GUIDE NO. AERB/NRF-TS/SG-10

GUIDE NO. AERB/NRF-TS/SG-10

GOVERNMENT OF INDIA

AERB SAFETY GUIDE

SECURITY OF RADIOACTIVE MATERIAL DURING TRANSPORT

ATOMIC ENERGY REGULATORY BOARD

AERB SAFETY GUIDE NO. AERB/NRF-TS/SG-10

SECURITY OF RADIOACTIVE MATERIAL DURING TRANSPORT

Atomic Energy Regulatory Board
Mumbai-400 094
India

January 2008

Price

Orders for this Guide should be addressed to:

The Administrative Officer
Atomic Energy Regulatory Board
Niyamak Bhavan
Anushaktinagar
Mumbai-400 094
India

FOREWORD

Activities concerning establishment and utilisation of nuclear facilities and use of radioactive sources are to be carried out in India in accordance with the provisions of the Atomic Energy Act, 1962. In pursuance of ensuring safety of members of the public and occupational workers as well as protection of environment, the Atomic Energy Regulatory Board (AERB) has been entrusted with the responsibility of laying down safety standards and enforcing rules for such activities. The Board has, therefore, undertaken a programme of developing safety standards, safety codes, and related guides and manuals. While some of these documents cover aspects such as siting, design, construction, operation, quality assurance and decommissioning of nuclear and radiation facilities, other documents cover regulatory aspects of these facilities.

Safety codes and safety standards are formulated on the basis of internationally accepted safety criteria for design, construction and operation of specific equipment, systems, structures and components of nuclear and radiation facilities. Safety codes establish the objectives and set requirements that shall be fulfilled to provide adequate assurance for safety. Safety guides and guidelines elaborate various requirements and furnish approaches for their implementation. Safety manuals deal with specific topics and contain detailed scientific and technical information on the subject. Experts in the relevant fields prepare these documents. The Board and its advisory committees review them before they are published. The documents are revised when necessary, in the light of experience and feedback from users as well as new developments in the field.

The widespread use of ionising radiation in medicine, industry, agriculture, research etc. has brought in the necessity of voluminous transport of the radioactive material from one place to another. Transport of radioactive material in India is governed by the AERB safety code AERB/SC/TR-1, (which is based on the 1985 edition of the IAEA regulations for the safe transport of radioactive material). This code, which is currently undergoing a comprehensive revision prescribes the requirements for ensuring safety in the movement of radioactive material through public domain. However, the scope of this safety code does not include the security aspects of transport of radioactive material.

Any breach in security during the transport of radioactive material, could have safety consequences resulting in radiation exposure to workers and / or the public in excess of the dose limits. In view of this, AERB has taken up the task of developing the technical basis to establish security levels for the safety of radioactive materials during transport and appropriate security measures commensurate with the potential radiological consequences that could result from malicious use of radioactive material. This guide addressing the above mentioned guidance is effective from the date of its issue.

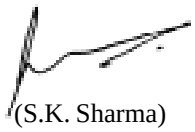
Consistent with the accepted practice, ‘shall’ and ‘ should’ are used in the guide to distinguish between a firm requirement and desirable option respectively. Appendices are an integral part of the document, whereas bibliography is included to provide further information on the subject that might be helpful to the user. Approaches for

implementation different to those set out in the guide may be acceptable, if they provide comparable assurance against undue risk to the health and safety of the occupational workers and the general public, and protection of the environment.

For aspects not covered in this Guide, national and international standards, codes and guides applicable and acceptable to AERB should be followed. Non-radiological aspects, such as industrial safety and environmental protection, are not explicitly considered. Industrial safety is to be ensured through compliance with the applicable provisions of the Factories Act, 1948 and the Atomic Energy (Factories) Rules, 1996.

Specialists in the field drawn from the Atomic Energy Regulatory Board, the Bhabha Atomic Research Centre, the Nuclear Power Corporation of India Limited, the Board of Radiation and Isotope Technology, the Department of Atomic Energy and other consultants have prepared this guide. It has been reviewed by experts and the Advisory Committee on Radiological Safety (ACRS) and Advisory Committee on Security (ACS).

AERB wishes to thank all individuals and organisations who have prepared and reviewed the draft and helped to finalise it. The list of persons, who have participated in this task, along with their affiliations, is included for information.



(S.K. Sharma)
Chairman, AERB

DEFINITIONS

A_2

Maximum activity of radioactive material, other than special form radioactive material permitted in a Type A package.

Carrier

Any individual, organisation or government, undertaking the transport of radioactive material by any mode of transport. The term includes both carriers for hire (known as contract carriers) and carriers on own account (known as private carriers)

Competent Authority

Any official or authority appointed, approved or recognised by the Government of India for the purpose of the Rules promulgated under the Atomic Energy Act, 1962.

Consignee

Any individual, organisation or government which receives a consignment.

Consignment

Any package or packages, or load of radioactive material, presented by a consignor for transport.

Consignor

Any individual, organisation or government which presents a consignment for transport, and is named as consignor in the transport documents.

Defence-in-Depth (Security)

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/her objective.

Graded Approach

An approach/process by which the scope, depth and rigour of the management and engineering controls are commensurate with the magnitude of any hazard involved with the failure of the item or process.

Guard (Security)

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

Low Specific Activity (LSA) Material

Radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding

materials surrounding the LSA material shall not be considered in determining the estimated average specific activity. LSA material shall be in one of the following three groups:

(a) LSA-I

(i) Uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides; or

(ii) solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or

(iii) radioactive material for which the A_2 value is unlimited, excluding fissile material in quantities not excepted under the relevant paragraphs of safety code on "Transport of Radioactive Materials AERB/SC/TR-1" ; or

(iv) other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in relevant schedules of AERB safety code (AERB/SC/TR-1).

(b) LSA-II

(i) water with tritium concentration up to 0.8 $TBq.l^{-1}$; or

(ii) other material in which the activity is distributed throughout and the estimated average specific activity does not exceed 10^{-4} A_2 $.g^{-1}$ for solids and gases, and 10^{-5} A_2 $.g^{-1}$ for liquids.

(c) LSA-III

Solids (e.g. consolidated wastes, activated materials), excluding powders, in which:

(i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);

(ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble matrix, so that, even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for seven days would not exceed 0.1 A_2; and

(iii) The estimated average specific activity of the solid, excluding any shielding material, does not exceed 2×10^{-3} A_2 $.g^{-1}$.

Package

The packaging with its radioactive contents as prescribed for transport.

Packaging

The assembly of components necessary to enclose the radioactive contents completely. It may, in particular, consists of one or more receptacles, absorbent materials, spacing structures, radiation shielding, service equipment for filling, emptying, venting and pressure relief devices for cooling, absorbing mechanical shocks, providing handling and tie-down capability, thermal insulation; and service devices integral to the package. The packaging may be a box, drum, or similar receptacle, or a freight container, tank or intermediate bulk container.

