INFCIRC/225/Rev.4
(Corrected)*

THE PHYSICAL PROTECTION OF NUCLEAR MATERIAL AND NUCLEAR FACILITIES

INTERNATIONAL ATOMIC ENERGY AGENCY

THE PHYSICAL PROTECTION OF NUCLEAR MATERIAL AND NUCLEAR FACILITIES

INFCIRC/225/Rev.4
(Corrected)*

Printed by the
International Atomic Energy Agency
in Austria - June 1999

* The correction relates solely to the title of this document in the English language version.

INTERNATIONAL ATOMIC ENERGY AGENCY

PREFACE

Physical protection against the theft or unauthorized diversion of nuclear materials and against the sabotage of nuclear facilities by individuals or groups has long been a matter of national and international concern. Although responsibility for establishing and operating a comprehensive physical protection system for nuclear materials and facilities within a State rests entirely with the Government of that State, it is not a matter of indifference to other States whether and to what extent that responsibility is fulfilled. Physical protection has therefore become a matter of international concern and co-operation. The need for international co-operation becomes evident in situations where the effectiveness of physical protection in one State depends on the taking by other States also of adequate measures to deter or defeat hostile actions against nuclear facilities and nuclear materials, particularly when such materials are transported across national frontiers.

The IAEA recognized early on that it might be called upon to play a role in the area of the physical protection of nuclear materials and facilities. Its first effort resulted in the publication, in 1972, of "Recommendations for the Physical Protection of Nuclear Material", which was prepared by a panel of experts convened by the Director General. These recommendations were revised by a group of experts in co-operation with the IAEA Secretariat, and the revised version was published in 1975 in the INFCIRC series. INFCIRC/225 has been favorably received by Member States and has since become a standard reference document. The document was subsequently revised in 1977, 1989 and in 1993.

The 1993 review was of limited scope and resulted in changes to the text of INFCIRC/225/Rev.2 designed to make the categorization table in that document consistent with the categorization table contained in the Convention on Physical Protection of Nuclear Materials[1]. Consequently, a comprehensive review of INFCIRC/225 has not been conducted since 1989. In late 1997, the Secretariat consulted with individuals from a number of Member States regarding the timeliness of arranging for a review of this document. There was general agreement that, as a result of technological changes, political adjustments and modifications to national physical protection approaches, it was timely to conduct a thorough review of INFCIRC/225/Rev.3.

As a result, a meeting of national experts was convened for this purpose. They met from 2-5 June 1998[2] and from 27-29 October 1998 [3]. The revised document reflects the recommendations of the national experts to improve the structure and clarity of the document and to take account of improved technology and current international and national practices. In particular, a chapter has been added which provides specific recommendations related to sabotage of nuclear facilities and nuclear material. As a result of this addition, the title has been changed to "The Physical Protection of Nuclear Material and Nuclear Facilities".

---

[1] INFCIRC/274/Rev.1

[2] Participants and observers from the following countries attended the experts meeting in Vienna from 2-5 June 1998: Argentina, Australia, Austria, Belarus, Belgium, Botswana, Brazil, Bulgaria, Canada, Chad, Chile, China, Czech Republic, Denmark, Egypt, Finland, France, Germany, Hungary, Indonesia, Israel, Japan, Lithuania, Netherlands, Oman, Pakistan, Russian Federation, Slovakia, Spain, Sudan, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and United States of America.

[3] Participants and observers from the following countries attended the experts meeting in Vienna from 27-29 October 1998: Argentina, Australia, Austria, Belarus, Belgium, Brazil, Brunei, Canada, China, Costa Rica, the Republic of Croatia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Hungary, Japan, Republic of Korea, Lebanon, Pakistan, Poland, Russian Federation, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and United States of America.

The recommendations presented in this IAEA document reflect a broad consensus among Member States on the requirements which should be met by systems for the physical protection of nuclear material and facilities. It is hoped that they will provide helpful guidance for Member States.

Mohamed ElBaradei
Director General

CONTENTS

1. INTRODUCTION

1.1. Principles of physical protection are realized through administrative and technical measures, including physical barriers. The measures for the physical protection of nuclear material in use and storage and during transport, and of nuclear facilities presented herein are recommended for use by States as required in their physical protection systems. These measures are based on the state of the art in physical protection hardware and systems and on the types of nuclear material and nuclear facilities.

1.2. It is essential that this document be reviewed and updated periodically to reflect advances made both in physical protection systems and nuclear technology.

1.3. In implementing these recommendations, States are encouraged to cooperate and consult, and to exchange information on physical protection techniques and practices, either directly or through international organizations. States should aid each other in physical protection, and particularly in the recovery of nuclear material, in cases where such aid is requested.

1.4. The Convention on the Physical Protection of Nuclear Material (INFCIRC/274 Rev.1) obligates parties to:

- make specific arrangements and meet defined standards of physical protection for international shipments of nuclear material;
- co-operate in the recovery and protection of stolen nuclear material;
- make as criminal offences specified acts to misuse or threats to misuse nuclear materials to harm the public; and
- prosecute or extradite those accused of committing such acts.

The Convention also promotes international co-operation in the exchange of physical protection information.

1.5. States should inform each other, either directly or through the International Atomic Energy Agency, of appropriate points of contact for matters related to the physical protection of nuclear material and nuclear facilities.

2. DEFINITIONS

2.1. **ASSESSMENT:** The determination by a *guard* or an electronic system of the cause of an alarm and the extent of the threat.

2. 2. **CENTRAL ALARM STATION**: An installation which provides for the complete and continuous alarm monitoring, assessment and communications with guards, facility management and the response force.

2.3. **DEFENCE IN DEPTH**: A concept used to design physical protection systems that requires an adversary to overcome or circumvent multiple obstacles, either similar or diverse, in order to achieve his objective.

2.4. **DESIGN BASIS THREAT**: The attributes and characteristics of potential insider and/or external adversaries, who might attempt *unauthorized removal* of nuclear material or *sabotage*, against which a physical protection system is designed and evaluated.

2.5. **GUARD**: A person who is entrusted with responsibility for patrolling, monitoring, assessing, escorting individuals or *transport*, controlling access and/or providing initial response.

2.6. **INNER AREA:** An area inside a *protected area* where Category I nuclear material is used and/or stored.

2.7. **INTRUSION DETECTION:** Detection of an intruder by a *guard* or by a system comprising of a sensor(s), transmission medium and control panel to annunciate an alarm.

2.8. **PATROL:** A function carried out by *guards* to inspect elements of physical protection at regular or irregular intervals.

2.9. **PHYSICAL BARRIER:** A fence or wall or a similar impediment which provides penetration delay and complements access control.

2.10. **PROTECTED AREA:** An area under surveillance, containing Category I or II nuclear material, and/or *vital areas* surrounded by a *physical barrier*.

2.11. **RESPONSE FORCES:** Persons, on-site or off-site who are armed and appropriately equipped and trained to counter an attempted *unauthorized removal* of nuclear material or an act of *sabotage*.

