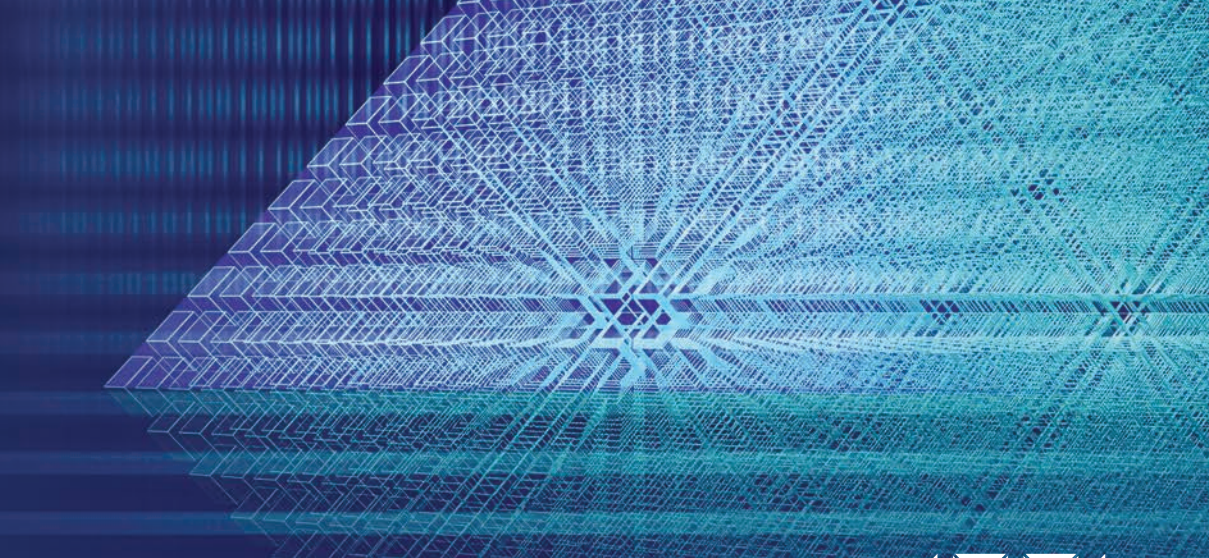

TECHNICAL REPORTS SERIES NO. 1001

Managing the Interface between Safety and Security for Normal Commercial Shipments of Radioactive Material

IAEA
International Atomic Energy Agency

MANAGING THE INTERFACE BETWEEN SAFETY AND SECURITY FOR NORMAL COMMERCIAL SHIPMENTS OF RADIOACTIVE MATERIAL

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TECHNICAL REPORTS SERIES No. 1001

MANAGING THE INTERFACE BETWEEN SAFETY AND SECURITY FOR NORMAL COMMERCIAL SHIPMENTS OF RADIOACTIVE MATERIAL

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2021

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PO Box 100
1400 Vienna, Austria
fax: +43 1 26007 22529
tel.: +43 1 2600 22417
email: sales.publications@iaea.org
www.iaea.org/publications

Printed by the IAEA in Austria
September 2021
STI/DOC/010/1001

IAEA Library Cataloguing in Publication Data

Names: International Atomic Energy Agency.
Title: Managing the interface between safety and security for normal commercial shipments of radioactive material / International Atomic Energy Agency.
Description: Vienna : International Atomic Energy Agency, 2021. | Series: Technical reports series, ISSN 0074–1914 ; no. 1001 | Includes bibliographical references.
Identifiers: IAEAL 21-01407 | ISBN 978–92–0–106121–8 (paperback : alk. paper) | ISBN 978–92–0–106221–5 (pdf) | ISBN 978–92–0–106321–2 (epub)
Subjects: LCSH: Radioactive substances — Transportation. | Radioactive substances — Transportation — Safety regulations. | Radioactive substances — Safety measures. | Radioactive substances — Security measures.
Classification: UDC 656.073 | STI/DOC/010/1001

FOREWORD

Through its nuclear security programme, the IAEA supports States to establish, maintain and sustain an effective nuclear security regime. The IAEA has adopted a comprehensive approach to nuclear security. This recognizes that an effective national nuclear security regime builds on the implementation of relevant international legal instruments; information protection; physical protection (security); material accounting and control; detection of and response to trafficking in such material; and national response plans and contingency measures. With its Nuclear Security Series, the IAEA aims at assisting States in implementing and sustaining such a regime in a coherent and integrated manner.

The IAEA Nuclear Security Series comprises Nuclear Security Fundamentals, which include the objective and essential elements of a State's nuclear security regime; Recommendations; Implementing Guides; and Technical Guidance.

Similarly, through its nuclear safety programme, the IAEA has provided a reference set of transport safety requirements, known as the Transport Regulations (currently IAEA Safety Standards Series No. SSR-6 (Rev. 1), Regulations for the Safe Transport of Radioactive Material), and a set of associated Safety Guides for the transport of radioactive material (which includes nuclear material). The Transport Regulations were first published in 1961, and multiple updated editions have been issued since; the associated Safety Guides have also been developed and updated during this time. The objective of SSR-6 (Rev. 1) is to protect people, property and the environment from harmful effects of ionizing radiation during the transport of radioactive material. A graded approach is applied to the requirements for package designs, preparation for transport and the accumulation of packages on a conveyance, while considering specified routine, normal and accident conditions of transport.

The Transport Regulations have been adopted for more than sixty years by international modal organizations (those organizations that focus on a particular mode of transport) in rules governing transport by air, sea, road, rail, and inland waterways; by regional organizations; and by Member States in their national regulations for the safe transport of radioactive material. They have provided an exemplary record of safety during the worldwide transport of millions of packages of radioactive material.

Nuclear safety and nuclear security share the aim of protecting people, property and the environment from harmful effects of ionizing radiation. However, the activities that address nuclear safety and nuclear security are different, and sometimes actions taken to strengthen safety affect security, either positively or negatively, or vice versa. It is therefore essential to establish a well coordinated approach to managing the interface between safety and security of

radioactive material in transport so that relevant measures are implemented in a manner that does not compromise either nuclear safety or nuclear security and that capitalizes on opportunities for mutual enhancement.

