuel were key objectives addressed in development of the NWMO's recommendation of Adaptive Phased Management. An important factor in APM is the need for transportation of used nuclear fuel to the central facility for long-term management, since additional security measures would be required. However, once underground, the used fuel would be difficult to access, reducing the scope for theft, diversion or sabotage.

Security and Safeguards Concerns

During the NWMO's dialogues, a significant number of comments was directed to the need for security and safeguards features within the management approach. At virtually all NWMO discussion sessions, participants expressed concerns over the prospect both of terrorist action and with used nuclear fuel being used in a military context (e.g. extracting plutonium for nuclear weapons.)

Threats to used fuel management include civil resistance, violent opposition (such as direct attack, sabotage, or infiltration and seizure of used fuel or facilities), and theft of used fuel.

Other influences considered in NWMO's assessment of options were:

- Impacts on global non-proliferation of the Canadian approach;
- Potential for insider threats as a security risk;
- Implications of societal breakdown.

APM, including the goal of centralized containment and isolation deep underground, was recommended by the NWMO for reasons including difficulty of access for hostile reasons.

Current Experience and Practices

SECURITY

Security provisions in Canada are based on well-established requirements set out in the Canadian Nuclear Safety Commission's (CNSC) Nuclear Security Regulations under the *Nuclear Safety and Control Act*. These regulations were reviewed following the 9/11 terrorist event, which resulted in amendments to the Nuclear Security Regulations in 2006.

The CNSC's expectations are detailed in several guides and standards; for example, G-208 describes the requirements for a Transportation Security Plan for used nuclear fuel.

Nuclear security is an issue of international concern, and the International Atomic Energy Agency (IAEA) has carefully documented international best practices. The CNSC took these into account and also consulted with licensees, law enforcement and intelligence agencies, federal departments and other levels of government in developing the amendments to the Nuclear Security Regulations.

Addressing physical risks and uncertainties related to security requires their identification by a process of threat assessment. All credible threats must be taken into account in the design of physical protection systems. All facilities are inspected by the CNSC for their compliance with the Nuclear Security Regulations on a regular basis.

Information related to the security of Canadian nuclear facilities is *prescribed* information, and access is restricted to help protect these facilities. However, this also means that this information cannot be shared as freely as the NWMO would wish.

FACILITIES SECURITY

An application for a licence to the CNSC for a Class I nuclear facility, such as a facility for management of used fuel, must ensure that physical security requirements are met and include specific information on: arrangements with the off-site response force; descriptions of the security equipment, systems and procedures; communications equipment, systems and procedures; structure and organization of the nuclear security officer service; plans to assess and respond to breaches of security; and the current threat assessment.

Examples of controls for facilities specified in the Nuclear Security Regulations are shown in the following table.

Table 1: **Examples of Security Measures for Used Nuclear Fuel**
(Nuclear Security Regulations, SOR/2006-191)

Stored in a protected area	» unobstructed area on both sides of a fenced barrier » continuously illuminated » vehicle entry controls » independent systems to detect and alarm on intrusion or tampering » under direct visual surveillance by a nuclear security officer
Monitored from a security monitoring room	» protected and monitored » equipped to communicate with an off-site response force
Personnel entry controls	» authorization requiring security clearance » identity verification by two separate systems » search for weapons and explosive substances on entry » search for nuclear material on exit
Availability of security officers and response force	» trained on-site response force » arrangements with an off-site local, provincial or federal police force » periodic security exercises and drills

TRANSPORTATION SECURITY

A licence is required from the CNSC to transport Category I, II or III nuclear materials, which includes used fuel. For off-site transport, a design certificate approval is also required for the transportation package. Transport Canada also enforces the requirement for detailed Emergency Response Assistance Plans.

A threat assessment would be carried out at the time of applying for the licence for the shipments and would dictate what security measures would be required. Input from law enforcement agencies and intelligence agencies as well as the CNSC would be factored into the assessment. The resulting security plan would be prepared in accordance with the CNSC regulatory guide (current Guide G-208) and would be prescribed information, in accordance with the regulations.