2.12. **SABOTAGE:** Any deliberate act directed against a nuclear facility or nuclear material in use, storage or *transport* which could directly or indirectly endanger the health and safety of personnel, the public and the environment by exposure to radiation or release of radioactive substances.

2.13. **SECURITY SURVEY:** A detailed examination, made by the State's competent authority, of proposed physical protection measures in order to evaluate them for approval.

2.14. **TRANSPORT**: International or domestic carriage of nuclear material by any means of transportation beginning with the departure from a facility of the shipper and ending with the arrival at a facility of the receiver.

2.15. TRANSPORT CONTROL CENTRE: An installation which provides for the continuous monitoring of vehicle location and security status and for communication with the *transport* vehicle, its *guards*, the *response forces* and the shipper/receiver.

2.16. UNAUTHORIZED REMOVAL: The theft or other unlawful taking of nuclear material.

2.17. VITAL AREA: An area inside a *protected area* containing equipment, systems or devices, or nuclear material, the *sabotage* of which could directly or indirectly lead to unacceptable radiological consequences.

3. OBJECTIVES

3.1. The objectives of the State's physical protection system should be:

(a) To establish conditions which would minimize the possibilities for *unauthorized removal* of nuclear material and/or for *sabotage*[4]; and

(b) To provide information and technical assistance in support of rapid and comprehensive measures by the State to locate and recover missing nuclear material and to cooperate with safety authorities in minimizing the radiological consequences of *sabotage*[5].

3.2. The objectives of the International Atomic Energy Agency (Agency) are:

(a) To provide a set of recommendations on requirements for the physical protection of nuclear material in use and storage and during *transport* and of nuclear facilities. The recommendations are provided for consideration by the competent authorities in the States. Such recommendations provide guidance but are not mandatory upon a State and do not infringe the sovereign rights of States; and

(b) To be in a position to give advice to States' authorities in respect of their physical protection systems at the request of the State. The intensity and the form of assistance required are, however, matters to be agreed upon between the State and the Agency.

It should be noted that the Agency has no responsibility either for the provision of a State's physical protection system or for the supervision, control or implementation of such a system. Assistance by the Agency will be provided only when so requested by the State.

---

[4] Terms in italics are defined in Section 2 above.

[5] See also the Convention on Early Notification of a Nuclear Accident (INFCIRC/335) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (INFCIRC/336).

4. ELEMENTS OF A STATE'S SYSTEM OF PHYSICAL PROTECTION OF NUCLEAR MATERIAL AND NUCLEAR FACILITIES

4.1. GENERAL

4.1.1. A State's system of physical protection of nuclear material and nuclear facilities should include the elements described in Sections 4.2. - 4.4. below.

4.1.2. The responsibility for the establishment, implementation and maintenance of a physical protection system within a State rests entirely with that State.

4.1.3. The State's physical protection system should be based on the State's evaluation of the threat. Other factors should also be considered, including the State's emergency response capabilities and the existing and relevant measures of the State's system of accounting for and control of nuclear material. The recommended physical protection measures are intended for all nuclear material in use and storage and during *transport* and for all nuclear facilities.

4.1.4. A *design basis threat* developed from an evaluation by the State of the threat of *unauthorized removal* of nuclear material and of *sabotage* of nuclear material and nuclear facilities is an essential element of a State's system of physical protection. The State should continuously review the threat, and evaluate the implications of any changes in that threat for the levels and the methods of physical protection.

4.1.5. It is essential that the State's system of physical protection for nuclear material and nuclear facilities be reviewed and updated periodically to reflect advances made in the state of the art in physical protection hardware and systems or introduction of new types of facilities. Further, the design of a physical protection system for a specific facility may vary from these recommendations when prevailing circumstances indicate a need for a different level of physical protection.

4.1.6. The State should develop and implement emergency plans for any needed response to *unauthorized removal* and subsequent unauthorized use of nuclear material or *sabotage* of nuclear material or nuclear facilities to support and supplement, when needed, those emergency plans prepared by operators.

4.1.7. The recommended measures are in all cases additional to, and not a substitute for, other measures established for safety purposes for nuclear material in use and storage and during *transport* and for nuclear facilities.

4.2. LEGISLATION AND REGULATIONS

4.2.1. The State's legislation should provide for the regulation of physical protection and include a licensing requirement. The State should promulgate and review regularly its comprehensive regulations for the physical protection of nuclear material and nuclear facilities whether in State or private possession.

4.2.2. The State should define requirements for the physical protection of nuclear material in use and storage and during *transport* and for nuclear facilities depending on the associated consequences of either *unauthorized removal* of nuclear material or *sabotage*. For protection against *unauthorized removal* of nuclear material, the State should regulate the categorization of nuclear material (see Chapter 5) in order

to ensure an appropriate relationship between the nuclear material of concern and the protection measures. For protection against *sabotage* (Chapter 7), the State should establish the design objectives pertaining to off-site radiological consequences in order to determine an appropriate level of physical protection measures (e.g., making use of existing nuclear safety or radiological protection standards). Based on these analyses, the State should apply the more stringent requirements for physical protection, either those against *unauthorized removal* of nuclear material or those against *sabotage*.

4.2.3. Responsibility, authority and sanctions

4.2.3.1. A State should take appropriate measures within the framework of its national law to establish and ensure the proper implementation of the State's system of physical protection. The State should be responsible for verifying continued compliance with the physical protection regulations and licence conditions through periodic inspections and ensuring that corrective actions are taken, when needed.

4.2.3.2. A State should designate a competent authority under its legislation which is empowered to establish and ensure the proper implementation of the State's system of physical protection. If the elements of the State's system of physical protection are divided between two or more authorities, arrangements should be made for overall co-ordination. Clear lines of responsibility should be established and recorded between the relevant entities.

4.2.3.3. The State's competent authority should have a clearly defined legal status and independence from the applicant(s)/operator(s) and have the legal authority to enable it to perform its responsibilities and functions effectively.

4.2.3.4. The State's competent authority should have access to information from other State authorities on present and foreseeable threats to nuclear activities.

4.2.3.5. The State's competent authority should have access to information from the State's system of accounting for and control of nuclear material.

4.2.3.6. Enforcement of physical protection regulations is a necessary part of a State's physical protection system. Sanctions against the *unauthorized removal* of nuclear material and against *sabotage* are important to an effective State system of physical protection.

4.2.4. Licensing and other procedures to grant authorization

4.2.4.1. The State should define a *design basis threat* as a common basis for physical protection planning by the operator and its approval by the competent authority. In the event of any change to the *design basis threat*, the State's competent authority should ensure that the change is sufficiently reflected in the regulations and by the operator's protective measures.

4.2.4.2. Physical protection measures can be implemented by the State itself, the operator or any other entity duly authorized by the State.

4.2.4.3. The State should license activities only when they comply with its physical protection regulations. The State's system of physical protection should make provisions for a *security survey* of these activities prior to licensing, and whenever a significant change takes place, to ensure continued compliance with physical protection regulations. It should be noted that other regulations such as those relating to radiological protection and nuclear safety may also apply.