This publication aims to provide technical guidelines and practical information based on international good practices to assist Member States, competent authorities and operators. Its goal is to facilitate management, in an integrated and coordinated manner, of the interface between nuclear safety and nuclear security during 'normal commercial shipments' of radioactive materials. The term 'normal commercial shipments' was chosen in order to define — for the purposes of this publication — shipments of radioactive material that pose a low risk of causing unacceptable radiological consequences if attacked by an adversary.

This publication was developed based on input from one IAEA technical meeting and five IAEA consultants meetings held from 2016 to 2018 and more than 200 comments provided by many reviewers. In these meetings and through these comments, the experience of Member States and non-governmental organizations was gathered, which provided the basis for the guidelines, approaches and examples used in this publication.

The IAEA wishes to thank the contributors to this publication for their efforts and valuable assistance. The IAEA officers responsible for this publication were D. Ladsous and M. Shannon of the Division of Nuclear Security, and S. Whittingham and C.S. Bajwa of the Division of Radiation, Transport, and Waste Safety.

EDITORIAL NOTE

CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

Nuclear safety and nuclear security share the same goal, which is to protect people and the environment from harmful effects of ionizing radiation. However, the activities that address nuclear safety and nuclear security may be different, and sometimes actions taken to strengthen nuclear safety may affect nuclear security, either positively or negatively, and vice versa. It is therefore essential to establish a well coordinated approach to managing the interface between nuclear safety and nuclear security of radioactive material in transport so that relevant measures are implemented in a manner that does not compromise or negatively impact either nuclear safety or nuclear security. This can be accomplished with the aim to capitalize on improving mutual awareness and understanding of the transport interface while providing opportunities for mutual enhancement of both transport safety and transport security.

The IAEA first published safety requirements for the transport of radioactive material (known as the Transport Regulations) in 1961; the current edition is SSR-6 (Rev. 1), Regulations for the Safe Transport of Radioactive Material, published in 2018 [1]. SSR-6 (Rev. 1) sets forth for the international community a set of measures for the safe transport of radioactive material, including nuclear material, which are incorporated into the United Nations Recommendations on the Transport of Dangerous Goods: Model Regulations (henceforth UN Model Regulations) [2]. Both SSR-6 (Rev. 1) and the UN Model Regulations are recommendations, not requirements. However, these recommendations are incorporated into international and regional modal dangerous goods transport regulations and recommendations and generally are also incorporated into Member States' transport safety regulations.

More specifically, the following international and regional modal regulations incorporate the provisions of the Transport Regulations in a relatively timely fashion following the publication of each edition of the regulations:

(a) The Technical Instructions for the Safe Transport of Dangerous Goods by Air, maintained by the International Civil Aviation Organization;
(b) The International Maritime Dangerous Goods Code, maintained by the International Maritime Organization;
(c) The European Agreement concerning the International Carriage of Dangerous Goods by Road, maintained by the United Nations Economic Commission for Europe Committee on Inland Transport;

(d) The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways, also maintained by the United Nations Economic Commission for Europe Committee on Inland Transport;
(e) The Regulations concerning the International Carriage of Dangerous Goods by Rail, maintained by the Intergovernmental Organisation for International Carriage by Rail;
(f) The Agreement for the Facilitation of Dangerous Goods Transportation in Latin America, maintained by the Common Market of the South (MERCOSUR).

These modal regulations also adopt the transport security recommendations that are contained in the UN Model Regulations [2].

IAEA Nuclear Security publications that focus solely on radioactive material other than nuclear material transport security include the following:

(a) A Recommendations publication, IAEA Nuclear Security Series No. 14, Nuclear Security Recommendations on Radioactive Material and Associated Facilities [3];
(b) An Implementing Guide, IAEA Nuclear Security Series No. 9-G (Rev. 1), Security of Radioactive Material in Transport [4].

IAEA Nuclear Security publications that focus solely on nuclear material transport security include the following:

(a) A Recommendations publication, IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5) [5];
(b) An Implementing Guide, IAEA Nuclear Security Series No. 26-G, Security of Nuclear Material in Transport [6].

In addition to the above cited safety and security publications, the application of SSR-6 (Rev. 1) [1] is supported through Safety Guides [7–9].

Some elements of these Recommendations publications and Implementing Guides (e.g. transport security thresholds) have been incorporated into the UN Model Regulations [2]. However, the security provisions of the UN Model Regulations remain recommendations as they are adapted into the modal regulations such as the International Civil Aviation Organization Technical Instructions and the International Maritime Organization International Maritime Dangerous Goods Code. In addition, there are general security requirements mandated by relevant international conventions (e.g. Annex 17 of the Convention on International Civil Aviation and Chapter XI-2 of the International Convention

for the Safety of Life at Sea), and transport security provisions for radioactive material need to be consistent with these requirements.

Some Member State competent authorities are responsible for both safety and security of radioactive material in transport and provide national requirements to operators[1] that address both topics. In other cases, multiple competent authorities issue separate regulations and requirements for safety and security of radioactive material in transport. In any case, there exists an interface between safety requirements and security recommendations in the transport of radioactive material that needs to be addressed to resolve any inconsistencies that may exist between transport safety and transport security provisions. For example, para. 108 of SSR-6 (Rev. 1) [1] specifically states:

> "[The Transport] Regulations do not specify controls such as routeing or physical protection that may be instituted for reasons other than radiological safety. Any such controls shall take into account radiological and non-radiological hazards, and shall not detract from the standards of safety that [the Transport] Regulations are intended to provide."

Similarly, para. 3.27 of Ref. [3] states (italics omitted):

> "The competent authorities should ensure that security measures for radioactive material, associated facilities and associated activities take into account those measures established for safety and are developed so that they do not contradict each other, during both normal and emergency situations."

Further, for international shipments it must also be recognized that national security requirements may vary between States since they may be determined based upon the threat assessments for radioactive material transport of each State.

States need to therefore establish national security requirements following a coordinated approach to ensure that security measures do not compromise safety and safety measures do not compromise security. To date, this interface in relation to the transport of radioactive material has only been partially addressed in separate IAEA safety and security publications.

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[1] For the purpose of this publication, the term operator includes consignor, carrier and consignee.