Radioactive Material

Any substance or material, which spontaneously emits radiation in excess of the levels prescribed by notification by the central government.

Surface Contaminated Object (SCO)

A solid object which is not itself radioactive but which has radioactive material distributed on its surfaces. SCO shall be in one of two groups, viz., SCO-I and SCO-II, as provided below:

(a) SCO-I: A solid object on which:

(i) the non-fixed contamination on the accessible surface of which averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0.4 Bq/cm^2 for all other alpha emittors; and

(ii) the fixed contamination on the accessible surface of which averaged over 300 cm^2 (or the are of the surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 for all other alpha emitters; and

(iii) the non-fixed contamination plus the fixed contamination on the imaccessible surface of which averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 for all other alpha emitters.

(b) SCO-II: A solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in (a) above and on which

(i) the non-fixed contamination on the accessible surface of which averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 400 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 40 Bq/cm^2 for all other alpha emittors; and

(ii) the fixed contamination on the accessible surface of which averaged over 300 cm^2 (or the are of the surface if less than 300 cm^2) does not

exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 8×10^4 Bq/cm^2 for all other alpha emitters; and

(iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface of which averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 8×10^4 Bq/cm^2 for all other alpha emitters.

SPECIAL DEFINITIONS

(Specific for the present guide)

Design Basis Threat (DBT) (for radioactive material)

The attributes and characteristics of a potential insider and /or external adversaries, who might attempt unauthorised removal of radioactive material or sabotage, against which a physical protection system is designed and evaluated.

Malicious Acts

Acts carried out during the transport of radioactive material, which may include any wrongful act or activity intentionally done or engaged in without legal justification or excuse and which causes or is likely to cause death or physical injury to a person or damage to property or the environment.

Operator

Any organisation or person authorized/responsible for radioactive transport security. This includes private individuals, governmental bodies, consignors, carriers, consignees.

Positive Identification

Any photographic identification or biometric record, which positively identifies the individual, and which has been issued by the Government or by any legally established organisation or agency.

Radioactive Source

Radioactive material that is permanently sealed in a capsule or closely bonded, is in a solid form and is not exempt from regulatory control.

Sabotage (Security)

Any deliberate act directed against a nuclear/radiation facility or radioactive material including 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.

Safety (during transport)

Measures intended to minimise the likelihood of accidents involving radioactive material and, should such an accident occur, to mitigate its consequences.

Security

The prevention and detection of, and response to malicious acts involving radioactive material.

Shipment

Shipment shall mean the specific movement of a consignment from origin to destination.

Threat

Characterisation of an adversary capable of causing undesirable consequences including the objectives, motivation, and capabilities, e.g. number of potential attackers, equipment, training, and attack plan.

Trustworthiness

Reliability of an individual, including characteristics that may be verified, when necessary, by background checks and checking criminal records.

Vulnerability

A feature or weakness that can bring about an unacceptable radiological consequence.

CONTENTS

FOREWORD i

DEFINITIONS iii

SPECIAL DEFINITIONS vii

1. INTRODUCTION 1
   1.1 General 1
   1.2 Objective 1
   1.3 Scope 1

2. DESIGN AND EVALUATION OF SECURITY MEASURES 4
   2.1 General 4
   2.2 Basic Security Principles 4
   2.3 Transport Security Principles 5
   2.4 Responsibilities 6
   2.4.1 Responsibilities of Government Agencies 6
   2.4.2 Operator Responsibilities 6
   2.5 International Shipments 8
   2.6 Establishing Levels of Security 8
   2.7 Determination of Specific Security Measures 9

3. ESTABLISHING RADIOACTIVE MATERIAL TRANSPORT SECURITY LEVELS 10
   3.1 General 10
   3.2 Categorisation of Radioactive Material Packages for Transport 10
   3.2.1 Types / Categories of Radioactive Materials (RAM) Transported 10
   3.2.2 Types of Packages Used for Transport of RAM 11
   3.2.3 Which Package to Use for Which Type of RAM 12
   3.3 Security Levels Envisaged during Transport of RAM . 12
   3.3.1 Level 1 - Prudent Management Practices 12
   3.3.2 Level 2 - Basic Security 12
   3.3.3 Level 3 - Enhanced Security 13
   3.4 Transport Requiring Special Security Measures 13
   3.5 Determination of Security Levels for Specific Radioactive Consignments 13

4. SECURITY MEASURES FOR THE DIFFERENT SECURITY LEVELS DURING TRANSPORT OF RADIOACTIVE MATERIAL 14
4.1 General 14
4.2 Level 1 - Prudent Management Practices 14
4.3 Level 2 - Basic Security Measures 14
4.3.1 General Security Provisions 15
4.3.2 Provision of Security Locks 15
4.3.3 Training in Security Awareness 16
4.3.4 Measures for Verification of Personnel Identity 16
4.3.5 Measures for Verification of Security of Conveyances 16
4.3.6 Adoption of Formal Procedures for Issue of Instructions 16
4.3.7 Security Related Information Exchange 16
4.3.8 Procedures for Verification of Trustworthiness of Personnel 17
4.4 Level 3 - Enhanced Security Measures 17
4.4.1 Availability of Formal Security Plans 17
4.4.2 Installation of Hardware for Tracking Shipments 18
4.4.3. Provision of Communication Links 18
4.5 Shipments Requiring Special Security Measures 18

APPENDIX - I : READY RECKONER FOR SECURITY LEVELS BASED ON THE TYPE OF RADIOACTIVE MATERIAL AND TYPE OF PACKAGES 20

APPENDIX - II: ISSUES / TOPICS TO BE COVERED IN TRAINING PROGRAMMES ON SECURITY 22

APPENDIX -III: A NOTE ON SHIPMENTS REQUIRING SPECIAL SECURITY MEASURES 24

BIBLIOGRAPHY 26

LIST OF PARTICIPANTS 28

COMMITTEE TO DEVELOP GUIDELINES ON SECURITY REQUIREMENTS DURING TRANSPORT OF RADIOACTIVE MATERIAL IN PUBLIC DOMAIN 28

ADVISORY COMMITTEE ON RADIOLOGICAL SAFETY (ACRS) 29

ADVISORY COMMITTEE ON SECURITY (ACS) 30

PROVISIONAL LIST OF RELEVANT REGULATORY DOCUMENTS ON TRANSPORT OF RADIOACTIVE MATERIALS 31

1. INTRODUCTION

1.1 General

The Atomic Energy Regulatory Board (AERB) has published a safety code on Transport of Radioactive Material (AERB/SC/TR-1). This code, which is periodically reviewed and revised, prescribes the requirements for ensuring safety in the movement of radioactive material through public domain. The competent authority for enforcing all safety codes issued under the Atomic Energy (Radiation Protection) Rules, 2004, is Chairman, AERB.