4.2.5. Physical protection requirements for nuclear material in use and storage and during *transport* and for nuclear facilities

4.2.5.1. State requirements for the physical protection of nuclear material should take into account the category of nuclear material, its location (use, storage, during *transport*) and the particular circumstances prevailing either in the State or along the transportation route. When considering the measures required for the physical protection of nuclear material against *unauthorized removal* or *sabotage*, the State should take into account the attractiveness and self-protecting nature of the material, the radiological consequences, and the containment measures used for safety reasons.

4.2.5.2. State requirements for physical protection should be based on the concept of *defence in depth* for preventive and protective measures. The concept of physical protection is one which requires a designed mixture of hardware (security devices), procedures (including the organization of *guards* and the performance of their duties) and facility design (including layout). The physical protection system is designed specifically for each facility taking into account the State's *design basis threat.*

4.2.5.3. The State's competent authority should ensure that the operator prepares emergency plans of action to counter effectively the *design basis threat*, including attempted *unauthorized removal* of nuclear material or *sabotage* taking into consideration actions of the *response force*.

4.2.5.4. Several types of nuclear facilities pose a hazard to the environment in case of *sabotage* because of the potential for release of radioactivity. Therefore, it is important that the level of protection of the facility should take the radiological consequences into consideration.

4.2.5.5. The State should define requirements for the physical protection of nuclear facilities against *sabotage*. They should take into account possible releases of radioactivity, the location of the nuclear facility, and the particular circumstances prevailing in the State. Adequate physical protection measures should be implemented for nuclear facilities which may be subject to *sabotage* regardless of the categorization of nuclear materials therein contained.

4.2.5.6. The State's evaluation of the threat should determine if there is a credible threat to disperse nuclear material malevolently. The State should then apply the level of physical protection measures needed to ensure protection against the acts leading to radiological consequences without regard to the categorisation of the material.

4.2.6. Additional physical protection requirements for nuclear material during *transport*

4.2.6.1. During international *transport* of nuclear material the responsibility for physical protection measures should be the subject of agreement between the States concerned. The shipping State should consider, before allowing the international *transport*, if the States involved in the *transport*, including the transit States:

- are Parties to the Convention on the Physical Protection of Nuclear Material (INFCIRC/274 Rev.1); or
- have concluded with it a formal agreement which ensures that physical protection arrangements are implemented; or
- formally declare that their physical protection arrangements are implemented according to internationally accepted guidelines; or
- have issued licences which contain appropriate physical protection provisions for the *transport*

of the nuclear material.

4.2.6.2. During international *transport* between two States sharing a common border, the State's responsibility for physical protection and the point at which physical protection responsibilities are transferred from one State to another should be the subject of an agreement between the States. However, with respect to the maintenance of communication regarding the continuing integrity of the shipment and with respect to the responsibility for carrying out physical protection measures and recovery actions in the event that a shipment becomes lost, the agreement between the States should provide that this responsibility will rest with the shipping State up to the border and will then be transferred to the receiving State.

4.2.6.3. When international shipments transit the territory of States other than the shipping State and the receiving State, the arrangements between the shipping and receiving States should identify the other States involved in such transit with a view to informing them and securing in advance their co-operation and assistance for adequate physical protection measures and for recovery actions on the territory of such States in case of loss of an international shipment thereon.

4.2.6.4. In the case of a Category I nuclear material international shipment transiting international waters or air space, the shipping and receiving States should establish specific measures to ensure the maintenance of communication regarding the continued integrity of the shipment and to ensure that responsibility for response planning and capabilities is defined and fulfilled.

4.2.7. Reporting of information

4.2.7.1. The State's system of physical protection should include reporting of events and information which enables the State's competent authority to be informed of any change at nuclear facilities or related to *transport* of nuclear material which may affect implementation of physical protection measures.

4.3. CONFIDENTIALITY

4.3.1. The State should take steps to ensure appropriate protection of specific or detailed information the unauthorized disclosure of which could compromise the physical protection of nuclear materials and nuclear facilities. It should define requirements for the confidentiality of physical protection systems and associated documentation.

4.3.2. Management of physical protection systems should limit access to sensitive information to those who need to know for the performance of their duties. Information addressing possible vulnerabilities in physical protection systems should be highly protected as it could indicate means of successfully removing nuclear material or of carrying out *sabotage*.

4.3.3. Sanctions against persons violating confidentiality should be part of the State's legislative or regulatory system .

4.4. EVALUATION OF THE IMPLEMENTATION OF PHYSICAL PROTECTION MEASURES

4.4.1. To ensure that physical protection measures are maintained in a condition capable of meeting the State's regulations and of effectively responding to the *design basis threat*, the State's competent authority should ensure that evaluations are conducted by operators at nuclear facilities and for *transport*. Such evaluations, which should be reviewed by the State's competent authority, should include administrative and

technical measures, such as testing of detection, assessment and communications systems and reviews of the implementation of physical protection procedures. Such evaluations should also include exercises to test the training and readiness of *guards* and/or *response forces*. When deficiencies are identified, the State should ensure that corrective actions are taken by the operator.

5. CATEGORIZATION OF NUCLEAR MATERIAL

5.1. BASIS FOR CONCERN

5.1.1. In determining the level of physical protection to be implemented for nuclear materials in use and storage or during *transport* account should be taken of the possibility that the *unauthorized removal* of plutonium, highly enriched uranium or uranium-233 could lead to the construction of a nuclear explosive device by a technically competent group.

5.2. CATEGORIZATION

5.2.1. The primary factor for determining the physical protection measures against *unauthorized removal* of nuclear material is the nuclear material itself, categorized in accordance with the following table which gives a categorization of the different types of nuclear material and with the considerations given below.

NOTE: This table is not to be used or interpreted independently of the text of the entire document.

TABLE: CATEGORIZATION OF NUCLEAR MATERIAL

Material	Form	Category I	Category II	Category III[c]
1.Plutonium [a]	Unirradiated [b]	2 kg or more	Less than 2 kg but more than 500 g	500 g or less but more than 15 g
2.Uranium-235	Unirradiated[b] - uranium enriched to 20% ^{235}U or more - uranium enriched to 10% ^{235}U but less than 20 % ^{235}U - uranium enriched above natural, but less than 10 % ^{235}U	5 kg or more	Less than 5 kg but more than 1 kg 10 kg or more	1 kg or less but more than 15g Less than 10kg but more than 1 kg 10 kg or more
3. Uranium-233	Unirradiated[b]	2 kg or more	Less than 2 kg but more than 500 g	500 g or less but more than 15 g
4. Irradiated Fuel (The categorization of irradiated fuel in the table is based on international *transport* considerations. The State may assign a different category for domestic use, storage, and *transport* taking all relevant factors into account.)			Depleted or natural uranium, thorium or low-enriched fuel(less than 10% fissile content)[d/e]	

[a] All plutonium except that with isotopic concentration exceeding 80 % in plutonium-238.