1.2. OBJECTIVE

The objective of this publication is to provide technical advice and practical information to Member States, competent authorities and operators based on international good practices, and to facilitate management of the interface between nuclear safety and nuclear security during normal commercial shipments of radioactive material in an integrated and coordinated manner. It is important that the interface between transport safety and transport security for radioactive materials be defined and understood, and that it be adequate to ensure that security measures and safety measures complement each other when these sometimes disparate measures are applied.

The purpose of this publication is to define the interface between transport safety and transport security and the management of any consequential changes in the interface due to the need for additional security measures. To achieve effective management of changes to the interface, this publication encourages dialogue and agreement between the competent authorities involved and ultimately with operators undertaking shipments.

1.3. SCOPE

This publication discusses the considerations to be made by State competent authorities for the establishment and ongoing management, at a national level, of the interface between safety and security during normal commercial shipments of radioactive material. In addition, this publication recognizes that it is crucial for operators to understand and implement regulatory requirements in order to provide effective safety and security for both domestic and international shipments. The interface situations that could arise in different States owing to various State specific needs are also discussed, including the following:

(a) How safety and security regulations are applied domestically;
(b) Specific security needs based on the conditions, threat levels and risks in a given State.

The interface with emergency preparedness and response is outside of the scope of this publication. Guidance provided here, describing good practices, represents expert opinion but does not constitute recommendations made on the basis of a consensus of Member States.

1.4. STRUCTURE

This publication is structured as follows: Section 2 provides a discussion of the basis for defining what constitutes 'normal commercial shipments', which are the shipments that this publication addresses. Section 3 outlines the safety–security interface issues faced in normal commercial shipments. Section 4 reviews interface considerations. Section 5 outlines and provides a summary overview of 20 tasks associated with the transport of normal commercial shipments of radioactive material. Section 6 presents a decision process that can be used for resolving safety–security interface issues. Appendix I provides example questions for each of the 20 tasks discussed in Section 5 that can be used to assist in resolving safety security interface issues. Appendix II provides a guide to classifying packages of radioactive material for determining the appropriate United Nations (UN) number and security requirements. These are followed by a list of references and a list of definitions to assist users in understanding the intent of the document. The list of definitions is provided since the potential exists for interface issues to arise with respect to the terminology used for safety and security because different IAEA safety and security publications, and other international publications frequently use different terminology.

2. BASIS FOR DEFINING WHAT CONSTITUTES NORMAL COMMERCIAL SHIPMENTS

For the purposes of this publication, normal commercial shipments of radioactive material involve radioactive materials in transport that only require prudent management practice or both prudent management practice and basic transport security level measures as specified in Ref. [4]. Specifically, these are radioactive material packages where the upper threshold values are as follows:

(a) For specified radioactive sources, $10D^2$ and less;

[2] IAEA Safety Standards Series No. RS-G-1.9, Categorization of Radioactive Sources [10] provides a categorization system based on a set of D values defining the activities of a number of common radionuclides that correspond to the quantity of radioactive material, which, if uncontrolled, could result in the death of an exposed individual or a permanent injury that decreases that person's quality of life.

(b) For most other radioactive material, $3000A_2$[3] and less.

Thus, for this publication, normal commercial shipments are those which consist of Category 3, 4 and 5 radioactive sources and/or other low activity radioactive material, and may include nuclear material below Category III as defined in INFCIRC/225/Revision 5 [5] and IAEA Safety Standards Series No. RS-G-1.9, Categorization of Radioactive Sources [10].

2.1. BASIS FOR UPPER THRESHOLD FOR NORMAL COMMERCIAL SHIPMENTS

With respect to the choice of the upper thresholds of 10D and $3000A_2$, para. I.18 of Ref. [4] states:

> "Although sources with an activity exceeding the D values…are considered dangerous (i.e. they could result in the death of an exposed individual or a permanent injury that decreases the person's quality of life) it is not considered realistic to implement enhanced security measures for all sources with an activity exceeding the D values. Considering this, a threshold of 10 times the D values is recommended to specify the enhanced transport security level for radionuclides listed in the Code to include Category 1 and 2 sources".

Thus, radioactive sources with activity of less than 10D for the 25 radionuclides listed in table 1 of Ref. [4], and all other radioactive material packages containing less than $3000A_2$ are of sufficient security concern to warrant the measures described in this publication because (except for some that are of very limited concern) they contain sufficient radioactive material to

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[3] Paragraph 201 of SSR-6 (Rev. 1) [1] states (italics omitted):
"A_1 shall mean the activity value of special form radioactive material that is listed in Table 2 or derived in Section IV [both of the Transport Regulations] and is used to determine the activity limits for the requirements of [the Transport] Regulations. A_2 shall mean the activity value of radioactive material, other than special form radioactive material, that is listed in Table 2 or derived in Section IV [both of the Transport Regulations] and is used to determine the activity limits for the requirements of [the Transport] Regulations."

cause significant operational, economic, psychological, social, and/or political consequences due to:

(a) Loss of credibility and confidence of the population in those involved in regulating and shipping the material;
(b) Stress, panic or other psychological consequences within the population;
(c) Loss of use of important public places, transport or services owing to radioactive contamination;
(d) Economic burden arising from monitoring and cleanup resulting from malicious acts (e.g. radiological dispersal device).

2.2. BASIS FOR APPLYING PRUDENT MANAGEMENT PRACTICES ONLY

With respect to some packages containing very low levels of radioactive material that are of very limited concern, para. 3.12 of Ref. [4] notes the following:

> "A State should also define which radioactive material poses very low potential radiological consequences if subject to unauthorized removal or sabotage and thus does not represent a substantial security concern. Packages containing such material do not need to be assigned a transport security level and only need to be controlled through prudent management practices."

Paragraph 3.13 of Ref. [4] then states:

> "For radioactive material transported in excepted packages and for low specific activity (LSA-I) and surface contaminated objects (SCO-I)…, no specific security measures beyond the control measures required by the safety regulations and prudent management practices already implemented by shippers and carriers are recommended."

Paragraph 5.5 of Ref. [4] describes prudent management practices as: "basic control measures and normal commercial practices [that]…include actions by shippers, carriers and receivers to protect the material against unauthorized removal or sabotage, as would be the case for any valuable commodity."