It is now well recognised that any breach in security during the transport of radioactive material, could have safety consequences resulting in radiation exposure to workers and/or the public in excess of the dose limits. In view of this, AERB has taken up the task of developing the technical basis to establish security levels for the safety of radioactive material during transport and appropriate security measures commensurate with the potential radiological consequences that could result from malicious use of radioactive material.

The guidelines provided in this document address the radiological concerns / hazards associated with the unauthorised removal, sabotage and other malicious acts during the transport of radioactive material which are used for peaceful purposes such as production of nuclear power, medical, industrial and research applications.

1.2 Objective

The objective of this document is to provide guidance, to an authorised user of radioactive material, consignor, carrier and other concerned persons, in implementing, maintaining or enhancing security in order to protect radioactive material while in transport against theft, sabotage or other malicious acts that could result in significant radiological consequences. From a security point of view, a threshold has to be defined for determining which packages or type of radioactive material need to be protected beyond prudent management practice. The likelihood of theft or sabotage of radioactive material during transport has to be minimised by a combination of measures involving deterrence, detection, delay and response, complemented by other measures for mitigation of consequences of such acts, including recovery.

This guide also addresses the elements of security requirements[1] to ensure security and safety of any radioactive material, which is transported in the public domain.

1.3 Scope

These guidelines apply to authorised transport of all packages containing

radioactive material in respect of which a breach of security could result in significant potential radiological hazard to individuals, society and the environment. The authorised transport of radioactive materials using standard packages may only ensure that there would be no significant radiation concern arising from an accident scenario. Hence, security threat scenarios[2] should be prioritised while applying the guidelines given in this document.

The security provisions specified in this guide relate to the following radioactive consignments:

- Exempted consignments (with limited radioactivity like radioimmuno assay (RIA) kits, reference sources, sources used in consumer products, etc)
- Low specific activity material (LSA I / II/ III)
- Surface contaminated objects (SCO I / II)
- Type A packages
- Type B packages

---

1 Elements of security requirements

Some of the important generic requirements for transport security of radioactive material are:

- Design features
- Access control
- Administrative control (e.g. personnel verification)
- Information control
- Specific training of carrier's personnel (formalised familiarisation programme)
- Tracking of shipment
- Alerting state authorities prior to and during shipment

These elements should be utilised to various extents in a graded manner thus characterising the different security levels and implemented in the transport of radioactive material.

2 Prioritisation of security threat scenarios

While the design of the standard packages used for transport of radioactive material will ensure that there would be no significant radiation concern arising from an accident scenario, there could be safety concerns arising due to a breach in the security of the sources. This breach in security could occur due to weakness in administrative procedures, which could result in a source getting lost or due to deliberate acts of theft to take control of the source for use in criminal activities like making a radiological dispersal device (RDD) or due to the possibility of sabotage during transport. Consequently, security measures would have to address all these scenarios. Though high radioactivity sources might seemingly pose a greater threat under such scenarios, they could be considered as an unattractive option by criminal elements because of the high personal fatality risk to the person committing the theft and also due to the heavy shielding of such sources being a physical deterrent for ease of stealing. Therefore, it is felt that the lightweight packages carrying some significant radioactivity are the ones that have most potential for being misused and hence require adequate security provisions.

The threshold values outlined in this document have been derived on the basis of the potential radiological consequences of malicious acts involving intentional dispersion of radioactive material.

While separate AERB publications usually address safety and security for the transport of radioactive material, it is recognised that some of the measures designed to address safety can also complement security aims. Therefore, the safety measures and procedures already in place as a result of the broad and effective application of the AERB safety code (AERB/SC/TR-1), 'Safety Code for the Transport of Radioactive Materials', may meet some of the security requirements. Care should be taken to ensure that safety and security measures do not conflict.

2. DESIGN AND EVALUATION OF SECURITY MEASURES

2.1 General

The authorised transport of radioactive materials is carried out in one or more of the following circumstances:

- From the producer/supplier of radioactive material to an authorised user.
- During use of the radioactive material from one authorised location to another.
- From authorised user of the radioactive material to disposal facility.

The potential radiological consequences resulting from a breach of security during such transport do not differ in principle from violation of the safety requirements. The organisations/persons involved in the transport of any radioactive material should therefore be well aware of the security threats which could arise during such transport.

This section defines the responsibilities of such organisations/persons to ensure that the appropriate level of security during the transport of radioactive material has been established. It considers the consignor's formal security plans appropriately to implement requisite security measures. Depending on the type and quantity of the radioactive material being transported, the assessment of security threat and the potential consequences, a graded system of security measures would need to be put in place by the consignor. The design of a transport security system should consider defence-in-depth principles to prevent the material from being susceptible to malicious acts.

2.2 Basic Security Principles

The basic principles for security for transport of radioactive material are as follows:

- Availability of management systems for drawing up and implementing formal security plans;
- Inculcating security culture amongst all involved organisations/ persons;
- Defining the responsibility of various public functionaries;
- Defining the responsibilities of those involved in transport (consignors, carriers and consignees);
- Pragmatic evaluation of threats;
- Adoption of a graded approach in implementing security measures;

- Incorporating a defence-in-depth concept for the security measures;
- Measures to maintain confidentiality; and
- Availability of contingency/emergency plans to respond to any breach of security.

2.3 Transport Security Principles

The following factors should be considered while designing the transport security system:

- Quantity and the physical/chemical form of the radioactive material;
- Mode(s) of transport;
- Transport schedules and route of shipment;
- Package(s) being used;
- Measures required to deter, detect and delay unauthorised access to the radioactive material while in transport and during storage incidental to such transport to deter or defeat any attempt of malicious acts;
- Identifying potential malicious acts while in transport or during storage incidental to transport to enable appropriate response and early commencement of recovery/mitigation efforts;
- Provisions for rapid response to attempts directed towards unauthorised access to radioactive material, to actual unauthorised access, or to other malicious acts involving radioactive material while in transport or storage incidental to such transport;
- Capability to detect and recover any damaged, stolen or lost radioactive material, and bringing it into secure regulatory control and minimising and mitigating the radiological consequences of any theft, sabotage or other malicious acts; and
- Procedures for maintaining information security.

As far as practicable, the following features should be incorporated during the design of security measures:

- Avoid predictable movement schedules;
- Plan routes to avoid areas, which are, at the time of planning, affected by a natural disaster or a disruption of the local law and order situation;
- Keep total transport duration and the number of modal transfers to the minimum;
- Disseminate information regarding the transport and related security measures on a ‘need-to-know’ basis;

- Do not leave packages or conveyances containing radioactive material unattended; and
- Subject the radioactive material in transport and in temporary storage incidental to transport to security measures consistent with those to be applied to the material in use and storage.

2.4 Responsibilities

2.4.1 Responsibilities of Government Agencies

The government agencies dealing with law and order are responsible to communicate warnings/alerts/advisories about the perceived security threats sufficiently in advance so that authorised users, consignors and carriers of radioactive material could implement appropriate measures. Depending on the nature of these alerts/warnings, different places may pose different levels of security threat at a given time and a given place may pose different security levels of threat at different times. Consequently, the concerned authorities should continuously review the threats associated with the radioactive material in transport and evaluate the implication of any changes in those threats for the strengthening of the security measures.