[b] Material not irradiated in a reactor or material irradiated in a reactor but with a radiation level equal to or less than 1 Gy/hr (100 rad/hr) at one meter unshielded.

[c] Quantities not falling in Category III and natural uranium, depleted uranium and thorium should be protected at least in accordance with prudent management practice.

[d] Although this level of protection is recommended, it would be open to States, upon evaluation of the specific circumstances, to assign a different category of physical protection.

[e] Other fuel which by virtue of its original fissile material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 Gy/hr (100 rad/hr) at one meter unshielded.

5.2.2. This categorization should be based on the potential risk of the material being used for a nuclear explosive device, which itself depends on: the type of material, e.g. plutonium, uranium; isotopic composition, i.e. content of fissile isotopes; physical and chemical form; degree of dilution; radiation level; and quantity. For example:

(a) The protection of nuclear material with a radiation level that exceeds 1 Gy/hr (100 rad/hr) at one meter unshielded, which is classified as Category I or II, may be reduced one category level below that determined by the fissile content of the material; and

(b) Nuclear material that is in a form that is no longer usable for any nuclear activity, minimizes environmental dispersal and is practicably irrecoverable, may be protected in accordance with prudent management practices.

5.2.3. In determining the levels of physical protection in a facility, which may consist of several buildings, it is possible that the State's competent authority may identify part of the facility which contains material of a different category and which is therefore protected at a different level than the rest of the facility. Conversely, consideration may need to be given to adding together the total amount of material contained in a number of buildings to determine the appropriate protection arrangements for this group of buildings.

6. REQUIREMENTS FOR PHYSICAL PROTECTION AGAINST UNAUTHORIZED REMOVAL OF NUCLEAR MATERIAL IN USE AND STORAGE

6.1. GENERAL

6.1.1. The concept of physical protection is one which requires a designed mixture of hardware (security devices), procedures (including the organization of *guards* and the performance of their duties) and facility design (including layout). The level of the physical protection measures should be specifically designed to take into account the nuclear material or nuclear facility and the State's *design basis threat*. Emergency procedures should be prepared to counter effectively the State's *design basis threat*.

6.1.2. Achievement of the objectives of the physical protection system should be assisted by:

(a) Taking into account physical protection of nuclear material in the design of the facility as early as possible;

(b) Limiting access to nuclear material or facilities to a minimum number of individuals. To accomplish this aim the State's competent authority should validate the operator's designation of *protected areas*, and *inner areas*. In designating such areas, the operator should give consideration to the plant safety design, the location of the plant and the *design basis threat*. Access to these areas should be limited and controlled; and

(c) Requiring predetermination of the trustworthiness of all individuals permitted unescorted access to nuclear material or facilities.

6.1.3. Potential conflicting requirements, resulting from safety and physical protection considerations, should be carefully analyzed to ensure that they do not jeopardize nuclear safety, including during emergency conditions.

6.2. REQUIREMENTS FOR CATEGORY I NUCLEAR MATERIAL

6.2.1. Category I nuclear material should be used or stored only within an *inner area* or *inner areas*, located in a *protected area*. The ceiling, walls and floor of *inner areas* should provide penetration delay against *unauthorized removal* of nuclear material.

6.2.2. Access to and the number of access points into the *protected area* and *inner areas* should be kept to the minimum necessary. Persons authorized unescorted access to the *protected area* or *inner areas* should be limited to persons whose trustworthiness has been determined. Persons whose trustworthiness has not been determined such as temporary repair, service or construction workers and visitors should be escorted by a person authorized unescorted access. The identity of all persons entering such areas should be verified and they should be issued with appropriately registered passes or badges.

6.2.3. All persons and packages entering or leaving *inner areas* should be subject to search to prevent the *unauthorized removal* of nuclear material. Instruments for the detection of nuclear material and metals can be used for such searches.

6.2.4. Entry of private motor vehicles into *protected areas* should be strictly minimized and limited to

designated parking areas. All vehicles entering and leaving the *protected area* should be subject to search. Private motor vehicles should be prohibited access to *inner areas*.

6.2.5. Whenever persons are present in *inner areas*, those areas should be under constant surveillance. The surveillance can be effected by mutual observation between two or more co-workers (e.g. two-man rule).

6.2.6. All employees should be informed at least annually of the importance of effective physical protection measures and be trained in their implementation as appropriate.

6.2.7. Every nuclear material handler should be required to conform to procedures for transferring custody of the nuclear material to the succeeding handler. Additionally, nuclear material handlers should endeavor to ascertain on reporting for duty that no interference with or *unauthorized removal* of nuclear material has taken place, and report to a senior authority whenever they have reason to suspect that a discrepancy exists.

6.2.8. A record should be kept of all persons having access to or possession of keys or key-cards concerned with the containment or storage of nuclear material. Arrangements should be made for:

(a) The checking and custody of keys or key-cards, particularly to minimize the possibility of duplication;

(b) The changing of combination settings at suitable intervals; and

(c) The changing of locks, keys, or combinations whenever there is evidence or suspicion that they have been compromised.

6.2.9. Movements of nuclear material within the *inner area* and the *protected area* should be the responsibility of the operator who should apply all prudent and necessary physical protection measures. Movements out of or between two *protected areas* should be treated in full compliance with the requirements for nuclear material during *transport*, after taking account of prevailing conditions.

6.2.10. *Intrusion detection* should be performed at the *physical barrier* surrounding the *protected area* and timely *assessment* should be carried out. Clear areas should be provided on both sides of the *physical barrier* with illumination sufficient for *assessment*. To protect against unauthorized access or malevolent acts, special attention should be paid to all points of potential access. The perimeter of the *protected area* should normally consist of a *physical barrier* in addition to and outside the building walls. In cases where the walls of a building are of a specially solid construction, these walls may be designated as being the perimeter of the *protected area* under conditions specified by a *security survey*.

6.2.11. *Inner areas* should be so arranged that the number of entries and exits is minimized (ideally only one). All emergency exits should be fitted with *intrusion detection* sensors. Other points of potential access should be appropriately secured and alarmed . *Inner areas* should not be sited close to public thoroughfares.

6.2.12. Storage areas should be of the "strong room" type in design and should be located within an *inner area*. They should be continuously locked and alarms activated when not occupied. The issuing of keys or key-cards should be closely controlled and keys or key-cards should remain within the *protected area*. Access to storage should be strictly limited to assigned persons and to others only when under their escort. Where nuclear material is held in an unmanned work area, e.g., overnight, specially authorized procedures should be used to protect the nuclear material. *Intrusion detection* and *assessment or patrols* can satisfy this requirement.

6.2.13. All *intrusion detection* sensors should annunciate and be recorded in a continuously staffed *central alarm station* to provide for monitoring and assessment of alarms, initiation of response and communication with the *guards*, facility management and, *response force*. The *central alarm station* should normally be located in the *protected area* unless its function will be more effectively performed in another area nearby. The *central alarm station* should be hardened so that its functions can continue in the presence of the *design basis threat.*

6.2.14. A 24-hour guarding service should be provided. The *guard* force or the *central alarm station* personnel should report at scheduled intervals to the off-site *response forces* during non-working hours. *Guards* should be trained and adequately equipped for their function in accordance with national laws and regulations. When *guards* are not armed, compensating measures should be applied. The objective should be the arrival of adequately armed *response forces* in time to counter armed attacks and prevent the *unauthorized removal* of nuclear material.

