# INSPECTION METHODS FOR PHYSICAL PROTECTION TASK III REVIEW OF OTHER AGENCIES' PHYSICAL SECURITY ACTIVITIES FOR RESEARCH REACTORS

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# TASK III BACKGROUND

## INTRODUCTION

In Task I of this project, we examined the current Nuclear Regulatory Commission (NRC) position on physical security practices and procedures at research reactors. In the second task, we reviewed a sampling of the physical security plans and visited the three actual reactor sites described in the security plans that we reviewed. The purpose of Task III is to review other agencies' physical security activities for research reactors.

During this phase, we examined the actions, procedures and policies of two domestic and two foreign agencies other than the NRC that relate to the research reactor community. The agencies examined were:

- International Atomic Energy Agency
- Canadian Atomic Energy Control Board
- Department of Energy
- American Nuclear Insurers

In this report, we first discuss the policies and activities of each agency listed above. We then compared their research reactor activities with those of the NRC.

We determined that the best way to illustrate our findings would be a comprehensive matrix that actually compares the NRC inspection areas with those currently used by (or suggested in the regulation of) these other agencies. Such a matrix offers several advantages. Obviously, it facilitates a quick comparison of an agency's inspection practices with those of the NRC. Equally important, the matrix provides comparison between agencies.

While we have reviewed the regulations, reports, and other organizational documents pertinent to research reactor security, we did not attempt to evaluate the adequacy of these programs. Our primary purpose in Task III is to provide a clear understanding

of other agencies' policies and current inspections practices with regard to the research reactor community. We wish to emphasize that this task was basically one of information acquisition rather than critical analysis.

## AGENCIES REVIEWED

### The International Atomic Energy Agency

The International Atomic Energy Agency (IAEA) is an self-governing organization in the United Nations system. It began functioning in 1957 with the dual objective of fostering peaceful uses of nuclear energy and curbing the spread of nuclear weapons technology.

Although the responsibility for a physical protection system rests entirely with the governments of the individual member nations, physical protection is of international concern. For this reason, the IAEA published INFCIRC/225/Rev. 1,[1] "The Physical Protection of Nuclear Material" containing "recommendations and explanations as to what should be done by Member States to establish their national systems for the physical protection of nuclear facilities and materials or to improve the quality and effectiveness of such systems." These recommendations are not mandatory, and the Agency has no responsibility for designing, supervising, controlling, or implementing a State's physical security system.

The recommended physical protection measures are intended for all nuclear facilities, but the IAEA recognizes that research type facilities outside the nuclear fuel cycle may not be able to meet the regulations. In such cases, the State may make specific exceptions to the regulations on a case-by-case basis.

In general, the IAEA recommends that the States' physical security systems provide for the following elements.

- Licensing - Activities should be granted licenses only if they comply with the State's physical protection requirements.
- Categorization of Nuclear Material - Nuclear material should be categorized by potential hazard to ensure that the protection measures are appropriate to the material being protected.

- Physical Protection Requirements - Described in our Task III Findings section in the report.
- Information System - The system should provide for notification of the State if there are changes that affect physical protection measures.
- Monitoring of Compliance - The licensed activities should be reviewed periodically, and whenever a major change occurs, to ensure compliance with the regulations.

Atomic Energy Control Board (Canada)

The Atomic Energy Control Board (AECB) was established by the 1946 Atomic Energy Control Act. The basic functions of the Board are:

- To control prescribed atomic energy materials and devices and nuclear facilities (including subcritical research reactors) in the interest of health and safety.
- To control atomic energy materials, equipment, and information in the interest of national and international security.

In order to control prescribed substances and nuclear facilities, the AECB uses a comprehensive licensing system. The licensing process includes a thorough evaluation of the application for a license and compliance inspections after the license is issued. Among the information is a description of "measures to prevent theft, loss or unauthorized use" of the prescribed substances.(2)

The Board is empowered to appoint inspectors to enforce the provisions of the Atomic Energy Control Regulations. These inspectors have the right to examine premises and records relating to the health, safety, and security aspects of prescribed substances and nuclear facilities.

On February 21, 1980, the AECB proposed amendments(3) to Section 5 of the Atomic Enegy Control Regulations which deals with the physical security of nuclear facilities and strategic nuclear materials.(4) Although various sections of the existing regulations require security provisions for any licensed activity, the nature and scope of these provisions are not clearly outlined, which forces

the AECB to specific security requirements as case-by-case license conditions. The proposed amendments will provide detailed statutory authority for enforcing physical security measures.