2.4.2 Operator Responsibilities

All organisations (consignors, carriers and consignees), and other persons involved in the transport of radioactive material should implement the security measures commensurate with their responsibilities and the required security level.

The concerned organisations in consultation with the law and order authority as necessary should establish in advance contingency plans to respond to malicious acts involving radioactive material during transport including the recovery of lost or stolen material and for minimising and mitigation of consequences.

For international transport, while implementing the security measures, the concerned organisations should consider the variations in security requirements and clearly define each point at which the security responsibility is transferred from one agency to another.

The competent authority will have the powers to impose penalties for non-compliance with the security requirements.

2.4.2.1 Consignor

The consignor should

- Submit a security plan for the transport of radioactive material to the competent authority prior to undertaking the shipments. Up on

verifying continued compliance with the security requirements through periodic inspections, the competent authority would prescribe corrective actions, where needed.

- Identify, classify and control sensitive information, the unauthorised disclosure of which could compromise the security of radioactive material in transport.
- Establish a security clearance procedure for persons engaged in the transport of radioactive material, commensurate with their responsibilities.
- Report to the competent authority all security related events with regard to the entire security plan, such as attempts to breach security and actual breach of security, attempted thefts and actual thefts, and even misplacement or loss of radioactive material or loss/theft of transport related sensitive information at the earliest but not later than 24 hours of the event.

Although the following sections (2.4.2.2 and 2.4.2.3) detail the responsibilities for the carrier and consignee, it must be recognised that the consignor bears the sole responsibility for ensuring that the other operators involved in the transport have all the requisite applicable security systems in place.

2.4.2.2 Carrier

The primary responsibility of the carrier commences from the moment the package is accepted for transport till its proven delivery to the authorised consignee.

The carrier

- Is responsible for implementing adequate measures to prevent theft or pilferage of the package either in part or in full, whether during the transport itself or during its temporary storage.
- Should report any such pilferage/theft or even the attempt of it to the consignor and to the police authorities at the earliest but not later than 24 hours of the event.
- Should ensure that the package is delivered only to the consignee or his/her authorised representative at the destination as stated in the transport documents.
- Should ensure that his/her identity and designation of the person taking delivery of the package are first established in the event of the package being handed over to an authorised representative.
- Should retain custody of the package and report back to the consignor in the event of any doubt whatsoever regarding the identity of the consignee or his/her authorised representative.

- Should also maintain complete records of all the transport details of the radioactive material handled by his/her organisation. The maintenance of these records should be such that they are verified and authentic, up-to-date and be available if required, for audit at a later stage by the competent authority. The records should include complete information about the consignor, consignee and the consignment and also confirmation of the consignor that the transport is in conformity with the regulatory requirements for safe transport of radioactive material (AERB/SC/TR-1) . The records should also ensure the complete inventory of all packages, which were accepted for transport, and this should include those in storage, in transit and those, which have been delivered to the consignee.

2.4.2.3 Consignee

To begin with, the consignee should ensure that his/her organisation has been authorised by the competent authority to receive and handle the radioactive source being delivered. It is the responsibility of the person/official identified in the transport documents as the consignee to personally collect or take delivery of the package. In the event of the consignee authorising a representative for this purpose, the consignee should make available a verifiable authorisation document, which the carrier will accept before handing over the package. In the event of the package having to be collected from the office of the carrier, it is the responsibility of the consignee to collect the same within five (5) working days of being informed of its receipt at the carrier's office.

2.5 International Shipments

For air transport, the shipment should be carried in accordance with applicable security provisions (Annexes 17 and 18 of the convention on International Civil Aviation and the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air). For maritime transport, shipments should be carried out in accordance with the applicable security level provisions of the ISPS code of the International Maritime Dangerous Goods Code as required with the International Convention of the Safety of Life at Sea (SOLAS 74 amended). These provisions should be supplemented by the guidance in this document.

Before undertaking an international shipment, the originating country should make adequate provisions to ensure that the security requirements of the receiving country or any country through which the material will transit, will be met.

2.6 Establishing Levels of Security

The level of security to be assigned to a shipment would depend upon the nature and quantity of the radioactive material being transported.

Certain low specific activity materials (LSA) such as natural uranium and natural thorium and their ore concentrates or tritiated heavy water of specific activity not greater than 0.8 $TBq.l^{-1}$ and transported in industrial packages, involve relatively low security risk. So is the case with radiopharmaceuticals, which are used for diagnosis and treatment in nuclear medicine and transported in Type A packages. This holds good even if such transport is done in large quantities or numbers, which may be associated with a higher security risk. This is because LSA materials are intrinsically safe and radiopharmaceuticals are permitted to be transported only in small quantities in Type A packages.

On the other hand, Type B (U / M) packages containing radioactive sources, may be used/transported in relatively smaller numbers and could therefore be associated with a low probability of breach of security. But since the radioactive content of such packages is relatively high, the associated potential radiological consequence would also be high and therefore they would involve a higher security risk.

In addition to what is stated above, fissile materials which are transported in industrial packages (IPs), Type A or Type B (U / M) packages, would need to be considered differently because of their fissile characteristics, and hence would require additional security considerations.

2.7 Determination of Specific Security Measures

As stated earlier, the consignor is responsible for determining the appropriate security level for the shipment of radioactive material and implementing the appropriate security measures. The next section provides specific guidance for the determination of security levels and the following section provides the specific security measures recommended for each of these levels.

3. ESTABLISHING RADIOACTIVE MATERIAL TRANSPORT SECURITY LEVELS

3.1 General

In order to specify the transport security levels in a manner that is easily understood and integrated into existing safety and security systems, it is essential to categorise the radioactive materials being transported. In recognition of the fact that human health is of paramount importance, the standard categorisation system of IAEA is based primarily on the potential for radioactive sources to cause deterministic health effects. Adopting this as such for establishing security levels may not suffice, since there is also a need to consider portable packages containing reasonably high activity and which are susceptible to being stolen and used for malevolent purposes.

3.2 Categorisation of Radioactive Material Packages for Transport

3.2.1 Types/Categories of Radioactive Materials (RAM) Transported

The transport of RAM could involve different types/categories of the material. This categorisation itself could be done in two ways.

The first method, which is based on the IAEA method, sorts all sealed radioactive sources in five categories. This number is considered sufficient to enable the practical application of the scheme, without unwarranted precision. Within this categorisation system, sources in Category 1 are considered to be the most 'dangerous' because they can pose a very high risk to human health if not managed safely and securely. An exposure of only a few minutes to an unshielded Category 1 source may be fatal. At the lower end of the categorisation system, sources in Category 5 are the least dangerous; however, even these sources could give rise to doses in excess of the dose limits if not properly controlled, and therefore need to be kept under appropriate regulatory control. The categorisation method outlined here is available in detail in IAEA literature. It may be noted that this categorisation does not cover unsealed sources and RAM which are not defined as sources, for example, spent nuclear fuel.