With respect to excepted packages, para. 3.14 of Ref. [4] specifies that the following need more than prudent management practices for security purposes:

- UN 2910 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — LIMITED QUANTITY OF MATERIAL with activity greater than $10^{-3}A_2$;

- UN 2911 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — INSTRUMENTS OR ARTICLES with activity greater than A_2.

In addition, situations may arise where a SCO-I shipment could require more than prudent management practice for security purposes if the contaminating radioactive material were nuclear material.

Hence, this publication is limited to addressing normal commercial shipments of radioactive material as specified above. Only a limited number of IAEA security recommendation and guidance publications have been developed for these materials, mostly because efforts at the international and State level have been focused on shipments of higher activity radioactive material and on Category I, II and III nuclear material. It is noteworthy, however, that normal commercial shipments of radioactive material as defined in this publication generally constitute a large majority of the shipments of radioactive material made worldwide.

Many normal commercial shipments of radioactive material are undertaken in package designs which, as prescribed in SSR-6 (Rev. 1) [1], are not required to be resistant to accident conditions of transport. This reflects the graded approach implemented in both the IAEA Nuclear Security Recommendations publications and Implementing Guides [3–6], and the IAEA transport safety regulations, SSR-6 (Rev. 1) [1], which requires accident approved packages for higher activities and risk as well as reduced testing conditions for packages with lower activities called normal conditions of transport. On the one hand, since these packages are often light weight, accommodating lower activities, they may therefore present a greater attractiveness for theft and sabotage by those with malicious intent. Additional security measures may need to be considered for these packages in order to reduce accessibility by an adversary. On the other hand, these packages may generally provide a significantly lower risk for safety relevant events to the public due to the limited activity permitted by SSR-6 (Rev. 1) [1]. Conversely, in the case of normal commercial shipments of radioactive material in thick walled and heavy weight packages such as Type B packages, the risk of theft and sabotage may be mitigated because significant efforts would be required to either divert or breach the containment of such robust packagings. Reference [4] suggests that there may be a need to assign appropriate enhanced security measures depending upon the attractiveness of the material being shipped; the same approach may need to be taken with respect to the level of robustness of packagings being used in normal commercial shipments.

3. SAFETY–SECURITY INTERFACE ISSUES

3.1. GENERAL SAFETY–SECURITY INTERFACE ISSUES

Transport safety–security interfaces occur when one or more aspects of the State transport safety regulations and State transport security regulations overlap. Individual safety/security measures may either complement each other or result in inconsistencies that need to be addressed.

For safety, national transport safety regulations are essentially based on the UN Model Regulations [2], which incorporate SSR-6 (Rev. 1) [1]. For security, national transport security regulations may be based on the UN Model Regulations [2] and/or the international and regional modal regulations, which adopt the security threshold values of the IAEA Nuclear Security Series publications (e.g. Refs [4, 5]). For each shipment of radioactive material, the operators must comply with the relevant State transport safety and transport security regulations.

To achieve internationally agreed levels of safety during shipments, all the safety measures set forth in SSR-6 (Rev. 1) [1], which align with the requirements in the international and regional modal regulations for air, sea and land transport and which should also align with the Member State national land transport regulations, must be complied with in relation to the package type, shipment preparation and consignment requirements.

If prudent management practices and basic transport security level measures are mutually adopted by in-transit and receiving States, these measures would then become a common basis for transport security, as safety measures arising from SSR-6 (Rev. 1) [1] are for transport safety. This could thereby enable the community of Member States involved in these shipments to implement transport security within a common set of practices.

The interface between the IAEA recommended safety measures and prudent management practices (for security) is intended to allow compliance in both safety and security to be achieved with no compromises. This interface needs to be discussed and agreed by the competent authorities responsible for transport safety and transport security.

Safety requirements recommended by SSR-6 (Rev. 1) [1] and subsequently implemented by international agreements for land, sea and air transport need to be completely respected. Compensatory measures can only be considered by special arrangements provided in SSR-6 (Rev. 1). For international shipments, special arrangements require multilateral approvals in all countries involved in the transport; this can result in a significant effort for consignors and carriers to obtain the necessary approvals. The introduction of compensatory measures

needs to be carefully balanced with security recommendations provided by Implementing Guides such as Ref. [4].

Because any increases in security measures above prudent management practices may affect the safety–security interface, such changes in the interface will need to be discussed and agreed by the competent authorities responsible for transport safety and transport security. Competent authorities need to recognize that increases in security measures may have an adverse effect on safety and compensatory safety measures may then become necessary. Close collaboration between the competent authorities involved is needed to address any safety–security interface issues so that appropriate levels of safety and security during shipments are achieved and non-compliances or inconsistencies are avoided. Agreement also needs to be reached on the strategy by competent authorities for expeditiously and effectively informing operators of actions they need to impose in line with their duties.

This publication presents methods for management of the interface between transport safety and transport security within the following context:

(a) The safety measures of SSR-6 (Rev. 1) [1], if imposed by law, need to be met to ensure safety during transport.
(b) Prudent management practices (for both safety and security) and, as applicable, basic transport security level measures included in Ref. [4] for normal commercial shipments of radioactive material generally will not compromise safety measures when in compliance with the safety measures of SSR-6 (Rev. 1) [1]; however, some compromising safety–security interface issues may exist which are addressed in this publication.
(c) The effects of implementing additional security measures on the interface between safety and security need to be assessed and, if necessary, compensatory safety requirements may then need to be introduced.
(d) Effective communication between safety and security authorities and with operators will ensure there are no surprises and that both safety measures (including compensatory arrangements if necessary) and additional security measures can be complied with.
(e) The competent authorities involved need to provide operators with clear mandates for safety and security.
(f) Unless approved by the competent authorities, operators should not introduce additional security measures without consideration of their effects on compliance with the safety requirements.

3.2. TERMINOLOGY RELATED SAFETY–SECURITY INTERFACE ISSUES

In addition to the general interface issues described above, the potential exists for interface issues to arise with respect to the terminology used for safety and security. Different IAEA safety and security publications use different terminology. For example, the transport safety publications use 'consignor' whereas the transport security publications use 'shipper', and the safety publications use 'consignee' whereas security publications use 'receiver'. The safety terms 'consignor' and 'consignee' are used herein.