The AECB's overall approach to nuclear security follows the recommendations of the International Atomic Energy Agency's recommendations, specifically those in INFCIRC/225 Rev. 1, "The Physical Protection of Nuclear Material." The regulations apply to all licensees operating a facility that incorporates nuclear reactor with a thermal power rating exceeding 1 MW during normal operation or a facility that has any prescribed substance referred to in Column I of Schedule IV (reproduced on the next page) in the quantities listed in Columns II or III. We know that Canada has at least one research reactor with a power rating greater than 1 MW (the McMaster University 5-MW pool-type reactor) but do not know the amounts of prescribed substances held at the research reactor facilities. Licensees who have quantities of plutonium, U-233, and U-235 in the amounts listed in Column IV of Schedule IV are required only to store such substances so that they cannot be removed by a single individual using hand-held tools or to store it in the manner authorized in their license.

U.S. Department of Energy

The U.S. Department of Energy (DOE) is responsible for four types of reactors: those used for weapons production, the prototype reactors used to train personnel for the Navy's nuclear submarines, research reactors at laboratories and the breeder reactor (the Shippingport, Pennsylvania, light water breeder reactor is the only one in this category). Two DOE policy orders govern the physical security of these facilities. Interim Management Directive No. 6105,[5] issued September 29, 1977, concerns physical protection of DOE property; DOE Order 5632.2,[6] issued February 16, 1979, covers the physical protection of special nuclear materials.

DOE policy is to establish minimum standards equivalent to the NRC requirements. The 10 DOE Field Offices are responsible for the physical protection programs at facilities within their regions. Most facilities are required to submit a "safeguards and security plan," but Managers of the Field Offices may grant

## SCHEDULE IV

## CONTROL OF PRESCRIBED SUBSTANCES

| Item | Prescribed Substances Column I | Quantities Column II | Column III | Column IV |
|---|---|---|---|---|
| 1. | Unirradiated Plutonium or U-233 | 2 kg or more | Less than 2 kg but more than 500 g | 500 g or less but more than 15 g |
| 2. | Unirradiated U-235, in uranium enriched in U-235 | | | |
| | (a) 20% or more | 5 kg or more | Less than 5 kg but more than 1 kg | 1 kg or less but more than 15 g |
| | (b) 10% or more but less than 20% | | 10 kg or more | Less than 10 kg but more than 1 kg |

### Notes to Schedule IV

1. For the purposes of this Schedule, an unirradiated substance means a substance not irradiated in a reactor, or irradiated in a reactor but with a radiation level equal to or less than 100 rad (one gray) per hour at 1 m.

2. The total quantities of substances of each type in the possession of a licensee shall be the quantity considered for the purposes of this Schedule, except that quantities of a substance

(a) located more than 1000 m from any other substance of the same type, or
(b) located in a locked building;

shall be deemed to be separate quantities of the substance.

exceptions. There is no formal approval process although the Field Office Manager does review the plans.

Inspections (known as security surveys in the DOE lexicon) are required at least annually for facilities with Category II quantities of SNM and biennially for Category IIIA quantities. The inspectors compare their findings with the facilities' security and safeguards plans. In conducting the security survey, many inspectors rely on Sandia Laboratories' Barrier Technology Handbook[7] to determine not only if the facility is complying with its plan but also if the plan complies with the intent of DOE Order 5632.2 and Interim Management Directive No. 6105. In determining if facilities are complying with the requirements, the inspectors also consider whether the fuel is irradiated and whether the facility is protected by virtue of colocation with a more strictly secured facility. If the facility operator and the inspector differs in their interpretations of the security requirements, the Regional Director of Safeguards and Security must settle the issue. Even if a noncompliance is discovered, there is no financial penalty.

In practice, many of the facilities are exempt from the requirement set forth in the policy orders because their SNM "is not readily separable from other radioactive material and the combination of the SNM and other radioactive material delivers an external radiation dose of approximately 100 rems per hour or more at 1 meter from any accessible surface without intervening shielding material," (Special Condition 4a, DOE Order 5632.2).

American Nuclear Insurers

American Nuclear Insurers (ANI) (formerly known as NEL-PIA, the Nuclear Energy Liability - Property Insurance Association) is a pool of liability and property insurance companies that supplies third-party liability insurance to nuclear facilities, including research reactors. ANI's Nuclear Engineering Department provides information on the risks presented by each insured, takes steps to enhance the insurability of these risks, and advises the Claims Department on technical issues.

The ANI Engineering Manual dated July 1977 provides guidance for inspecting university research, and other non-power reactors.[8] The inspectors are first referred to sections of the NRC I&E Manual that apply to research reactors. Types of reactors, size, use, coverage and special hazards are then discussed. "Security" is listed as one of the special hazards and discussed in the following general terms:

> The larger reactors are in general quite well protected by their containment, but some of the small teaching reactors have a minimum of protection. Fortunately, we seem to have passed the era of student disturbances. The effectiveness of the protection should be evaluated in terms of the size and location of the reactor and the possibility that some form of nuclear release might result.
>
> As a minimum, the security provisions should include lock and key controls, periodic inspections of the reactor building by security, written procedures that spell out actions to be taken by security in the event of an incident, and maintaining call lists up-to-date.