The used fuel is shipped in heavy, impact-resistant containers, so it is not easily removed, accessed or damaged. A current typical road transport container weighs about 23 metric tons. Removal of the container lid requires special tools and lifting equipment. The used fuel is also highly radioactive, and if removed from the transport container, it would present considerable personal hazard to a hijacker.

For APM, the security requirements, such as the need for armed escort, would be based on the threat assessment at the appropriate time.

Examples of security measures that could be applied are shown in the next table.

Table 2: Examples of Possible Security Measures for Transportation of Used Fuel

General
- Minimize travel time; for example, in the case of rail transport, by the use of dedicated trains
- Pre-screening of personnel involved in the shipments
- Search of vehicles before loading
- Decision on specific route to be taken shortly before shipment
- Provision for overnight stays at a prearranged secure area

Communications
- Provision of an escort to ensure communications are not interrupted by an incident
- Satellite tracking of shipments
- A direct hotline to the relevant police force (e.g. Ontario Provincial Police) from the tracking room

Delay
- Shipment vehicles equipped with immobilising devices
- Casks locked and sealed, and secured to the vehicles
- Contingency plans in the event of mechanical breakdown

Response
- Provision of armed guards or armed escort
- Regular exercises and drills with the response force
- Pre-notification of shipments to the response force
- Notification to tracking room if shipment stops

SAFEGUARDS

The cornerstone of the international nuclear non-proliferation regime is the *Treaty on the Non-Proliferation of Nuclear Weapons* (*NPT*). The *NPT* establishes commitments to prevent the spread of nuclear weapons, promote cooperation in the peaceful uses of nuclear energy, and achieve nuclear disarmament. Canada is an original signatory to the *NPT*.

Safeguards provide assurance to the international community that Canada is not using nuclear material for the production of nuclear weapons or other nuclear explosive devices. These are serious obligations, and non-cooperation has significant repercussions.

In 1972, Canada was the first country to bring into force a comprehensive safeguards agreement with the IAEA pursuant to the *NPT*. Safeguards require accurate accounting of nuclear material and inspection activities which include various technical measures to provide assurance that the sensitive material remains in place. The safeguards agreement gives the IAEA the right and the obligation to monitor Canada's nuclear related activities and verify nuclear material inventories and flows in Canada.

In 2000, an Additional Protocol to the safeguards agreement entered into force, thereby placing Canada under a system of strengthened safeguards. This enabled the IAEA to reach a positive, broad conclusion about Canada in 2005, providing credible assurance of (i) no diversion of declared nuclear material to non-peaceful activities, and (ii) the absence of undeclared nuclear material and activities.

Through its regulatory process, the CNSC performs compliance and auditing activities to ensure that all relevant licensees have measures, policies and procedures in place to comply with Canada's international commitments.

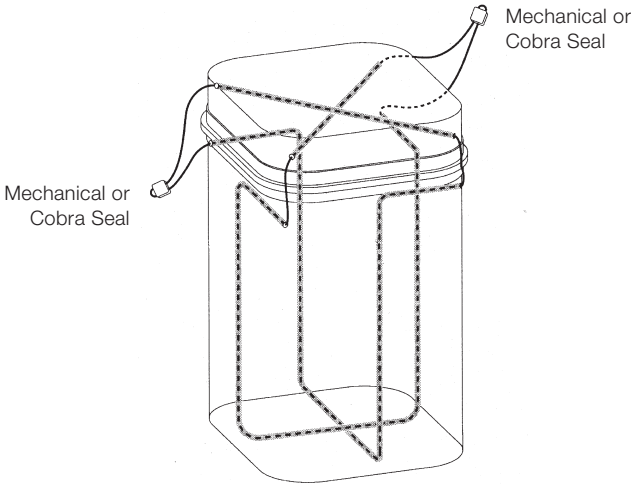
SAFEGUARDS INSPECTIONS

The IAEA carries out different types of on-site inspections and visits, acting independently of station management and the CNSC. These inspections may include: (http://www.iaea.org/Publications/Factsheets/English/sg_overview.html)

- Ad hoc inspections to verify reported inventories and international transfers.
- Routine inspections, the type most frequently used, may be carried out according to a defined schedule, may be unannounced or on short notice.
- Special inspections if the IAEA is not satisfied with the information obtained from routine inspections.
- Safeguards visits during construction, during routine facility operations, following maintenance and/or during decommissioning.