6.2.15. *Patrols* of the *protected area* should be provided.

6.2.16. Dedicated, tamper-indicating transmission systems and independent power supplies, should be provided between the *intrusion detection* sensors and the *central alarm station*. Alarms generated by *intrusion detection* sensors should be promptly assessed and appropriate action taken.

6.2.17. Dedicated, redundant and diverse transmission systems for two-way voice communication between the *central alarm station* and the *response force* should be provided for activities involving detection, assessment and response. Also, dedicated two-way voice communication should be provided between *guards* and the *central alarm station*.

6.2.18. Emergency plans of action should be prepared to counter effectively any attempted *unauthorized removal* of nuclear material. Such plans should provide for the training of *guards* and *response forces* in their actions in case of an emergency. They should also provide for appropriate response by *guards* or *response forces* to attempted intrusion into the *protected area* and *inner areas*. The close co-ordination between *guards* and *response forces* should be regularly exercised. In addition, other facility personnel should be trained and prepared to act in full co-ordination with the *guards*, *response forces* and safety response teams for implementation of emergency plans.

6.2.19. Arrangements should be made to ensure that during emergency evacuation conditions (including exercises) *unauthorized removal* of nuclear material does not occur.

6.2.20. Evaluations of the overall implemented physical protection system, procedures and the timely response of the *guards* and *response forces* should be conducted at least annually by the operator to determine their reliability and effectiveness.

6.2.21. Operators should regularly test *intrusion detection, assessment* and communications systems as well as other physical protection functions to determine their continued operability. When deficiencies are identified, corrective actions should be taken as soon as possible.

6.3. REQUIREMENTS FOR CATEGORY II NUCLEAR MATERIAL

6.3.1. Category II nuclear material should be used or stored only within a *protected area*.

6.3.2 Access to and the number of access points into the *protected area* should be kept to the minimum

necessary. Persons authorized unescorted access to the *protected area* should be limited to persons whose trustworthiness has been determined. Persons whose trustworthiness has not been determined such as temporary repair, service or construction workers and visitors should be escorted by a person authorized unescorted access. The identity of all persons entering such areas should be verified and they should be issued with appropriately registered passes or badges.

6.3.3. Vehicles, persons and packages entering or leaving the *protected area* should be subject to search.

6.3.4. Entry of private motor vehicles into the *protected area* should be minimized and limited to designated parking areas.

6.3.5. All employees should be informed at least annually of the importance of effective physical protection measures and be trained in their implementation, as appropriate.

6.3.6. Every nuclear material handler should be required to conform to procedures for transferring custody of the nuclear material to the succeeding handler. Additionally, nuclear material handlers should endeavor to ascertain on reporting for duty that no interference with or *unauthorized removal* of nuclear material has taken place, and report to a senior authority whenever they have reason to suspect that a discrepancy exists.

6.3.7. A record should be kept of all persons having access to or possession of keys or key-cards concerned with the containment or storage of nuclear material. Arrangements should be made for:

(a) The checking and custody of keys or key-cards, particularly to minimize the possibility of duplication;

(b) The changing of combination settings at suitable intervals; and

(c) The changing of locks, keys, or combinations whenever there is evidence or suspicion that they have been compromised.

6.3.8. Movements of nuclear material within a *protected area* should be the responsibility of the operator who should apply all prudent and necessary physical protection measures. Movements out of or between two *protected areas* should be treated in full compliance with the requirements for nuclear material during *transport*, due account should be taken of prevailing conditions.

6.3.9. *Intrusion detection* should be performed at the *physical barrier* surrounding the *protected area* and timely *assessment* should be carried out. Clear areas should be provided on both sides of the perimeter of the *protected area* with illumination sufficient for *assessment*. To protect against unauthorized access or malevolent acts, special attention should be paid to all points of potential access. The perimeter of the *protected area* should normally consist of a *physical barrier* in addition to and outside the building walls. In cases where the walls of a building are of a specially solid construction, these walls may be designated as being the perimeter of the *protected area* under conditions specified by a *security survey*.

6.3.10. All *intrusion detection* sensors should annunciate and be recorded in a continuously staffed *central alarm station* to provide for monitoring and *assessment* of alarms, initiation of response and communication with the *guards*, facility management and, *response force*. The *central alarm station* should normally be located in the *protected area* unless its function will be more effectively performed in another area nearby. The *central alarm station* should be hardened so that its functions can continue in the presence of the *design*

basis threat.

6.3.11. Dedicated, tamper indicating transmission systems, and independent power supplies, should be provided between the *intrusion detection* sensors and the *central alarm station.* Alarms generated by *intrusion detection* sensors should be promptly assessed and appropriate action taken.

6.3.12. Dedicated, redundant and diverse transmission systems for two-way voice communication between the *central alarm station* and the *response force* should be provided for activities involving detection, *assessment* and response. Also, dedicated two-way voice communication should be provided between *guards* and the *central alarm station.*

6.3.13. Emergency plans of action should be prepared to counter effectively any attempted *unauthorized removal* of nuclear material. Such plans should provide for the training of *guards* and *response forces* in their actions in case of an emergency. They should also provide for appropriate response by *guards* or *response forces* to attempted intrusion into the *protected area.* The close co-ordination between *guards* and *response force* should be periodically exercised. In addition, other facility personnel should be trained and prepared to act in full co-ordination with the *guards, response forces* and safety response teams for implementation of emergency plans.

6.3.14. Arrangements should be made to ensure that during emergency evacuation conditions (including exercises) *unauthorized removal* of nuclear material does not occur.

6.3.15. Evaluations of the overall implemented physical protection system, procedures and the timely response of the *guards* and *response forces* should be conducted periodically by the operator to determine their reliability and effectiveness.

6.3.16. Operators should regularly test *intrusion detection, assessment* and communications systems as well as other physical protection functions to determine their continued operability. When deficiencies are identified, corrective actions should be taken as soon as possible.

6.4. REQUIREMENTS FOR CATEGORY III NUCLEAR MATERIAL

6.4.1. Category III nuclear material should be used or stored only within an area to which access is controlled.

6.4.2. All employees should be frequently (about annually) informed of the importance of effective physical protection measures and be trained in their implementation.

6.4.3. Movements of nuclear material should be the responsibility of the operator, who should apply all prudent and necessary physical protection measures.

6.4.4. Provision should be made for detecting unauthorized intrusion and for appropriate action by *guards* or *response forces* to attempted intrusions.

6.4.5. Emergency plans of action should be prepared to counter effectively any attempted *unauthorized removal* of nuclear material. Such plans should provide for the training of facility personnel in their actions in case of an emergency. They should also provide for appropriate response by *guards* or *response forces* to attempted intrusion.