ANI's inspectors no longer check physical security measures at the research reactor facilities it insures. It is assumed that if the facilities can meet the NRC's requirements, they do not pose a substantial risk.

## TASK III: FINDINGS

The matrix on the following page compares the inspection criteria currently used by the NRC to check physical security practices at research reactors with the physical security requirements of three other agencies. (Although their policies were reviewed, American Nuclear Insurers no longer inspects for physical security at research reactors because, as stated, they assume that if the facility can pass NRC inspection, its practices are adequate.) We caution the reader that the IAEA physical security measures are recommendations to its member States. Only if the member State adopts these recommendations will IAEA inspectors check to see that they have been implemented. The reader should also be aware that the Canadian physical security measures were proposed in an amendment to the Atomic Energy Control Regulations early in 1980 and are not yet statutory requirements.

The following discussion is organized by the NRC criteria listed in the first column of the matrix.

### PHYSICAL SECURITY PLAN

The NRC requires a physical security plan to be submitted as part of the application for a license to operate a nuclear reactor. (Category III reactor licensees with less than 10 KG of LEU are exempt from this requirement although they must comply with all other physical security regulations.) The approved security plan is the basis of the compliance inspection; that is, the inspector reviews the facility to see that the plan has been implemented.

The IAEA does not mention a physical security plan or its equivelent in its recommendations to Member States. Canada's proposed amendments to its Atomic Energy Control Regulations would require licensees to submit a "security report" to the AECB within 30 days of the issuance of its license. This security report would consist of the site plan and comprehensive information on:

- Security equipment, systems, and procedures
- Communications equipment, systems, and procedures (on-site and off-site)

# PHYSICAL PROTECTION MEASURES FOR RESEARCH REACTORS

| NRC Inspection Criteria | IAEA Minimum Levels of Protection* | AECB (Canada) Proposed Requirements | U.S. DOE Orders for Physical Protection of SNM** and Physical Protection of DOE Property | American Nuclear Insurers |
|---|---|---|---|---|
| Physical Security Plan | Not specified | Security Report required within 30 days after issuance of license | Required by most DOE regional offices | |
| Security Organization | Not specified | To be described in facility's Security Report | Not specified | Discontinued inspections of physical security at research reactor facilities |
| Access Controls | Registration and badging of all persons entering the Protected Area; all visitors escorted; minimized entry of private vehicles into PA; records of all persons with access to keys or key cards (II). Provisions for detection of unauthorized intrusion (III). | Exit monitoring; written authorization to enter; physical barrier either locked or under guard. | Hardened security post; private vehicles excluded; search of personnel, packages, and vehicles upon entrance and exit. | |
| Design Features That Facilitate Physical Protection | Storage within inner area of the strong-room type; locks; physical barriers w/unobstructed zones (II). Communications system, alarms. | Physical barrier surrounded by unobstructed area; devices to detect persons tampering with or crossing barrier; alarm signal to security control room; alarm device to alert off-site force; locks. | Illumination of perimeter; security inspector posts equipped with duress systems; hardened security communications center; signs prohibiting trespass; perimeter intrusion alarm systems or equivalent; all detection/alarm devices to be failure- and tamper-indicating. | |
| Personnel Screening | "Predetermined trustworthiness" | Identification reports on each person authorized to enter protected area; identification reports, medical reports and proof of Canadian citizenship required for each security guard. | "Q" security clearance (Category II). Designated by management (Category III a). Visitors must be escorted. Security guards must meet the standards in DOE 5632.1. | |
| Monitoring Status of Vital Equipment and Facilities | Not specified | Not specified | Not specified | |
| Emergency Security Procedures | Procedures to be followed by facility personnel in case of alarm or emergency; appropriate response by security force. | Arrangements confirmed in writing with off-site police force to respond in case of break-in or other security incident. | Arrangements with local and state police or other security forces; emergency plan should be considered. | |