Further, SSR-6 (Rev. 1) [1] uses the terms 'fissile nuclides' and 'fissile material', whereas IAEA security publications (e.g. Ref. [5]) use the term 'nuclear material'. This also introduces a potential interface issue between transport safety and transport security.

Specifically, fissile nuclides and fissile material are defined in para. 222 of SSR-6 (Rev. 1) [1] as follows (italics omitted):

> "Fissile nuclides shall mean uranium-233, uranium-235, plutonium-239 and plutonium-241. Fissile material shall mean a material containing any of the fissile nuclides. Excluded from the definition of fissile material are the following:
>
> (a) Natural uranium or depleted uranium that is unirradiated;
> (b) Natural uranium or depleted uranium that has been irradiated in thermal reactors only;
> (c) Material with fissile nuclides less than a total of 0.25 g;
> (d) Any combination of (a), (b) and/or (c).
>
> These exclusions are only valid if there is no other material with fissile nuclides in the package or in the consignment if shipped unpackaged."

For comparison, table 1 of Ref. [5] defines nuclear material as follows:

- Unirradiated plutonium except that with isotopic concentration exceeding 80% in plutonium-238;
- Unirradiated uranium-235 at various levels of enrichment and irradiated uranium-235 having specified unshielded radiation levels;
- Unirradiated uranium-233 and irradiated uranium-233 having specified unshielded radiation levels;
- Irradiated fuel.

Thus, care needs to be taken with the transport safety–security interface when dealing with these materials.

4. INTERFACE CONSIDERATIONS

Variations in security requirements may have various causes, including a State's regulatory framework, its application of regulations, a State's (or even a consignor's or carrier's) assessment of transport security threats and risks, the perceived attractiveness of the material being shipped and its potential to cause harm.

Reference [4] lists seven elements that should be addressed by a State to ensure adequate safety and security interfaces. Each of these has implications relative to the State's competent authorities and the operators undertaking low activity shipments. These seven elements are provided in the first column of Table 1, while the second column lists potential competent authority actions related to each respective step taken by a State and the third column lists potential operator actions related to each respective step taken by a State.

TABLE 1. PRACTICAL STATE/OPERATOR INTERFACE CONSIDERATIONS

State interface considerations [4]	Competent authority actions	Operator actions
(1) "A balance is maintained between safety and security concerns throughout the nuclear security regime, from the development of the legislative framework to the implementation of safety and security measures".	Establish a regulatory regime ensuring that the transport safety and security regulations are practical and balanced, and do not adversely impact each other.	Maintain awareness of regulations, communicate with competent authorities to ensure that the application of the regulations is practical and balanced, and does not adversely impact either safety or security.

TABLE 1. PRACTICAL STATE/OPERATOR INTERFACE CONSIDERATIONS (cont.)

State interface considerations [4]	Competent authority actions	Operator actions
(2) “Regulatory requirements for safety and security are consistent, especially when responsibilities for safety and security are assigned to different competent authorities”.	Establish State transport safety requirements and State transport security requirements that do not compromise either safety or security. Inform operators in Member State of the regulatory regime.	Maintain awareness of all relevant regulations. Communicate with competent authorities if transport security regulations for additional security measures adversely impact either safety or security.
(3) “Safety requirements do not compromise security and security requirements do not compromise safety”.	Ensure collaboration between safety and security authorities to evaluate transport security regulations for additional security measures and resolve any inconsistencies to ensure safety requirements and security recommendations are achieved. Inform operators of revised national arrangements.	Communicate with competent authorities to develop practical resolutions if operational inconsistencies exist.
(4) “Authorities in charge of nuclear safety and of nuclear security coordinate, as applicable”.	Ensure coordination is maintained between the competent authorities involved to ensure effectiveness of collaboration when additional security measures are to be implemented.	Not applicable.

TABLE 1. PRACTICAL STATE/OPERATOR INTERFACE CONSIDERATIONS (cont.)

State interface considerations [4]	Competent authority actions	Operator actions
(5) "Safety culture and security culture are both addressed in an integrated management system".	Require that operators have a viable integrated management system that addresses the interface between transport safety and transport security cultures.	Implement an integrated management system that addresses the interface between transport safety and transport security cultures.
(6) "Security measures for radioactive material in transport take into account those measures required for safety and vice versa, during both normal and emergency situations".	Ensure continuing collaboration exists between the competent authorities involved for both normal and emergency situations and resolve any inconsistencies. Ensure operators are aware of the national requirements and their duties and responsibilities.	Comply with national requirements for transport safety and transport security.
(7) "Security measures in place during a response to a nuclear security event do not adversely affect the safety of the transport personnel and the public, to the extent possible."	Evaluate whether security response measures required during a nuclear security event compromise safety to the transport personnel, emergency responders and public, and resolve any inconsistencies.	Provide contingency response arrangements to complement the arrangements for national emergency response to a nuclear security event in order to provide assurances for the safety of transport personnel, emergency responders and members of the public.

The fifth interface consideration in Table 1 deals with the importance of strengthening the interface between safety culture and security culture, which may be accomplished by applying a viable integrated management system. Ultimately, a sound safety and security culture, and a proper interface between them, is dependent on individuals, policy makers, regulators, managers, individual employees and even to a certain extent members of the public (see IAEA Nuclear Security Series No. 7, Nuclear Security Culture [11]). Two publications that can

be used to guide individuals and organizations to determine how to evaluate their safety and security cultures through self-assessment are: IAEA Safety Reports Series No. 83, Performing Safety Culture Self-assessments [12]; and IAEA Nuclear Security Series No. 28-T, Self-assessment of Nuclear Security Culture in Facilities and Activities [13].

In addition to the interface considerations between the competent authorities and the operators as discussed in Table 1, consignors need to also consider the interfaces that exist with their carriers. Normal commercial shipments of radioactive material can involve a complex range of situations such as a carrier using a single dedicated conveyance, a carrier using multiple dedicated conveyances, or even multiple carriers using multiple conveyances that are not dedicated to just the shipment involved.