6.4.6. Evaluations of the implemented physical protection system and the timely response of the *guards*

and *response forces* should be conducted periodically by the operator to determine their reliability and effectiveness. When deficiencies are identified, corrective action should be taken, as soon as possible.

7. REQUIREMENTS FOR PHYSICAL PROTECTION AGAINST *SABOTAGE* OF NUCLEAR FACILITIES AND NUCLEAR MATERIAL DURING USE AND STORAGE

7.1. GENERAL

7.1.1. An act of *sabotage* involving nuclear material or against a nuclear facility could create a radiological hazard to the personnel, and a potential radioactive release to the public and the environment. Radiological hazards are strongly dependent on the threat to be considered, on the type of nuclear material, on the inventory of nuclear material and associated fission products, on the design of the facility or package and on its safety features. Consequently, a plant-specific or package design evaluation of the potential for *sabotage* and associated radiological consequences should be made in close consultation between safety and physical protection specialists.

7.1.2. The concept of physical protection to protect against *sabotage* requires a designed mixture of hardware (security devices), procedures (including the organization of *guards* and the performance of their duties) and facility design (including layout). The level of the physical protection measures should be specifically designed to take into account the nuclear facility or nuclear material, the State's *design basis threat* and the radiological consequences. Emergency procedures should be prepared to counter effectively the State's *design basis threat.*

7.1.3 The objective of the physical protection system should be to prevent or delay access to or control over the nuclear facility or nuclear material through the use of a set of protective measures including *physical barriers* or other technical means or the use of *guards* and *response forces* so that the *guards* or *response forces* can respond in time to prevent the successful completion of *sabotage.*

7.1.4. Achievement of the objectives of the physical protection system should be assisted by:

(a) Taking into account physical protection in the design of the nuclear facility as early as possible;

(b) Limiting access to nuclear material or facilities to a minimum number of individuals. To accomplish this aim the State's competent authority should validate the operator's designation of *protected areas*, *vital areas* or other areas. In designating such areas, consideration should be given to the plant safety design, the location of the plant and the *design basis threat.* Access to these areas should be limited and controlled; and

(c) Requiring predetermination of the trustworthiness of all individuals permitted unescorted access to nuclear material or facilities.

7.1.5. Safety specialists, in close cooperation with physical protection specialists, should evaluate the consequences of malevolent acts, considered in the context of the State's *design basis threat*, to identify nuclear material, or the minimum complement of equipment, systems or devices to be protected against *sabotage*. Also measures that have been designed into the facility for safety purposes should be taken into account. When protecting against *sabotage*, nuclear material or equipment, systems or devices the *sabotage* of which, alone or in combination based on analysis, could lead to unacceptable radiological consequences, should be located in a *vital area(s)*. Potential conflicting requirements, resulting from safety and physical protection considerations, should be carefully analyzed to ensure that they do not jeopardize nuclear safety, including during emergency conditions.

7.1.6. Evaluations of the overall implemented physical protection system, procedures and the timely response of the *guards* and *response forces* should be conducted at least annually by the operator to determine their reliability and effectiveness.

7.1.7. Operators should regularly test *intrusion detection, assessment* and communications systems as well as other physical protection functions to determine their continued operability. When deficiencies are identified, corrective actions should be taken as soon as possible.

7.2. REQUIREMENTS FOR NUCLEAR POWER REACTORS

7.2.1. The following set of measures represents the requirements applicable for the physical protection of nuclear power plants against *sabotage* because of their inventory of fission products and their inherent driving force for dispersion.

7.2.2. Nuclear material or equipment, systems or devices that are important to safety or the *sabotage* of which could lead to unacceptable radiological consequences, should only be located within a *vital area(s).* Equipment, systems or devices located outside the *protected area* should be evaluated with respect to their potential impact on plant safety when subjected to the *design basis threat.*

7.2.3. Access to and the number of access points into the *protected area* and *vital area(s)* should be kept to the minimum necessary. Persons authorized unescorted access to the *protected area* or *vital areas* should be limited to persons whose trustworthiness has been determined. Persons whose trustworthiness has not been determined such as temporary repair, service or construction workmen and visitors should be escorted by a person authorized unescorted access. The identity of all persons entering such areas should be verified and they should be issued with appropriately registered passes or badges.

7.2.4. All persons and packages entering *protected areas* should be subject to search to prevent the introduction of articles for use for *sabotage.* All vehicles entering the *protected area* should be subject to search. Instruments for the detection of explosives and metals can be used for such searches. Consideration should be given to preventing the forceful intrusion of motor vehicles.

7.2.5. Entry of private motor vehicles into *protected areas* should be strictly minimized and limited to designated parking areas. Private motor vehicles should be prohibited access to *vital areas.*

7.2.6. All employees should be informed at least annually of the importance of effective physical protection measures and be trained in their implementation as appropriate.

7.2.7. Operators should monitor to detect that no tampering or interference with equipment, systems or devices in *vital areas* has taken place, or to provide for timely detection of such tampering or interference. A report should be made to the competent authority whenever there is reason to suspect that any malevolent activity has occurred.

7.2.8. Following a shutdown/maintenance period, special precautions should be taken prior to reactor startup to detect any malevolent actions.

7.2.9. A record should be kept of all persons having access to or possession of keys or key-cards concerned with the containment or storage of nuclear material or to *vital areas.* Arrangements should be made for:

(a) The checking and custody of keys or key-cards, particularly to minimize the possibility of duplication;

(b) The changing of combination settings at suitable intervals; and

(c) The changing of locks, keys, or combinations whenever there is evidence or suspicion that they have been compromised.

7.2.10. *Intrusion detection* should be performed at the *physical barrier* surrounding the *protected area* and timely *assessment* should be carried out. Clear areas should be provided on both sides of the perimeter of the *protected area* with illumination sufficient for *assessment*. To protect against unauthorized access or malevolent acts, special attention should be paid to all points of potential access. The perimeter of the *protected area* should normally consist of a *physical barrier* in addition to and outside the building walls. In cases where the walls of a building are of a specially solid construction, these walls may be designated as being the perimeter of the *protected area* under conditions specified by a *security survey*.

7.2.11. *Vital areas* should be so arranged that the number of entries and exits is minimized (ideally only one). All emergency exits should be fitted with *intrusion detection* sensors. Other points of potential access should be appropriately secured and alarmed. *Vital areas* should not be sited close to public thoroughfares.

7.2.12. *Vital areas* should provide penetration delay. They should be appropriately secured and alarmed when unattended. The issuing of keys or key-cards should be closely controlled. They should be appropriately protected to ensure that they are not malevolently used.

7.2.13. All *intrusion detection* sensors should annunciate and be recorded in a continuously staffed *central alarm station* to provide for monitoring and *assessment* of alarms, initiation of response and communication with the *guards*, facility management and *response force*. The *central alarm station* should normally be located in the *protected area* unless its function will be more effectively performed in another area nearby. The *central alarm station* should be hardened so that its functions can continue in the presence of the *design basis threat*.