## PHYSICAL PROTECTION MEASURES FOR RESEARCH REACTORS (Cont.)

| NRC Inspection Criteria | IAEA Minimum Levels of Protection | AECB (Canada) Proposed Requirement | U.S. DOE Orders for Physical Protection of SNM** and Physical Protection of DOE Property | American Nuclear Insurers |
|---|---|---|---|---|
| Security Communications | Two-way voice communications with off-site response force | Security control room resistant to forced entry; two-way radio system with off-site response force; alarm device to alert off-site police; equipment permitting communication with guards not in control room. | Hardened communications center with periodically tested radio and telephone communication channels with off-site security forces. | |
| Employee Security Training | Facility personnel should be trained to meet all necessary demands of physical protection and recovery of nuclear material; external emergency teams should also be appropriately trained (II). The emergency plan of action should describe the training of facility personnel to deal with alarms or emergency. | To be described in facility's Security Report. | Must meet the standards of DOE 5632.1. | |
| Security Force Duties and Responsibilities | To be described in facility's emergency plan of action. | Must be set forth in writing. | Not specified. | |
| Intrusion Alarm Response | Response by facility personnel and off-site security force. | Alarm sounds in security control room and in off-site response force station. | Alarm annunciates in second location continuously manned by cleared personnel; security inspector response within 10 minutes. | |
| Search Provisions | Random search of persons and packages; search of all vehicles and large containers (II). | Persons, packages, vehicles monitored by guards or devices before leaving. | Search of personnel, packages, and vehicles upon entrance to and exit from a protected area. | |

## PHYSICAL PROTECTION MEASURES FOR RESEARCH REACTORS (Cont.)

| NRC Inspection Criteria | IAEA Minimum Levels of Protection | AECB (Canada) Proposed Requirements | U.S. DOE Orders for Physical Protection of SNM** and Physical Protection of DOE Property | American Nuclear Insurers |
|---|---|---|---|---|
| Patrol Procedures | Not specified | At least 1 guard in security control room at all times | When perimeter alarm not operating, security patrols conducted at random at intervals not exceeding one hour for Category II SNM and two hours for Category IIIA SNM. | |
| Personnel Identification System | Registered passes or badges for all persons entering the protected area. Passes and badges should be designed so as to make counterfeiting difficult (II). | Up to date lists of persons authorized to enter protected area given to security guards. | Not specified. | |
| Testing and Maintenance of Security Systems | Annual Security Survey (II). Initial Security Survey (III). Plant operators should check for efficient functioning. | Alarm drill every six months. | Test and maintenance program required. Annual security survey (Category II). Biennial security survey (Category III). | |
| Audit Record System and Documentation | Record of key possession/ access; registration of passes or badges issued (II). Notification of State if changes not at site or in material. | List of authorized persons. | Reports of actual or suspected attempts at removal or sabotage reported immediately to DOE Safeguards and Security Office. | |

*(II) indicates recommendations for Category II facilities, (III) for Category III facilities. Items not followed by parenthesis apply to Category II and Category II facilities.

**DOE categorizes SNM quantities as Category I, II, IIIA, or IIIB. The security measures listed apply to protected areas. Category II quantities must be used, processed, and stored in a protected area, and Category IIIa quantities may be located in a protected area.

- Security guard force structure, administration, and training
- Provisions for responding to branches of security

The DOE field organizations require most facilities to submit a safeguards and security plan (the Managers of Operations Offices may grant execptions). This plan consists of a specific description of the systems and procedures used to protect SNM. Like the NRC inspectors, DOE inspectors use the security plan as the basis for their inspection. However, there is no formal approval process for the safeguards and security plan, so the inspector is faced with not only determining whether the facility is complying with its plan but also if the plan meets the intent of the regulations.

SECURITY ORGANIZATION

In examining the licensee's security organization, the NRC inspector must determine that the organization's structure, its relationship to management, and its functional responsibilities are consistent with those described in the licensee's approved security plan. Offsite security forces are often employed by research reactor facilities. In this case, inspectors must determine that arrangements with the local law enforcement agency are documented, that the arrangements are the same as those called for in the security plan, and that the licensee has familiarized the offsite security force with the facility's security procedures.

The IAEA recommends only that Category II and III facilities prepare emergency plans that "provide for appropriate response by guards on off-site emergency teams." The AECB's proposed amendments require that the duties and responsibilities of security guards be set out in writing. DOE requires that its facilities formulate plans with local and state law enforcement agencies for prompt notification and assistance, but, in the two policy orders that we reviewed specific instructions for the organization of the internal security force were not given.

ACCESS CONTROLS

When inspecting for access control, the NRC inspector must determine if personnel and packages entering and exiting security areas are controlled as described in

the security plan and if these controls are adequate. This determining whether

- Visitors are escorted in areas where there is essential equipment or SNM.
- Personnel with access to unirradiated SNM are searched upon leaving.
- Only the categories of personnel authorized by the PSP are allowed access.
- Access control methods (guards, locks, closed-circuit TV, alarms, etc.) are operating as described in the PSP.
- The badge identification system is in use.