Activities associated with these inspections and visits can include auditing of accounting and operating records, verifying nuclear material inventories and inventory changes, and applying containment and surveillance measures.

As an example, IAEA inspectors oversee the transfer of used fuel from the used fuel storage pools at Ontario Power Generation's (OPG) nuclear power reactors to the dry storage containers for continued on-site storage. These inspections are performed on a randomized and unannounced basis. Safeguard seals are applied by the inspectors prior to storage. The seal configuration is shown in this figure.



Safeguard Seals Configuration

Figure 1: The OPG Dry Storage Container is designed with provision for safeguard seals. Two separate stainless steel tubes are embedded in the dry storage container walls, floor and lid as shown in this simplified drawing. These tubes are used for attaching two different types of IAEA seals.

Implications for NWMO

The used fuel management approach must ensure high levels of regulatory oversight, security and safeguards. This will require the application of established methods such as those identified above, including appropriate threat assessment, personnel selection and screening, availability of a response force, and use of heavy, robust containers.

Some aspects to consider in the implementation of the APM approach are:

INFORMATION

- Current CNSC security regulations prohibit the public disclosure of security information on facilities and on the location, routing and timing of shipments of used fuel. This information is limited to officials who have a legitimate need to know, such as response forces.

- As part of implementing APM, NWMO may need to discuss the balance between information sharing with communities and security. The challenge is to balance the desire to make information on risks available to interested Canadians, while protecting information that might compromise security. The balance could involve discussion of the appropriate level of disclosure, or (for transportation) designation of several acceptable routes, or development of constraints on where or when shipments would occur. Or perhaps it could include review of the plans by independent experts that could assert to the interested public that everything practical is being done.

- Security of electronic information (e.g. e-mail) and assets (e.g. computers) that could be subject to cyber attack, either for obtaining information for use in a physical attack, or for the purpose of disrupting operations.

STORAGE

- Robust, heavy, large containers used for storing used fuel provide significant barriers to sabotage or theft. Also the high radioactivity of the used fuel provides a 'self-protecting' barrier against intruders for the first several hundred years.

- Centralizing management of used fuel, which is part of APM, has advantages. However, associated challenges include ensuring the availability of an off-site response force to respond to events at the repository site and the risks during transport to the central site.

Figure 2: Dry storage casks at OPG's Western Waste Management Facility, Tiverton, Ontario

TRANSPORTATION

- Transportation to a central facility is part of the APM approach. This will involve security measures. Flexibility in the timing of transportation to centralized facilities, provided by the APM approach, could be a useful factor in maintaining appropriate security.

- As part of the central facility siting, the increase in vulnerability of the used fuel must be considered. As the travel distance increases, so does the opportunity for an "attack" on a shipment.

- Security in unusual situations, such as delay caused by large-scale demonstrations, which has happened with shipments between countries such as France and Germany.

Figure 3: Tractor-trailers for road transport of used fuel: OPG

Figure 4: Ship for used fuel transport in Sweden. Photo from SKB.

DEEP GEOLOGICAL REPOSITORY

- Once the used fuel is placed underground and the facility is backfilled and closed, it is difficult to access, reducing the scope for theft, hostile intervention and dispersion of nuclear material. Even before closure, limited access to the used fuel in the underground repository and the 500-1000 metres distance to surface provide considerable protection against security threats.

- Over the long term, security of used nuclear fuel in a closed and sealed repository does not rely on ongoing repackaging and handling, or active institutional oversight, an important feature for the long term, over which societal stability and institutional controls cannot be assured.

- The balance between retrievability and security may need to be discussed.

- Safeguards for repositories containing nuclear material have been under discussion internationally for many years. Specific measures are being developed, led by IAEA. The NWMO will need to be involved in these discussions.

Overall, the APM approach was selected in part because of the assessment of security and safeguards considerations among the alternative options. The risks are different in the different phases of the APM approach. The phased approach allows for these to be assessed as part of the timing of the decision to move forward in each phase.

For more information, please contact:

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