Specific examples of these could include the following:

(a) A single road vehicle dedicated to carrying the consignment from the consignor to the consignee;
(b) A road vehicle dedicated to transporting the consignment to a distribution point where the consignment would be transferred to a second dedicated road vehicle, which might also include in-transit storage of the consignment at the vehicle exchange point;
(c) The use of a courier delivery service picking up the consignment using a non-dedicated road vehicle, delivery of the consignment to an airport for carriage on a courier delivery service aircraft, possibly changing to a second courier delivery service aircraft at an interchange point, and ultimately delivery of the consignment to the consignee using a non-dedicated courier delivery service road vehicle.

Many variations of the shipment scenarios are possible. As a result, the consignor's transport planning can be very complex. It can involve multiple carrier entities as well as a significant number of carrier personnel, multiple carrier related competent authorities and, for international shipments, potential changes in carriers or personnel at State borders. Thus, the consignor's planning needs to consider the specific shipment situation and the entities involved, and define how to provide adequate control of both safety and security for the transport environment expected.

5. TYPICAL PRIMARY INTERFACE TASKS

A set of transport related tasks are shown in Sections 5.1–5.20. This does not constitute an inclusive list of tasks to be achieved during the transport of radioactive material, rather it provides a wide range of examples of the primary tasks that need to be accomplished. Operators, working with their competent authorities, can list and mutually address other tasks as needed.

For each of the listed tasks, transport security measures may complement safety or may in some way lead to inconsistencies. This potential for each of the 20 tasks complementing or leading to inconsistencies with the safety–security interface is briefly highlighted in this section.

Each of the tasks identified here is further elaborated in Appendix I. That appendix provides a process that can be followed by competent authorities and operators to assist them in identifying and addressing interface issues when striving to comply with transport safety requirements and transport security measures for each of the 20 transport tasks. Specifically, the details of the basis for the requirements are elaborated, identifying where there may be security functions, safety measures and potential interface issues that either complement each other or are inconsistent with each other.

Each of the transport safety–security interfaces elaborated in this section may affect both the competent authorities (when assessing how safety and security measures are to be applied for a given transport system), and the operators (when determining how to apply the regulatory requirements to their specific transport security system). Operators need to ensure that all transport safety and security regulatory requirements are satisfied and the associated transport safety–security interfaces are appropriately addressed. If inconsistencies exist, the involved parties will need to coordinate and communicate with their relevant competent authorities and obtain direction and approval for any changes that affect either safety or security.

For safety, consignors are required to provide transport documents (see paras 545–553 of SSR-6 (Rev. 1) [1]). These can serve as a basis for managing their operations consistently with the application of a management system (para. 306 of SSR-6 (Rev. 1)) for transport (see also IAEA Safety Standards Series No. TS-G-1.4, The Management System for the Safe Transport of Radioactive Material [14]).

Similarly, the relevant security recommendation and guidance publications, and the applicable requirements from relevant international and regional modal regulations (that emanate from the UN Model Regulations [2]) and relevant State regulations need to be addressed.

The following 20 subsections list the typical primary transport tasks, discuss the transport safety–security interface relating to each task, and elaborate on whether those interfaces may introduce potential inconsistencies or whether the interface between safety and security is likely to mean that the two complement each other. Where an inconsistency exists or may exist, a possible means for resolving the inconsistency is suggested.

5.1. GENERAL INTERFACE BETWEEN SAFETY AND SECURITY

Both transport safety regulations [1–2] and transport security recommendation and guidance publications [2–6] specify that radioactive materials shall be shipped only where security provisions recognize and accommodate safety provisions, and safety provisions recognize and accommodate security provisions.

Paragraph 1.10 of IAEA Safety Standards Series No. SF-1, Fundamental Safety Principles [15] states:

> "Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security."

A similar statement is provided in SSR-6 (Rev. 1) [1]. The agreed interface measures between the safety requirements (SSR-6 (Rev. 1)) and the prudent management practices (Ref. [4]) are structured with a view to ensuring one does not detract from the other. Complying with all relevant dangerous goods transport regulations [2] provides a high level of safety, while any inconsistencies introduced by security need to be addressed.

5.2. COMPLIANCE WITH REGULATIONS

For a normal commercial shipment of radioactive material, relevant domestic and international transport safety and security regulations apply. Safety and security regulations may emanate from different competent authorities, making it difficult for operators to develop a comprehensive understanding of how to fully comply with both sides of the regulatory framework. This interface can be further complicated if the radioactive material in the shipment possesses other dangerous properties, in which case provisions for both safety and security owing to the other dangerous properties will apply (e.g. see paras 110 and 507 of SSR-6 (Rev. 1) [1] and para. 1.5.5.1 of the UN Model Regulations [2]).

If the competent authorities governing transport safety are different from those for transport security, disparate sets of regulations may result, and care will need to be taken to ensure that the regulatory interface is closely considered by all competent authorities involved. It is therefore essential that the safety and security authorities involved effectively communicate the national requirements to operators.

Where an interface inconsistency is identified between specific safety requirements and security recommendations, steps will need to be immediately taken by the competent authorities to initiate resolution of the inconsistency, and the operators will need to be notified accordingly by the competent authorities. If early priority is given to highlighting the transport safety–security interface problem and striving to evaluate and resolve the problem in an expeditious manner, choices/alternatives can be identified, and resolutions developed in a timely manner by the competent authorities involved. When the operators are then informed of the agreed resolution to the interface, sufficient time will be available for effectively implementing needed changes before final plans and arrangements are made for the shipment(s).

5.3. THREAT ASSESSMENTS

SSR-6 (Rev. 1) [1] specifies package design and test requirements. The tests for demonstrating the ability of transport packages to withstand normal conditions of transport that are specified in paras 719–725 of SSR-6 (Rev. 1), and the tests for demonstrating the ability of transport packages to withstand accident conditions of transport that are specified in paras 726–737 of SSR-6 (Rev. 1) are applied on the basis of a graded approach to the performance requirements of transport package design 'types' which have defined external radiation dose rate limits and requirements for the package to contain or permit release of its radioactive contents in the event of a transport accident. These tests have been historically demonstrated to address the threat of radiation exposure posed by transport events by considering routine, normal and accident scenarios and the permitted contents of defined package types.