The IAEA requires that Category II material should be used or stored within a protected area (defined as an area under constant surveillance either by a guard or electronic means), surrounded by a physical barrier that has a limited number of controlled admittance points, and approved by a security survey). Access to the protected area should be kept to a minimum, and all those who enter the protected area should be issued either a special pass or a badge. Only persons whose trustworthiness has been predetermined and visitors together with their escort should be admitted into the protected area. The visitor-escort ratio should be limited. Entry of private vehicles into the protected area should be minimized and limited to authorized parking spaces within it. For Category III materials, the IAEA's general recommendation is to use or store them within an area to which access is controlled.

The AECB's access control methods include a physical barrier equipped with a device that detects person's crossing, climbing, or damaging the barrier. Every extrance/exit of the physical barrier is to be kept closed and locked unless under the surveillance of a security guard. The only persons granted admittance to the protected area are those with written authroization from the licensee or visitors who are escorted by someone with written authroization.

DOE 5632.3 specifies that "protected areas shall be subject to a system of access controls." These include exclusion of private vehicles and access by government vehicles and service vehicles only when driven by personnel with the

appropriate clearances (or escroted by properly-cleared personnel). Access to the material is limited to employees in specifically designated positions and visitors escorted by these employees. Personnel who have access to Category II quantities must have a "Q" security clearance. Personnel, packages, and vehicles are searched before they are permitted to enter the protected area.

DESIGN FEATURES THAT FACILITATE PHYSICAL PROTECTION

Design features include the facility's structural characteristics (e.g., safe-rooms, physical barriers) and hardware (e.g., locks, alarms, closed-circuit TV, lighting).

In checking the alarm systems, NRC inspectors must ascertain that they correspond to their description (including type, capability, location of annunicator) in the security plan. Specifically inspectors check to establish that:

- Essential equipment and SNM storage vaults are coverd by an alarm system capable of detecting intrusions.
- Alarm communications are received in an area designated and protected as a vital area.
- The alarm system can determine when and where an emergency exit has been opened without authorization and when unauthorized access occurs.
- Alarms are operable.
- Contingent security measures have been developed for the case of alarm system failure.
- Intrusion alarms are tested at the beginning of every period of use or at least once every seven days of continuous use.

For keys, locks, and other hardware, NRC inspectors check to see that:

- Keys, locks, combinations, and related equipment are controlled.
- Keys, locks, combinations, and related equipment are changed when they may have been compromised or when an employee is terminated.
- The licensee maintains a current list of persons authorized to have keys.
- The hardware used to secure doors and windows is adequate.

NRC inspectors must also verify that unirradiated SNM is stored in a vault equipped with an intrusion alarm, or, if the facility has less than 2 kg of SNM, that it can be stored in an approved security container or burglary-resistant chest.

The design features recommended by the IAEA include provisions of a storage area of the strong-room type for Category II quantities of SNM. A physical barrier in addition to the building walls should define the perimeter of the protected area. However, if the Security Survey finds that the walls are solid enough to provide an adequate physical barrier, then a supplementary surveillance system should be provided outside the walls. An unobstructed, well-illuminated zone should surround the perimeter of the protected area. All windows on the perimeter wall should be permanently locked, alarmed, and covered with firmly embedded bars. Emergency exists on the perimeter wall should have alarms. The only requirements specified for these alarms are that they be able to detect and signal any intrusion or interference and still be able to function in the event of power failure.

The IAEA recommends that the facilities keep a careful inventory of keys and key-cards. Combinations of locks should be changed periodically, and the locks themselves should be changed if compromised.

The AECB has adopted the IAEA recommendation to provide a physical barrier around the perimeter of the area. This barrier requirement may be met by any of the following:

- A wire chain-link fence at least 2.4 meters high with openings not larger than 6 centimeters, with a gauge number of at least 11, and topped by three or more strands of barbed wire or tape; or
- A fence of coiled barbed wire or tape at least 2.4 meters high, or
- A vertical wall of steel, wood, concrete, masonry, or some composite of these materials at least 2.4 meters high and topped by three or more strands of barbed wire or tape where the wall does not form part of the building

The AECB also requires an unobstructed area for at least 5 meters around the physical barrier. The barrier must be continuously illuminated so that persons

within the unobstructed area can be observed. The barrier should also be equipped with a device that can detect anyone crossing the barrier and send an audio and visual alarm to the security control room, or the barrier should be under the surveillance of a security guard who can provide the alarm signal. All openings in the physical barriers must be locked unless they are under guard.

Another design feature required by the AECS is security control room. This room must be designed and constructed so as to resist forced entry by individuals using hand-held tools or light firearms.

DOE Order 5632.2 requires similar physical protection design features. Perimeters intrusion alarm systems must be used at the borders of protected areas (or, as an alternative, at least two security inspectors must observe the perimeter), and sufficient illumination must be provided. A "hardened" security force communications center must be established, and a secondary station providing emergency communications capability is also required. Detection/alarm devices connected to monitor/display panels in the security communications center must be failure- and tamper-indicating. An alternate alarm annunciation point must be provided in a second location.