The second method discussed below, recognises that security guidelines should cover all types of RAM, including sealed sources, unsealed sources and irradiated nuclear fuel. Further, since these guidelines are meant to be used by specific users to establish their security levels, it is felt desirable that the categorisation should be such that the user (consignor or consignee) is able to identify the level of security applicable to the specific consignment being transported. For this purpose, given below is the list of possible RAM that are commonly transported.

(i) Reference sources;

(ii) Consumer products (like smoke detectors, luminous painted dials, tritium light sources);

(iii) Uranium/thorium ores or ore concentrates, depleted uranium, un-irradiated natural uranium fuel assemblies and other RAM defined as LSA I / II / III in AERB's safety code AERB/SC/TR-1, Safety Code for the Transport of Radioactive Materials;

(iv) Surface contaminated objects defined as SCO I / II in AERB's safety code document AERB/SC/TR-1, Safety Code for the Transport of Radioactive Materials;

(v) Radiopharmaceuticals;

(vi) Nucleonic gauges;

(vii) Neutron sources used in oil-well logging;

(viii) Industrial radiography sources;

(ix) Manually handled brachytherapy sources;

(x) Remotely handled brachytherapy sources;

(xi) Teletherapy sources;

(xii) Gamma irradiator sources;

(xiii) Decayed sealed sources for disposal;

(xiv) Uranium hexafluoride (enriched);

(xv) Wastes arising from the nuclear fuel cycle;

(xvi) Unirradiated enriched nuclear fuel;

(xvii) Special nuclear material in different types of packages; and

(xviii) Irradiated nuclear fuel.

As would be noticed, the above list is generally in terms of increasing hazard potential arising out of their radioactivity content.

3.2.2 Types of Packages Used for Transport of RAM

The type of package that has to be used for transporting RAM is stipulated by the regulatory authority in the AERB's safety code AERB/SC/TR-1, Safety Code for the Safe Transport of Radioactive Materials, which also prescribes the design specifications for different types of packages. The types of packages that are used for transport of RAM are:

- Excepted packages (the term 'excepted' is used to indicate that these qualify for exceptions from many of the regulatory provisions - basically it is a standard package normally used);

- Industrial packages (IPs) - IP-1, IP-2 and IP-3;
- Type A packages;
- Type B (U) / (M) packages;
- Packages for fissile materials; and
- Packages for uranium hexaflouride.

3.2.3 Which Package to Use for Which Type of RAM

The choice of the type of package to be used is dependant on the nature, the quantity and the physical form of the RAM being transported. Therefore the same RAM would have to be transported in a different type of package if there are changes in the above parameters. To identify the type of package to be used, a table is given at Appendix I, which indicates the type of package for different RAM under different conditions. Appendix I has been included here only for guidance of the consignor, who should comply with the transport regulatory requirements as detailed in AERB's safety code AERB/SC/TR-1, Safety Code for the Safe Transport of Radioactive Materials, with regard to type of package to be used. Once the type of package has been decided upon for a given RAM, it is possible to assign the required level of security to be adopted for its transport.

3.3 Security Levels Envisaged during Transport of RAM

Three levels of security are envisaged during the transport of radioactive material. These are detailed in the following paragraphs.

3.3.1 Level 1 - Prudent Management Practices

This is the minimum level of security, which is expected to be available with the adoption of prudent management practices that would be put in place by any responsible operator. For such material, which has very low quantities of radioactivity and thereby poses relatively low risk of radiological hazard to the public, this level of security is considered adequate during its transport. This level of security would be applicable to radioactive material transported in 'Excepted Packages' and 'Industrial Packages (Types IP-1, IP-2 and IP-3)'.

3.3.2 Level 2 - Basic Security

This is the basic security level which would be available with the adoption of specific procedures / measures, over and above what the prudent management practices referred to earlier. Examples of the type of radioactive materials, which would require this level of security would be sources used in nucleonic gauges, nuclear medicine, low dose rate (LDR) brachytherapy sources, etc. This level of security would be applicable to all radioactive material, except fissile material, transported in Type A packages.

3.3.3 Level 3 - Enhanced Security

This would be the security level which would be available with the enhanced security procedures/measures, over and above the basic security level described in the preceding paragraph. Examples of the type of radioactive materials, which would require this level of security would be sources used in teletherapy, irradiator, high dose rate (HDR) brachytherapy sources, industrial radiography sources, etc. This level of security would be applicable to all radioactive material (except irradiated nuclear fuel and fissile material) transported in Type B (U)/(M) packages.

3.4 Transport Requiring Special Security Measure

Over and above the commonly transported radioactive materials as detailed in the previous paragraph, there would be certain types of transport / shipment for which, elaborate measures/procedures would need to be put in place to ensure security. These measures would include amongst others prior approval for the shipment, special vehicle, additional security personnel and escort, secure communication support and on line tracking system, etc. This level of security would be applicable to all radioactive material transported in Type IF, Type AF, Type B(U)F and Type B(M)F packages as well as irradiated nuclear fuel packages.

3.5 Determination of Security Levels for Specific Radioactive Consignments

As stated earlier, the choice of the type of package to be used is dependant on the nature, the quantity and the physical form of the RAM being transported. To facilitate this determination, Appendix I also gives the security level for the various types of RAM listed at 3.2.1 and types of packages listed at 3.3 and 3.4. The details of measures to be adopted for each of these levels of transport security, are given in the next section.

4. SECURITY MEASURES FOR DIFFERENT SECURITY LEVELS DURING TRANSPORT OF RADIOACTIVE MATERIAL

4.1 General

This section is intended to provide adequate baseline security measures that would protect the radioactive material being transported against theft, sabotage or other malicious acts. Based on the type of package being transported, and after determination of the security level that would be necessary, this section details various procedures/steps to be taken to ensure that the desired level of security during transport is achieved (refer to Appendix I). Over and above these measures, the consignor should carry out a threat and vulnerability assessment of the ground realities expected to prevail during the actual shipment, and implement additional measures as are felt necessary. Such measures could even include cancellation of the shipment itself till such time as the consignor feels necessary.

The security measures detailed below are with respect to the three levels of security identified in the earlier section, namely:

- Level 1 - Prudent management practices
- Level 2 - Basic security measures
- Level 3 - Enhanced security measures

4.2 Level 1 - Prudent Management Practices

This level of security would be applicable to radioactive material transported in “Excepted Packages” and “Industrial Packages (Types IP-1, IP-2 and IP-3), excepting for fissile materials”. These would apply to S. Nos. 1 to 4 of Appendix I.