7.2.14. A 24-hour guarding service should be provided. The *guard* force or the *central alarm station* personnel should report at scheduled intervals to the off-site *response forces* during non-working hours. *Guards* should be trained and adequately equipped for their function in accordance with national laws and regulations. When *guards* are not armed, compensating measures should be considered. The objective should be the arrival of adequately armed *guards* and/or *response forces* before an act of *sabotage* begins or while the act is in progress so that they may prevent its successful completion.

7.2.15. *Patrols* of the *protected area* should be provided.

7.2.16. Dedicated, tamper indicating transmission systems and independent power supplies, should be provided between the *intrusion detection* sensors and the *central alarm station*. Alarms generated by *intrusion detection* sensors should be promptly assessed and appropriate action taken.

7.2.17. Dedicated, redundant and diverse transmission systems for two-way voice communication between the *central alarm station* and the *response forces* should be provided for activities involving detection, *assessment* and response. Also, dedicated two-way voice communication should be provided between *guards* and the *central alarm station*.

7.2.18. Emergency plans of action should be prepared to counter effectively any attempted *sabotage*. Such

plans should provide for the training of *guards* and *response forces* in their actions in case of an emergency. They should also provide for appropriate response by *guards* or *response forces* to attempted intrusion into the *protected area* and *vital areas*. The close co-ordination between *guards* and *response forces* should be regularly exercised. In addition, other facility personnel should be prepared to act in full coordination with *guards*, *response forces* and safety response teams for implementation of emergency plans.

7.2.19. Arrangements should be made to ensure that during emergency evacuation exercises access to *vital areas* remains controlled.

7.3. REQUIREMENTS FOR OTHER NUCLEAR FACILITIES AND NUCLEAR MATERIALS

7.3.1. *Sabotage* of nuclear facilities other than nuclear power plants and of various forms and quantities of nuclear material could also result in radiological hazards to the public. States should determine the level of protection needed against such *sabotage* depending upon the degree of radiological consequences. Measures specified in Section 7.2. may be applied as appropriate.

8. REQUIREMENTS FOR PHYSICAL PROTECTION OF NUCLEAR MATERIAL DURING *TRANSPORT*

8.1. GENERAL

8.1.1. The *transport* of nuclear material is probably the operation most vulnerable to an attempted act of *unauthorized removal* of nuclear material or *sabotage*. Therefore, taking into account the State's *design basis threat*, the physical protection provided should be "in depth" and particular attention should be given to the recovery of missing nuclear material. Emergency procedures should be prepared to counter effectively the State's *design basis threat*.

8.1.2. Achievement of the objectives of physical protection should be assisted by:

(a) Minimizing the total time during which the nuclear material remains in *transport*;

(b) Minimizing the number and duration of nuclear material transfers, i.e. transfer from one conveyance to another, transfer to and from temporary storage and temporary storage while awaiting the arrival of a vehicle, etc.;

(c) Protecting nuclear material during *transport* and in temporary storage in a manner consistent with the category of that material;

(d) Avoiding the use of regular movement schedules;

(e) Requiring predetermination of the trustworthiness of all individuals involved during *transport* of nuclear material; and

(f) Limiting advance knowledge of *transport* information to the minimum number of persons necessary.

8.1.3. Appropriate measures, consistent with national requirements, should be taken to protect the confidentiality of information relating to *transport* operations, including detailed information on the schedule and route, and particular consideration should be given to those operations involving Category I and II nuclear material. This requires great restraint in the use of any special markings on vehicles, and also in the use of open channels for transmission of messages concerning shipments of nuclear material. When a message is required by safeguards or radiological safety regulations, measures such as coding and appropriate routing to the extent practicable should be taken; care should be exercised in the handling of such information. These considerations should apply also to any subsequent communications.

8.1.4. An evaluation of the potential for *sabotage* and associated radiological consequences of a package design with respect to its mode of *transport* may be required by the State's competent authority. This should be done in close consultation with safety specialists.

8.1.5. Before an international shipment is made the shipper should ensure that the arrangements are in accordance with the physical protection regulations of the receiving State and of other States which are transited.

8.2. REQUIREMENTS FOR CATEGORY I NUCLEAR MATERIAL

8.2.1. Advance notification to receiver

8.2.1.1. The shipper should give the receiver advance notification of the planned shipment specifying the mode of *transport* (road/rail/sea/air), the estimated time of arrival of the shipment and the exact point of hand-over if this is to be done at some intermediate point before the ultimate destination.

8.2.1.2. The receiver should confirm his readiness to accept delivery immediately (and hand-over, if applicable) at the expected time, prior to commencement of the shipment.

8.2.2. Advance authorization

8.2.2.1. Advance authorization by the competent authority is required. This implies the performance of a *security survey* in advance. The consent to a *transport* operation can include specific limitations and conditions related to the particular circumstances and to whatever emergency plans have been prepared.

8.2.3. Selection of mode of *transport* and routing

8.2.3.1. In choosing the route, consideration should be given to the security of passage, in particular, arranging the route in such a way as to avoid areas of natural disasters or civil disorders and taking into consideration the capabilities of the *response forces*. The mode of *transport* for any given consignment should be such as to keep to a minimum the number of cargo transfers and the length of time the cargo remains in *transport*. The co-operation of the carrier concerning the implementation of physical protection measures should be ensured in advance.

8.2.3.2. Competent authorities should approve the route, including alternate routing as appropriate, stopping places, destination hand-over arrangements, identification of persons authorized to take delivery, accident procedures and reporting procedures, both routine and emergency.

8.2.4. Provision of locks and seals

8.2.4.1. Unless there are overriding safety considerations, the packages containing nuclear material should be carried in closed, locked vehicles, compartments or freight containers. However, carriage of packages weighing more than 2000 kg that are locked or sealed should be allowed in open vehicles. Subject to safety considerations, the package should be tied down or attached to the vehicle or freight container.

8.2.4.2. Checks should be made before dispatch to confirm the integrity of the locks and seals on the package, vehicle, compartment or freight container.

8.2.5. Search of load vehicle

8.2.5.1. There should be a detailed search of the load vehicle prior to loading and shipment, to ensure that *sabotage* devices have not been implanted or that *sabotage* has not been initiated.

8.2.6. Written instructions

8.2.6.1. Personnel with physical protection responsibilities should be given written instructions detailing their responsibilities during the *transport* which have been approved by the competent authority.

8.2.7. Measures after shipment

8.2.7.1. The receiver should check the integrity of the packages, locks and seals and accept the shipment immediately upon arrival. The receiver should notify the shipper of the arrival of the shipment immediately or of non-arrival within a reasonable interval after the estimated time of arrival at its destination. In addition, the *guard* should be instructed to report by two-way voice communications to the *transport control centre* his arrival at his destination and each overnight stopping place and place of hand-over of the shipment.

8.2.8. Communication

8.2.8.1. Physical protection measures should include provision of a continuous two-way voice communication system between the vehicle, its escort and the *transport control centre*. Redundant and diverse communication systems should be utilized, where available.