Paragraph 5.10 of Ref. [4] states:

> "Shippers, carriers, receivers and others engaged in the transport of radioactive material should take into consideration all available threat information, including threat information provided by the regulatory body, when implementing security measures."

No interface inconsistencies exist between transport safety and transport security when dealing with threat assessments. In addition, the relative robustness of a given package determined by its contents and design for satisfying the safety regulatory requirements may very often be useful to the designer of a transport security system in addressing specific issues that result from security threat and accident assessments.

5.4. MANAGEMENT OF SECURITY RELATED INFORMATION

The management of sensitive, security related information may introduce a transport safety–security interface inconsistency. A potential inconsistency could involve the transmittal of transport specific information to meet safety requirements that may be inconsistent with the challenges of maintaining control of this information for security purposes. Specifically, in some cases the transfer of information may be inconsistent with the need to protect security sensitive information which may only be shared with those having a 'need to know'. For basic security level shipments, para. 5.11 of Ref. [4] states that "Appropriate measures should be taken to protect sensitive information relating to transport operations, such as information on the schedule and route."

Thus, for basic transport security level shipments, operators may need to take appropriate measures to protect sensitive information relating to transport operations, such as information on the schedule and route that could be used by an adversary to plan a malicious act.

Where transmitting information results in transport safety–security interface inconsistencies, the operator will need to coordinate its transport documents and other communications relating to a shipment with the relevant competent authorities to work around those inconsistencies. Competent authorities are responsible to resolve such inconsistencies, whereas operators can only notify authorities when such issues exist and then follow instructions from the authorities. Applying this process will ensure that the information is transmitted and protected appropriately for the purposes of both security and safety.

At the basic transport security level, para. 5.14 of Ref. [4] states:

> "Carriers should provide crew members, as appropriate, with written procedures on security measures required by the regulatory body. These procedures should include information addressing how to respond to a security incident during transport. At the basic transport security level, it is generally sufficient for these written procedures to contain no more than details of emergency contacts."

More detailed guidance on protection of security related information can be found in IAEA Nuclear Security Series No. 23-G, Security of Nuclear Information [16].

5.5. OPERATIONAL CONTROLS

Paragraph 1.1.1.4 of the UN Model Regulations [2] states:

> "In the transport of dangerous goods, the safety of persons and protection of property and the environment are assured when [the UN Model] Regulations are complied with. Confidence in this regard is achieved through quality assurance and compliance assurance programmes."

Specifically, for security, para. 1.4.1.1 of the UN Model Regulations [2] further states that "All persons engaged in the transport of dangerous goods shall consider security requirements for the transport of dangerous goods commensurate with their responsibilities."

Thus, operational controls used in the shipment of radioactive material need to be in accordance with all applicable international and domestic dangerous goods regulations, from the perspective of both safety and security.

With respect to operational controls, para. 502 of SSR-6, Rev. 1 [1] states (italics omitted):

> "Before each shipment of any package, it shall be ensured that the package contains neither:
>
> (a) Radionuclides different from those specified for the package design; nor
> (b) Contents in a form, or physical or chemical state, different from those specified for the package design."

In addition, para. 503 of SSR-6 (Rev. 1) [1] states, in part (italics omitted):

> "Before each shipment of any package, …[t]he following requirements shall also be fulfilled, if applicable:
>
> (a) "It shall be ensured that lifting attachments that do not meet the requirements of para. 608 [of the Transport Regulations] have been removed or otherwise rendered incapable of being used for lifting the package".

Hence, it is incumbent upon operators to strive for full compliance with all relevant safety and security regulations and to work with competent authorities to resolve outstanding safety–security interface issues.

For shipments requiring only prudent management practices, para. 5.5 of Ref. [4] states:

> "Some packages and types of radioactive material are identified in Section 3 as requiring no further security measures other than basic control measures and normal commercial practices. These practices include actions by shippers, carriers and receivers to protect the material against unauthorized removal or sabotage, as would be the case for any valuable commodity."

Paragraph 5.6 of Ref. [4] then provides examples of prudent management practices, including the following:

> "(a) Securing and storing the package while in transport (e.g. in a locked conveyance or storage area);
> (b) Utilizing carriers with package tracking systems (e.g. bar code system to monitor the status of the shipment), as appropriate;
> (c) Using closed vehicles;
> (d) Not leaving packages or conveyances unattended for any longer than is absolutely necessary;
> (e) Providing drivers of road conveyances with effective communication capability."

For shipments requiring basic transport security level, the consignee needs to verify package contents are as listed in shipping documents. The consignee also needs to have a procedure in place for notifying the consignor and/or carrier if radioactive material is discovered to be missing or when a package has not been delivered by the expected time. The consignor and carrier also need to have procedures in place for responding to a notification from the consignee of a missing shipment. Thus, operationally related controls for safety need to be developed so they do not introduce inconsistencies with the transport safety–security interface, and the interface between the two will generally ensure that they complement each other.

5.6. CARRIER QUALIFICATIONS

The UN Model Regulations [2] specify that consignors are only to offer dangerous goods (including radioactive materials) to carriers that have been appropriately identified (see para. 1.4.1.2 of Ref. [2]).

Paragraph 5.19 of Ref. [4] specifies that at the basic transport security level the shipment will need to be offered only to registered or authorized carriers and only transferred to authorized carriers and consignees.

The requirements to use appropriately identified carriers and to properly control the transfer of materials to and between authorized operators do not create an inconsistency with the transport safety–security interface. Such actions will generally complement both safety and security.

5.7. TRAINING AND TRAINING RECORDS

For all shipments of radioactive material other than those with UN Numbers UN 2908, UN 2909, UN 2910 (less than $10^{-3}A_2$), UN 2911 (less than A_2), UN 2912 (LSA-I) and UN 2913 (SCO-I), section 1.4.2 of the UN Model regulations [2] specifies that safety training shall also include elements of security awareness addressing the nature of security risks, methods to address and reduce such risks, and actions to be taken in the event of a security breach. It further specifies that such training shall be provided or verified upon employment in a position involving dangerous goods transport and shall be periodically supplemented with retraining.

The UN Model Regulations [2], applicable IAEA Nuclear Security Series publications [4, 6] and SSR-6 (Rev. 1) [1] all specify that records of training be maintained and made available upon request by the employee and competent authorities.