As a responsible organisation, the operator should adopt prudent management practices, which would ensure that a minimal level of security is maintained. This requires the consignor to have formal systems in place for accounting the radioactive material in terms of quantity produced, dispatched and balance in stock. In addition, the consignor should also have a formal system in place for proper selection of a carrier, prompt notification to the consignee regarding the dispatch of the consignment, keeping track of the consignment during its movement in the public domain and formal confirmation of the receipt of the consignment by the consignee.

4.3 Level 2 - Basic Security Measures

This level of security would be applicable to all radioactive material transported

in Type A packages. These would apply to S. Nos. 5 to 8 and 13 of Appendix I.

The measures detailed in this paragraph should be adopted in addition to the prudent management practices described in paragraph 4.2. These measures include certain general security provisions, provision of security locks, training of personnel on security awareness, identity verification of personnel and conveyances, adoption of formal procedures/instructions, security related information exchange and procedures for verification of trustworthiness of personnel.

4.3.1 General Security Provisions

Only properly authorised operators should be involved in the transport of radioactive materials. Normally, the existence of good business relationship between a carrier and consignee/consignor can be considered as sufficient. Where such a relationship does not exist, the carrier's / consignee's suitability or ability to receive or transport radioactive material should be established by confirmation with national regulatory authorities or trade / industry associations and the legitimacy of the carrier and consignee should be established.

All operators (consignors, consignees, carriers) and any other person involved in the transport of radioactive material should consider security requirements that are commensurate with their responsibilities and the level of threat. Operators should take all threat information into consideration while implementing security measures. In case of international transport, the threat information of each country involved in such transport should be considered.

The operator should have a systematic procedure, which would continually give the status on the position of the package and alert the operator when packages are not delivered to the intended recipient at the expected time. As soon as it is determined that a package has been lost or stolen, actions should be immediately initiated to locate and recover the package.

When radioactive materials are to be temporarily stored in transit sites, appropriate security measures as would have been applied for the material during transport or use and storage shall be applied.

4.3.2 Provision of Security Locks

Packages of radioactive materials should be generally carried in secured and closed vehicles, unless unfeasible for any operational or safety reasons. Packages weighing more than 500 kg, which have been sealed and secured to the conveyances, may be transported in an open conveyance. The integrity of locks and seals should be verified before dispatch and on arrival and verifiable at other times if so required.

4.3.3 Training in Security Awareness

All persons/agencies employed in a position involving radioactive material transport should have undergone training or should be provided training prior to employment in such a position. This should be supplemented by re-training, which shall also be adopted as a policy by the operator.

Such training should include the relevant elements of security awareness. The issues covered should address the nature of security threats, recognising security threats, recognising security concerns, the methods of addressing such concerns and actions to be taken in the event of a security related incident. The training should include awareness of security plans as commensurate with responsibilities of individuals and their part in implementing security plans. Records should be maintained of the security training undertaken by all individuals in the organisation.

More details of the typical contents of such training programmes are given Appendix II. Institutions accredited by the competent authority should conduct training programmes.

4.3.4 Measures for Verification of Personnel Identity

Each crew member of any conveyance transporting radioactive material should carry a positive means of identification during transport. In the absence of biometric detail confirmation, government issued photographic identification may be considered appropriate and positive means of identification.

4.3.5 Measures for Verification of Security of Conveyances

Prior to undertaking the transport, the conveyances involved shall be thoroughly checked to ensure that nothing has been tampered with or nothing has been affixed to the package or conveyance which might affect the security of the consignment. Given the carrier's own knowledge of his conveyance, a mere visual inspection of the conveyance would be considered adequate. However, this inspection shall be done routinely during the course of transportation also.

4.3.6 Adoption of Formal Procedures for Issue of Instructions

Appropriate written instructions to the crew members shall be provided on any required security measures including how to respond to a security incident during transport. At the basic security level, details of emergency contacts are considered sufficient.

4.3.7 Security Related Information Exchange

Operators shall co-operate with each other and with appropriate authorities to exchange information for applying security measures and responding to security incidents.

4.3.8 Procedures for Verification of Trustworthiness of Personnel

The antecedents and trustworthiness of persons engaged in transport of radioactive material should be got verified from the appropriate authorities. The extent of verification should be commensurate with the responsibility of the person involved in transportation.

4.4 Level 3 - Enhanced Security Measures

This level of security would be applicable to all radioactive material (except irradiated nuclear fuel and fissile material) transported in Type B (U)/(M) packages. These would apply to S. Nos. 9 to 15 of Appendix I.

The measures detailed in this paragraph should be adopted in addition to the prudent management practices described in paragraph 4.2 and measures for Level 2 Security. These enhanced security measures include procedures for carrier identification, availability of formal security plans, installation of hardware devices for tracking shipments and provision of communication links.

4.4.1 Availability of Formal Security Plans

The operators and all persons engaged in the transport of radioactive material that require enhanced security level should develop, adopt and implement a security plan. This plan should be periodically reviewed and compliance with the provisions shall be ascertained. The plan should be modified as needed to reflect the threat level at the time of its application and any changes to the transport plan. As a minimum requirement the security plan should include the following:

- Specific allocation of responsibilities for security to qualified and competent persons with appropriate authority to carry out their responsibilities;
- Records of types of radioactive materials and packages transported;
- Review of current operation to assess vulnerability, temporary transit storage, handling, distribution etc.;
- Clear statements of measures regarding training, policies (response to higher threat conditions, new employee verification), operating practices (e.g. choice of routes, use of guards and their placement and positioning, controlling access to radioactive material packages in storage) equipment and resources that are required to reduce security risk;
- Effective procedures and equipment for prompt reporting and dealing with security threats, breaches of security or security incidents;
- Procedures for evaluating and testing security plans;

- Procedures for review and update of the plans;
- Measures to ensure that sensitive transport information is sent only to concerned agencies to maintain security. However, these measures shall not preclude provisions of transport documents and consignor's declaration as required by applicable transport regulations;
- Measures to monitor the shipment; and
- Arrangements to define the transfer of responsibility for the security of the package wherever necessary.

4.4.2 Installation of Hardware for Tracking Shipments

Where possible, appropriate tracking devices should be used to monitor the movement/shipments of conveyances containing radioactive material. This system should be capable of tracking the shipment from its point of departure up to its destination and any change in its authorised route. The tracking system should be able to locate the shipment at any given time. This tracking system in conjunction with appropriate communication system and response procedure will allow the operator and competent authority to react in a timely manner in case of any emergency.

There should be a system of tracking of shipments of the radioactive material which require the basic security level and above through GPS system. Such a system might also be necessary for shipment of certain LSA-I type materials, which otherwise might require only the basic security level. The GPS device should be secured to the vehicle carrying the package containing the radioactive material, which cannot be detached without setting off an alarm at control room or in the driver cabin of vehicles itself. There should always be a back-up system for tracking of the shipment in case the GPS system fails or do not work due to any reason. The tracking requirement will also be applied during the transit storage of the package en-route. The information about any status changes should be readily available to all the operators.