PERSONNEL SCREENING

The NRC inspector must determine that the licensee has proper procedures for checking the identification and access authorization of all employees and visitors (described in more detail in the section on Personnel Identification System). Requirements for the pre-employment screening of security personnel (guards and watchmen*) are set forth in Regulatory Guide 5.20. These include:

- Minimum age of 21
- High school diploma or equivalent
- No record of felony convictions
- Employment application providing

*Guards are armed and uniformed; their primary duty is to protect SNM against theft and/or to protect the facility against industrial sabotage. Watchmen, who may or may not be armed and uniformed, protect the plant and SNM in the course of other duties.

  - Full name
  - Date and place of birth
  - Citizenship
  - Current residence
  - Prior residences (past 5 to 10 years)
  - Educational background
  - Previous employment history
  - Military service
  - Record of criminal convictions
- General good health as determined by a physician
- Specific physical capabilities
  - Able to withstand exposure to inclement weather
  - Capable of arduous physical exertion
  - Vision correctable to 20/20 in each eye
  - Hearing loss not exceeding 30 dB in both ears or 35 dB in the poorest ear
  - Mentally alert and capable of understanding and performing the duties assigned

The IAEA states only that access to protected areas should be limited to persons of "predetermined trustworthiness." The AECB requires that an identification report be submitted for each person authorized to enter a protected area. The identification report must provide:

- Full name and date and place of birth
- Evidence of person's legal status in Canada
- Address of principal residence
- A frontal photo of person's head

A list of all authorized employees is given to the security guard service.

Security guards are also required to submit this identification report and can be hired only afte the AECB approves the report. In addition, the guard must be in good physical and mental health, as certified and documented by a qualified medical doctor, and be a Canadian citizen.

DOE specifies that persons in positions that will give them the opportunity "to sabotage or to divert or to conceal the diversion of Category II quantities of SNM" must have a security clearance. Access to Category IIIA quantities of SNM is limited to employees specifically designated by management. Visitors must be escorted by employees with the proper clearnaces or authorizations. Security guards are required to meet the standards in DOE 5632.1.

MONITORING STATUS OF VITAL EQUIPMENT AND FACILITIES

Vital equipment is defined by ANSI N18.17 as "equipment and facilities the failure of which could lead to a radiological accident significantly affecting the health and safety of the public, for example, primary coolant boundary and reactor protection system." This sort of equipment is not normally found at a low-power reactor but may exist at a few of the high-power reactors. However, NRC inspectors are also instructed to consider the physical security systems described in the security plan, along with the backup/emergency power sources supplying these systems, as essential/vital equipment. We discuss this aspect of monitoring in the section titled Testing and Maintenance of Security Systems. The other agencies reviewed did not specify a similar protection measure.

EMERGENCY SECURITY PROCEDURES

NRC inspectors must ascertain if procedures have been established for responding to unauthorized intrusions of security areas, security violations by authorized personnel, bomb threats, and acts of civil disorder. The procedures should include the method of reporting security violations and corrective actions taken, including sanctions. The inspectors must also check that

operating personnel and security personnel know the procedures and are able to follow them. Guidance in this area warns that threat procedures at universities are often included in policy letters for the university as a whole, but may not be applicable to the reactor facility.

The IAEA recommends that "emergency plans of action should be prepared to counter effectively any possible threats, including attempted unauthorized removal of nuclear material or sabotage." These plans should provide for (1) the training of facility personnel to handle emergencies or respond to alarm, and (2) the response by guards or off-site emergency teams to the tnreat.

The AECB requires its licensees to have arrangements confirmed in writing for immediate communication with an assistance from the local police force, provincial or federal policy force detachments, or a Canadian Armed Forces base in the event of a break-in or other incident that threatens the security of the facility. The arrangements must provide for:

- A communications system between the facility and the off-site force
- An annual visit to the facility by the response force
- Consultation regarding the security resources and equipment available.

In their security report, AECB licensees must describe their provisions for responding to breaches of security.

DOE requires that managers at its facilities coordinate plans with local and state police departments and other law enforcement officials for prompt notification and assistance in the event DOE property is threatened by actual or suspected vandalism, arson, sabotage, civil disorders, riots, mob intrusions, or similar unlawful acts. Any such acts must be reported immediately to the responsible DOE Safeguards and Security Office. Interim Management Directive 6105 recommends that facilities consider the adoption of an emergency plan.

SECURITY COMMUNICATIONS

To determine if the licensee operates communications equipment in accordance with the approved security plan, the NRC inspector must check that:

- The communications system enables members of the security team to respond promptly to alarms, to report their determination of the cause of the alarm, and to request assistance if necessary.
- A means of communicating with an off-site response force exists.
- Communications equipment is tested at least at the beginning of each security force work shift.