8.2.8.2 For shipments by road, rail or sea, there should be a *transport control centre* for the purpose of keeping track of the current position and security status of the shipment of nuclear material, alerting *response forces* in case of an attack and maintaining continuous two-way communication with the shipment and the *response forces*. The *transport control centre* should be hardened so that its function can continue in the presence of the *design basis threat*. While the shipment is in progress, the *transport control centre* should be staffed by qualified shipper or State designees, whose trustworthiness has been predetermined.

8.2.9. *Guards*

8.2.9.1. *Guards*, who are appropriately equipped and trained, should accompany each shipment to protect the nuclear material against *unauthorized removal* or *sabotage*. Continuous, effective surveillance of the packages or locked cargo hold, or compartment holding the packages is to be maintained by the *guard* at all times, especially when the *transport* is not in motion. States are encouraged to use armed *guards* to the extent that laws and regulations permit. When *guards* are not armed, compensating measures should be applied.

8.2.10. Emergency action

8.2.10.1. Arrangements should be made to provide an adequately sized, equipped and trained *response force* to deal with emergencies. The objective should be the arrival of the *response force* in time to prevent the *unauthorized removal* of nuclear material or *sabotage*.

8.2.11. Arrangements for international *transport*

8.2.11.1. In contracts or agreements between shippers and receivers involving international *transport* of nuclear material, the point at which responsibility for physical protection is transferred from the shipper to the receiver should be clearly stated.

8.2.11.2. When the contract or agreement involving international *transport* provides for delivery to a destination in the receiving State in the vehicle of the shipping State, this contract or agreement should provide that information be supplied in time to enable the receiver to make adequate physical protection arrangements.

8.3. REQUIREMENTS FOR CATEGORY I NUCLEAR MATERIAL RELATED TO THE MODE OF *TRANSPORT*

8.3.1. General

8.3.1.1. In addition to the requirements mentioned above, there should be further detailed requirements for Category I material related to the mode of *transport* as set out below.

8.3.2. Shipment by road

8.3.2.1. Designated load vehicle(s) should be used exclusively for each consignment and should preferably be specially designed to resist attack and equipped with a vehicle disabling device. Each load vehicle should carry a *guard* for that vehicle.

8.3.2.2. Each load vehicle should be accompanied by at least one vehicle manned by one or more *guards*.

8.3.2.3. If the *transport* cannot be completed in one day, prior arrangements should be made for overnight stay at a stopping place approved by the competent authority. During such overnight stays the load vehicle should be immobilized or parked in a locked and guarded building or compound.

8.3.2.4. There should be two-way communication between the load vehicle and the escort vehicle in addition to communication between these vehicles and the *transport control centre*.

8.3.3. Shipment by rail

8.3.3.1. Shipment should be in a freight train in an exclusive use wagon.

8.3.3.2. Accompanying *guards* should travel in the carriage nearest to the shipment.

8.3.4. Shipment by sea

8.3.4.1. Shipment should be carried out by a dedicated *transport* ship.

8.3.4.2. The shipment should be placed in a secure compartment or container which is locked and sealed.

8.3.5. Shipment by air

8.3.5.1. Shipment should be by aircraft designated for cargo only and for which the nuclear material is its sole cargo.

8.4. REQUIREMENTS FOR CATEGORY II NUCLEAR MATERIAL

8.4.1. Advance notification to receiver

8.4.1.1. The shipper should give the receiver advance notification of the planned shipment specifying the mode of *transport* (road/rail/sea/air), estimated time of arrival of the shipment and the exact point of hand-over if this is to be done at some intermediate point before the ultimate destination.

8.4.2. Selection of mode of *transport* and routing

8.4.2.1. In choosing the route, consideration should be given to the security of passage, in particular, arranging the route in such a way as to avoid areas of natural disasters or civil disorders, and taking into consideration the capabilities of the *response force*. The *transport* method for any given consignment should be such as to keep to a minimum the number of cargo transfers and the length of time the cargo remains in *transport*. The co-operation of the carrier concerning the implementation of physical protection measures should be ensured in advance.

8.4.2.2. Competent authorities should approve the route, including alternate routing as appropriate, stopping places, destination hand-over arrangements, identification of persons authorized to take delivery, accident procedures, and reporting procedures, both routine and emergency.

8.4.3. Provision of locks and seals

8.4.3.1. Unless there are overriding safety considerations, the packages containing nuclear material should be carried inclosed, locked vehicles, compartments or freight containers. However, carriage of packages weighing mor e than 2000 kg that are locked or sealed shall be allowed in open vehicles. Subject to safety considerations, the package should be tied down or attached to the vehicle or freight container.

8.4.3.2 Checks should be made before dispatch to confirm the integrity of the locks and seals on the package, vehicle, compartment or freight container.

8.4.4. Search of load vehicle

8.4.4.1. There should be a detailed search of the load vehicle prior to loading and shipment to ensure that *sabotage* devices have not been implanted or that *sabotage* has not been initiated.

8.4.5. Written instructions

8.4.5.1. Personnel with physical protection responsibilities should be given written instructions detailing their responsibilities during *transport* which have been approved by the competent authority.

8.4.6. Measures after shipment

8.4.6.1. The receiver should check the integrity of the packages, locks and seals and accept the shipment immediately upon arrival. The receiver should notify the shipper of the arrival of the shipment immediately or of non-arrival within a reasonable interval after the estimated time of arrival at its destination.

8.4.7. Communication

8.4.7.1. Physical protection measures should include provision of frequent communication between the vehicle and the shipper, receiver and/or shipper/receiver/State designee.

8.4.8. Arrangements for international *transport*

8.4.8.1. In contracts or agreements between shippers and receivers involving international *transport* of nuclear material, the point at which responsibility for physical protection is transferred from the shipper

to the receiver should be clearly stated.

8.4.8.2. When the contract or agreement involving international *transport* provides for delivery to a destination in the receiving State in a vehicle of the shipping State, this contract or agreement should provide that information be supplied in time to enable the receiver to make adequate physical protection arrangements.

8.5. REQUIREMENTS FOR CATEGORY III NUCLEAR MATERIAL

8.5.1. Advance notification to receiver

8.5.1.1. The shipper should give the receiver advance notification of the planned shipment specifying the mode of *transport* (road/rail/sea/air), the estimated time of arrival of the shipment and the exact point of hand-over if this is to be done at some intermediate point before the ultimate destination.

8.5.2. Provision of locks and seals

8.5.2.1. Where practicable, locks and seals should be applied to vehicles or freight containers.

8.5.3. Search of load vehicle

8.5.3.1. There should be a detailed search of the load vehicle prior to loading and shipment, to ensure that *sabotage* devices have not been implanted or that *sabotage* has not been initiated.

8.5.4. Measures after shipment

8.5.4.1. The receiver should notify the shipper of the arrival of the shipment immediately or of non-arrival within a reasonable interval after the estimated time of arrival at the destination.