4.4.3 Provision of Communication Links

The carrier should provide a communication system during transport to enable the personnel to communicate with a designated contact point as specified in the security plan.

4.5 Shipments Requiring Special Security Measures

This level of security would be applicable to all radioactive material transported in Type AF, Type B(U)F and Type B(M)F packages as well as irradiated nuclear fuel packages. These would apply to S. Nos. 16, 17 and 18 of Appendix I.

The Consignor should prepare and submit to the competent authority, a detailed shipment plan, which among others will include a security plan. This security plan should give details of the route, details of conveyance, security personnel, details of security escort, communications facilities, tracking mechanisms, etc. A brief note on the various issues to be addressed for such shipments is given at Appendix III.

APPENDIX-I

READY RECKONER FOR SECURITY LEVELS BASED ON THE TYPE OF RADIO ACTIVE MATERIAL AND TYPE OF PACKAGES

S.No.	Type of Radioactive Material (RAM) being transported	Type of Package to be used	Applicable Transport Security Level
1	Reference sources	Excepted	Level 1
2.	Consumer goods (smoke detectors, luminous painted dials, tritium light sources)	Excepted	Level 1
3.	Uranium/thorium ores or ore concentrates, depleted uranium, un-irradiated fresh natural uranium fuel assemblies and other RAM defined as LSA I/II/III in AERB's safety code AERB/SC/TR-1	IP-1, IP-2 or IP-3	Level 1
4.	Surface contaminated objects defined as SCO I/II in AERB's safety code AERB/ SC/TR-1	IP-1, IP-2 or IP-3	Level 1
5.	Radiopharmaceuticals	Type A	Level 2
6.	Nucleonic gauges	Type A	Level 2
7.	Neutron sources used in oil-well logging	Type A	Level 2
8.	Manually handled brachytherapy sources	Type A	Level 2
9.	Industrial radiography sources	Type B (U/M)	Level 3
10.	Remotely handled brachytherapy sources	Type B (U/M)	Level 3
11.	Teletherapy sources	Type B (U/M)	Level 3
12.	Gamma irradiator sources	Type B (U/M)	Level 3
13.	Decayed sealed sources for disposal	Type A or Type B (U/M)	Level 2 for Type A and Level 3 for Type B (U/M)
14	Uranium Hexafluoride (enriched)	Type HF	Level 3
15	Wastes arising from the nuclear fuel cycle	Type B (U/M)	Level 3
16	Fresh enriched nuclear fuel	IP-2 (F) or IP-3 (F)	Transport requiring special security measures

APPENDIX-I (CONTD.)

READY RECKONER FOR SECURITY LEVELS BASED ON THE TYPE OF RADIOACTIVE MATERIAL AND TYPE OF PACKAGES

S.No.	Type of Radioactive Material (RAM) being transported	Type of Package to be used	Applicable Transport Security Level
17.	Special nuclear material in different types of packages	IP-2 or IP-3 or Type A or Type B(U)F or Type B(M)F	Transport requiring special security measures
18.	Irradiated nuclear fuel	Type B(U)F or Type B(M)F	Transport requiring special security measures

Notes:

1 The symbol 'F' used for type of package at S. Nos. 14, 16 to 18, is to indicate that these packages may contain fissile material.

2 The Type HF package mentioned at S.No. 14 is specially used for packages containing Hexa fluoride (fissile)

3 Irrespective of what is given above, consignor should comply with the transport regulatory requirements as detailed in AERB's safety code AERB/SC/TR-1, with regard to type of package to be used

APPENDIX-II

ISSUES/TOPICS TO BE COVERED IN TRAINING PROGRAMMES ON SECURITY

1. General awareness/familiarisation training:

1.1 Each person should receive training designed to provide familiarity with the provisions of this safety guide; and

1.2 Such training should include a description of the categories of radioactive material; labelling, marking, placarding and packaging and segregation requirements; a description of the purpose and content of the radioactive material transport document; and a description of available emergency response documents.

2. Function-specific training:

Each person should receive detailed training concerning specific radioactive material transport requirements, which are applicable to the function that person performs.

3. Safety training:

Commensurate with the risk of exposure in the event of a release and the functions performed, each person should receive training on:

3.1 Methods and procedures for accident avoidance, such as proper use of package-handling equipment and appropriate methods of stowage of radioactive material;

3.2 Available emergency response information and how to use it;

3.3 General dangers presented by the various categories of radioactive material and how to prevent exposure to those hazards, including if appropriate, the use of personal protective equipment; and

3.4 Immediate procedures to be followed in the event of an unintentional release of radioactive material, including any emergency response procedures for which the person is responsible and personal protection procedures to be followed.

4. Training about the importance of secrecy to be maintained along with the methods to respond to queries from the public.

5. Security awareness training should address the nature of security threats, recognising security concerns, methods to address such concerns and actions to be undertaken in the event of a security incident. It should include

awareness of security plans (as appropriate) commensurate with the responsibilities of individuals and their part in implementing security plans.

6. Such training should be provided or verified upon employment in a position involving radioactive material transport and should be periodically supplemented with retraining.

APPENDIX-III

A NOTE ON SHIPMENTS REQUIRING SPECIAL SECURITY MEASURES

This appendix can be used to develop detailed security procedures for transport of radioactive materials requiring special security measures, which would exceed those required under Security Level 3. Typically, such shipments would involve spent nuclear fuel and fissile materials. The essential factors, which should be taken into consideration while preparing the detailed security plan, are detailed below:

Administrative Controls

Special attention should be paid to procedures to be followed where security responsibilities are transferred from one agency to other and possible lapses during such transfers.

Radioactive material carriers should be specifically qualified, their security procedures subjected to audit and the security plans are required to be formally approved and periodically reviewed by competent authority.

Antecedents of persons engaged in transport of radioactive material may be subject to formal security clearance commensurate with their responsibilities. Further, a procedure to obtain formal clearance from the national intelligence authorities should be put in place to vet the transport agency involved in such transport.

Design of Package/Conveyance

An evaluation of possible sabotage and the associated radiological consequences in respect of a specific package design and a particular mode of transport, as required by competent authority, should be done. This should be done in consultation with safety specialists.

Vehicles specially designed or modified to provide additional security features may be deployed.

Advance Notifications

(1) The consignor should notify the consignee and the competent authority in advance of any planned shipment, mode of transport and expected shipment and delivery dates.

(2) The consignor should start the shipment only after obtaining confirmation that the consignee is ready to accept the shipment at the expected delivery time.

(3) The consignor should also inform the concerned law and order authorities whose jurisdiction the consignment is likely to pass through and request for local assistance to facilitate the uninterrupted and smooth movement of the convoy in that area.

The consignee should notify the consignor on receipt or non-receipt within the expected delivery time.

Control of Information

Appropriate measures should be taken to protect the confidentiality of information relating to transport operations like information on schedule, route etc. Secure communication should be used wherever possible. These should also be consistent with national requirements.