The IAEA recommends a transmission system for two-way voice communication to off-site response forces but does not describe the system in any detail.

The AECB requires that the security control room (discussed in the section titled Design Features that Facilitate Physical Protection) be equipped with the following communications systems:

- A two-way radio system for communicating with the off-site response force
- A public telephone system
- An alarm device for alerting the off-site response force of emergencies
- Equipment permitting communication directly with security guards not stationed in the control room

Like the AECB, DOE requires a hardened security force communications center. DOE Order 5632.2 specifies that:

- The communications center shall have periodically tested radio and telephone channels of communication with local law enforcement agencies.
- An alternate communications capability must exist in case the primary station is compromised.

- Radio equipment shall remain operable even if facility electrical power is lost.

EMPLOYEE SECURITY TRAINING

The required training for NRC licensees' security guards is described in Section 4.4.2 of ANSI Standard N18.17-1973 and Appendix B to the proposed changes to Part 73, "Performance Oriented Safeguards Requirements," 42 FR34310. The inspector should determine if security personnel clearly understand their responsibilities and the security procedures, including items to be checked and correct responses to attempted theft or sabotage. The inspector should also determine that security drills have been conducted and evaluated, and that the local law enforcement agency has received or provided its own orientation training in reactor protection and radiation safety and participated in security drills.

The IAEA recommends that facility operating personnel as well as the on-site and off-site security forces be trained in the proper response to alarms and other emergency situations. Facility personnel protection and recovery of nuclear material and should act in coordination with trained external emergency teams. To make employees aware of the importance of physical protection measures, the IAEA recommends that notices be conspicuously posted and an annual reminder issued.

The AECB requires only that the licensee describe security guard force training in its security report. DOE specifies that its security inspectors meet the standards contained in DOE 5632.1.

SECURITY FORCE DUTIES AND RESPONSIBILITIES

The NRC inspectors must determine that the licensee have established and followed written security procedures. The inspectors consider whether responsibilities and chain of command and job descriptions identifying the functions, responsibilities, and authority for each position are included in the written procedures. They must also compare the actual duties being

performed with the responsibilities described in the procedures. In addition, inspectors should determine that the type (apprehension and restraint, investigation, crowd control, bomb searches, etc.) and level of assistance to be provided by the local law enforcement agency are actually available.

IAEA recommends and the AECB requires that the duties and responsibilities of the security force be set forth in writing. DOE has no specific requirements in this area.

INTRUSION ALARM RESPONSE

The NRC inspector must ascertain that the alarm system has been implemented as described in the licensee's security plan and that the security force responds quickly and efficiently. To facilitate response, the alarm annunication should identify the location of the intrusion. The inspector should verify that the security organization responds to all intrusion alarms and promptly request assistance from the off-site security organization if necessary. The response times estimated by the off-site security force should be evaluated to determine if they are adequate and feasible. The inspector should also determine whether security drills are conducted and evaluated followed by appropriate corrective actions.

The IAEA recommends that both facility personnel and guards (or off-site emergency teams) be trained to respond to alarms. Facilities should describe the appropriate response to intrusion alarms in their emergency plans.

In its proposed regulations, the AECB requires that the alarm sounds in the on-site security control room and in the off-site security force station. Both audio and visual alarm signals are required in the control room, and these signals require manual acknowledgement before they will stop. The licensees must give the appropriate response to alarms in their security reports.

DOE Order 5632.2 specifies that the security inspector's response time to alarms shall be no more than 10 minutes. DOE also requires that alarms annunciate in another location in addition to the security force communications center. This secondary location should be staff by cleared personnel who can respond if the primary station is compromised.

SEARCH PROVISIONS

The NRC requires that persons having access to unirradiated SNM be searched upon leaving. A visual search is sufficient if the SNM is in full plate assemblies that could not be hidden on one's person.

For facilities with Category II quantities of SNM, the IAEA recommends random searches of persons and packages entering or leaving the protected area. Vehicles and all large objects entering the protected area should be checked.

The AECB's search requirement is slightly more stringent. It states that all persons, packages, containers, and vehicles must be monitored by devices or guards prior to leaving the facility.

Personnel, packages, brief cases and similar containers, and all vehicles are subject to search when entering and existing the protected area of a DOE facility. The search must be done using DOE-approved detection equipment.

PATROL PROCEDURES

The NRC inspector must verify that the number and kind of security force personnel, including shift coverage and frequency, are the same as described in the licensee's security plan. Patrols should be conducted when operating personnel are not on-duty. The patrols should not follow a set pattern of time or movement.

The IAEA makes no recommendations in this area. The AECB specifies that there should be at least one security guard in the security control room at all times; routine security patrol procedures are to be described in the licensee's security report.