The information contained in the security plans should be restricted to those who need to know it for the performance of their duties. Such information should not be included in plans developed for other purposes to avoid unnecessary spread of information.

Every person should be provided with written instruction for dealing with their responsibilities and they should treat these as classified documents.

Communications/Tracking of Shipment

Where necessary, provision for inter-communication between vehicles of a convoy should be provided.

Automated and real time tracking methods should be deployed in order to permit the transport control centre to remotely monitor the movement of radioactive material conveyances and packages and their status.

Physical Security Measures

Prior to loading of the shipment appropriately trained personnel may be deployed to conduct a thorough search of the conveyance to ensure that it has not been tampered with in any way, which could compromise security.

An accompaniment of armed guards may be provided for continuous and effective surveillance of the package conveyance. It shall also be ensured that they are adequately trained, suitably equipped and fully aware of their responsibilities.

Contingency Response Plans

While developing security plans, the operator should ensure that appropriate response plans are also considered.

Response plans, especially aspects of coordination with law and order authorities should be reviewed to ensure appropriate and timely response to attempts directed at theft, sabotage or other malicious acts.

Where feasible, the robustness of contingency plans shall be checked through appropriate exercises.

Special Training

Additional training should be imparted to the persons engaged in transport of radioactive material to enhance their skills and knowledge for implementing specific security measures associated with their responsibilities. The training should be more focused and specific and beyond imparting simple security awareness.

BIBLIOGRAPHY

1. International Atomic Energy Agency, Regulations for the Safe Transport of Radioactive Material, Safety Standards Series No. TS-R-1, IAEA, Vienna (2005).

2. Food and Agriculture Organisation of the United Nations, International Atomic Energy Agency, International Labour Organisation, OECD Nuclear Energy Agency, Pan American Health Organisation, World Health Organisation, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).

3. United Nations Committee of Experts on the Transport of Dangerous Goods, Recommendations on the Transport of Dangerous Goods - Model Regulations, Rep. ST/SG/AC.10/1/Rev.14, United Nations, New York (2001).

4. International Atomic Energy Agency, Convention on the Physical Protection of Nuclear Material, Vienna (adopted 1979) +Amendment of 2005.

5. International Atomic Energy Agency, The Physical Protection of Nuclear Material and Nuclear Facilities, INFCIRC/225/Rev.4 (Corrected), IAEA TEC DOC-967, IAEA, Vienna (1999).

6. International Atomic Energy Agency, Code of Conduct on the Safety and Security of Radioactive Sources, IAEA, Vienna (2004).

7. International Atomic Energy Agency, Categorisation of Radioactive Sources, Safety Standards Series No. RS-G-1.9, IAEA, Vienna (2005).

8. International Atomic Energy Agency, Physical Protection Objectives and Fundamental Principles, GOV/2001/41, IAEA, Vienna (2001).

9. International Atomic Energy Agency, Guidance on the Import and Export of Radioactive Sources, IAEA, Vienna (2005).

10. ICRP 82, Protection of the Public in Situations of Prolonged Radiation Exposure, ISSN 0146-6453, Annals of the ICRP, Vienna (1999).

11. International Atomic Energy Agency, Generic Assessment Procedures for IAEA, Vienna (1997).

12. Food and Agriculture Organisation of the United Nations, International Atomic Energy Agency, International Labour Organisation, OECD Nuclear Energy Agency, PAN American Health Organisation, United Nations Office for the Coordination of Humanitarian Affairs, World Health Organisation, Preparedness and Response for a Nuclear or Radiological Emergency, Safety Standards Series No. GS-R-2, IAEA,Vienna (2000).

13. LANGE, F. et al. Experimental Determination of UO_2-Release from a Spent Fuel Transport Cask after Shaped Charge Attack, Institute of Nuclear Material Management (INMM), 35th Annual Meeting, Naples (FL), July 1994.

LIST OF PARTICIPANTS

COMMITTEE TO DEVELOP GUIDELINES ON SECURITY REQUIREMENTS DURING TRANSPORT OF RADIOACTIVE MATERIAL IN PUBLIC DOMAIN

Dates of meeting	:	January 4, 2007 January 18, 2007 February 12, 2007 March 26, 2007 August 28, 2007

Members and Invitees of the Committee:

Dr. A.N. Nandakumar(Convenor)	:	AERB(Former)
Shri K. Muralidhar	:	DAE
Shri S. Vedamoorthy	:	NPCIL
Shri S.P. Agarwal	:	AERB
Shri T.K. Jayakumar	:	BRIT
Shri B.S. Manjunath	:	BARC
Shri R.K. Singh (Member Secretary)	:	AERB
Shri P.C. Chaturvedi	:	NPCIL
Dr. K.L. Narasimha Rao	:	BARC

ADVISORY COMMITTEE ON RADIOLOGICAL SAFETY (ACRS)

Dates of meeting	:	March 21-22, 2007 October 11, 2007

Members of the Committee:

Dr. U.C. Mishra (Chairman)	:	Director, HS&EG, BARC (Former)
Dr. A.R. Reddy	:	Director, Defence Lab., Jodhpur (Former)
Dr. Gursharan Singh	:	BARC
Dr. B.C. Bhatt	:	Head, RP&AD, BARC (Former)
Dr. S.K. Shrivastava	:	TMH
Dr. (Smt.) Meera Venkatesh	:	BARC
Shri S.P. Agarwal (Member Secretary)	:	AERB

ADVISORY COMMITTEE ON SECURITY (ACS)

Dates of meeting	:	September 7, 2007 October 11, 2007 November 2, 2007

Members and Invitees of the Committee:

Shri G.P Srivastava (Chairman)	:	BARC
Shri T.P. Das	:	DAE
Dr. A.K. Kohli	:	BRIT
Shri G. Nageshwara Rao	:	NPCIL
Shri W.S. Aruldoss Kanthiah	:	HWB
Shri P. Swaminathan	:	IGCAR
Shri R.I. Gujrathi	:	AERB
Shri R. Venkataraman	:	AERB
Shri S.P. Agarwal	:	AERB
Shri R. Bhattacharya	:	AERB
Shri Fredic Lall (Member Secretary)	:	AERB
Shri S. Bhattacharya (Co-opted Member)	:	BARC
Shri L.B. Mahale (Permanent Invitee)	:	AERB
Shri S.K. Pradhan (Permanent Invitee)	:	AERB

PROVISIONAL LIST OF RELEVANT REGULATORY DOCUMENTS ON TRANSPORT OF RADIOACTIVE MATERIALS

Safety Series No.	Title
AERB/SC/TR-1	Safety Code for the Safe Transport of Radioactive Materials
AERB/SC/TR-3	Safety Code on Emergency Responce Planning and Preparedness for Transport Accidents Involving Radioactive Material

AERB SAFETY GUIDE NO. AERB/NRF-TS/SG-10

Published by **:** Atomic Energy Regulatory Board
Niyamak Bhavan, Anushaktinagar
Mumbai - 400 094
INDIA.

BCS