Of all agencies reviewed, DOE has the most specific requirements for patrol procedures. Both mobile and fixed security inspector posts must be equipped with duress sytems, which enable the guards to communicate covertly with the control center or other personnel. Until a protected area can be placed under perimeter alarm protection, it shall be occupied by at least two security inspectors. These guards will have DOE-approved night vision devices and at least two means of summoning response forces. If the perimeter alarm system exists but is not operating, security inspectors must patrol the perimeter at random times but with intervals not exceeding one hour. If not protected by an alarm system, Category IIIA quantities of SNM should be patrolled at intervals not to exceed two hours.

PERSONNEL IDENTIFICATION SYSTEM

NRC requires its licensees to use a badge identification system, although for some reactors with small operating crews, personnel recognition may suffice. In the physical security plan, the licensee should provide a general description of the badge system, explaining the coding and the requirements for wearing or displaying the badges. Visitors must register before being admitted.

The IAEA recommends that all persons entering the protected area should be issued either special passes or badges, appropriately registered. They suggest the use of two types of badges: Type I for employees whose duties require continual access to the protected area and Type II for temporary repair, service, or construction workmen and visitors. Type II badged persons should be excorted by a Type I badged employee unless their "trustworhtiness has been predetermined." Passes and badges should be designed to discourage counterfeiting.

The AECB does not specifically require the use of badges or passes but does call for the maintenance of an up-to-date list of all persons authorized to enter the protected area. A copy of this list is given to the security guard service.

The DOE policy order states that personnel must have clearances and authorizations to enter a protected area but does not specify how these personnel are to be identified.

TESTING AND MONITORING OF SECURITY SYSTEMS

The NRC requires that intrusion alarms be tested at the beginning of any period that they will be in use. If operation is continuous, then the alarms should be tested at least once every seven days. Communications equipment must be tested not less frequently than once at the beginning of each security force work-shift. The inspector must also determine that periodic drills are conducted by both the on-site security force and the off-site emergency team.

The IAEA recommends that the State's designated physical protection authority make an annual "security survey" (defined as a critical examination by competent officers in order to evaluate, approve, and specify physical protection measures) at facilities with Category II SNM and an initial security survey at facilities with Category III SNM. An additional security survey should be made if the facility or its function changes significantly. Operators of both Category II and III facilities should check the functioning of the physical protection measures, but no schedule for testing is recommended.

The AECB specifically requires that an alarm drill be conducted every six months to ensure that equipment and procedures function as required.

DOE requires a test and maintenance program to assure that security-related subsystems and components are operable. A "survey" (defined as an on-the-spot critical examination by the responsible DOE operations office of an SNM facility and the devices, equipment and procedures used to protect the SNM) of Category II facilities should be conducted once a year or as often as is deemed necessary by the responsible Operations Office Manager. Category IIIA facilities should be surveyed at least once every two years or as often as is deemed necessary.

AUDIT RECORD SYSTEM AND DOCUMENTATION

None of the agencies reviewed required a formal record-keeping system, but all required some specific documents related to physical protection. These are listed below.

NRC: Register of visitors
List of persons authorized to have access to keys
Log of when and to whom keys are issued

IAEA: Record of key possession/access
Registration of passes/badges issued
Notification of State if changes in facility or material

AECB: List of authorized persons

DOE: Reports of attempted and successful intrusion or sabotage

## TASK III SUMMARY OF FINDINGS

The physical protection measures for research reactors of the agencies we reviewed do not differ radically. The NRC and its Canadian equivalent, the AECB, have both patterned their programs after the IAEA recommendations, and the programs are consequently very similar. DOE's standards for the protection of SNM are designed to provide protection equivalent to that offered by the old NRC standards. However, DOE does not have a formal, Department-wide program for non-power reactor security or inspection. Each of the 10 Field Offices administers its own security and safeguards program, and it is likely that considerable variety exists in their interpretations of the applicable DOE policy orders.

Certain physical protection measures are discussed in relative detail by all the agencies. These are the Access Controls, Design Features that Facilitate Physical Protection, Search Provisions, and Security Communications. Their selection for detailed treatment may indicate that agencies assign greater importance to them.

Most of the requirements are quite general, and it is left to the facility to decide how to comply. This vagueness in the regulations may be unavoidable because the non-power reactor community is so diverse, but it may also be desirable in that the facility can design a security system suited to its own particular characteristics. However, the authority approving the security systems will have to interpret and judge carefully in determining if the systems implemented meet the intent of the regulations in areas where specific requirements are not provided.

On the whole the generic characteristics of the non-power reactor community physical security requirements are patterned after those established for the power reactors, and are very similiar in general principle. In some instances there is a direct duplication of requirements, while in other cases there is appreciable similarity.

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