For shipments requiring only prudent management practices, the drivers need to be provided with appropriate training that is simple to understand. This training needs to (a) explain their roles and responsibilities; (b) detail the expected security practices and precautions to ensure their safety and security as well as that of the cargo; (c) define their expected actions during both transport and interim stops; (d) clarify their expected actions and responsibilities during unexpected events or emergencies; and (e) specify their expected actions upon delivery to the consignee including identifying the approved receiving agent.

For shipments requiring basic transport security level measures, the need for basic security awareness training is set forth in applicable IAEA Nuclear Security Series publications [4, 6]. Paragraphs 5.15 and 5.16 of Ref. [4] provide details on training to be provided from the security perspective, and paras 311–315 of

SSR-6 (Rev. 1) [1] provide training requirements that are to be satisfied from the safety perspective.

The detailed safety training requirements complement and are generally consistent with the security training requirements specified in the UN Model Regulations [2] and set forth in applicable IAEA Nuclear Security Series publications [4, 6]. However, to avoid a potential inconsistency with the transport safety–security interface, the training will need to (a) be comprehensive; (b) address basic security awareness, radiation protection and regulatory safety requirements commensurate with the individual responsibilities of each involved person; and (c) as appropriate, address function specific and modal specific requirements.

5.8. PERSONNEL TRUSTWORTHINESS

The need for establishing the trustworthiness of personnel involved in normal commercial shipments of radioactive material at the basic security level is only set forth in security related publications; for safety, there are no requirements to establish personnel trustworthiness.

For security, Ref. [4] states for the basic security level that personnel trustworthiness needs to be addressed as follows:

(a) Within a State's legislative and regulatory framework.
(b) By the State's regulatory body, in accordance with a graded approach. The regulatory body needs to:

> "Include requirements, consistent with national practices, for ensuring the trustworthiness of persons with authorized access to sensitive information or to radioactive material during transport or who have specific security responsibilities during transport and establish trustworthiness verification and security clearance procedures for such persons commensurate with their responsibilities".

(c) By operators by providing a conveyance and crew that complies with crew fitness for duty requirements related to trustworthiness.

Specifically, figure 2 of Ref. [4] states that for basic security level shipments, steps need to be taken to ensure trustworthiness and reliability of authorized individuals through background checks. According to IAEA Nuclear Security Series No. 8-G (Rev. 1), Preventive and Protective Measures against Insider Threats [17], trustworthiness determination is also important when

striving to address insider threats. No inconsistency exists with the transport safety–security interface with respect to establishing personnel trustworthiness.

5.9. PERSONNEL IDENTIFICATION

For transport security relating to all shipments of radioactive material other than those with UN Numbers UN 2908 through UN 2913 as noted above, the UN Model regulations specify that carriers are to be appropriately identified (see para. 1.4.1.2 of Ref. [2]).

For shipments of materials requiring basic transport security level measures, para. 5.18 of Ref. [4] specifies that each crew member of any conveyance transporting radioactive material need to carry a means of positive identification during transport. There are no requirements for establishing personnel identification for safety.

No inconsistency exists with the transport safety–security interface with respect to establishing personnel trustworthiness.

5.10. SAFETY AND SECURITY INSPECTIONS

Paragraph 7.2.4.4 of the UN Model Regulations [2] specifies that "Safety inspections on cargo transport units shall cover appropriate security measures."

For transport safety, a management system and compliance management programme based on international, national or other standards acceptable to the competent authority needs to be established and implemented for all activities within the scope of SSR-6 (Rev. 1) [1], as identified in para. 105 thereof, to ensure compliance with the relevant inspection provisions of those regulations. Also, the user needs to be prepared to provide facilities for inspection during use.

For transport security, para. 5.22 of Ref. [4] specifies that for shipments requiring basic transport security level measures, carriers perform security inspections as follows:

> "Just prior to commencing transport, carriers should perform their own security inspections of the package or conveyance, commensurate with the potential radiological consequences of the material transported, to verify that security measures associated with the conveyance are effective. In normal circumstances and as appropriate to the mode of transport, it is sufficient for the carrier to perform a visual inspection of the package or conveyance to ensure that nothing has been tampered with and that nothing has been affixed to the package or conveyance that might affect

the security of the consignment. Such inspections may be performed by transport personnel using their own knowledge of the conveyance or by other security personnel."

If security inspections and safety inspections are carefully combined, the provisions may complement each other, a process that will assist in ensuring both the transport safety and transport security systems are complete and that, for security, the system is prepared to satisfy all the security functions.

If additional security measures are required that are not included in required safety measures owing to an arising threat or risk, there may be an inconsistency in the transport safety–security interface. Any inspection inconsistencies may relate to elements such as the schedule of inspections, the extent of inspections or documentation. If any such inconsistencies are identified, the operator will need to coordinate its pre-shipment planning with all the relevant competent authorities to resolve the inconsistencies prior to undertaking a shipment.

5.11. DESIGN OF TRANSPORT PACKAGES

For all shipments of radioactive material, the UN Model Regulations [2], using the requirements originally stated in SSR-6 (Rev. 1) [1], establish design requirements for transport packages following a graded approach. For normal commercial shipments of radioactive material, these packages could include excepted packages with the least robust design, industrial and Type A packages of moderately robust design or Type B packages with the most robust design.

For safety, the design, testing and acceptance requirements for packages specified in SSR-6 (Rev. 1) [1] are clearly and specifically established. They follow a graded approach to maintain the same level of safety for all package types. That is, as the risk posed by the contents of a package increases, the extent of the design, testing and acceptance requirements also increases. Thus many packages, including many of those used for the type of material considered in this publication, may be of a significantly robust design (e.g. Type B packages capable of withstanding routine, normal and accident conditions of transport), while others may be designed only to be capable of withstanding routine and/or normal conditions of transport (this includes Type A packages, industrial packages and excepted packages).

For security, the design of a transport security system needs to consider the robustness of the package(s) being used, especially where the robustness of a package may contribute to detering and delaying functions of security. There may be situations, however, where satisfying the safety requirements may result in inconsistencies when satisfying security measures.

An example of a potential inconsistency would be the placing of an electronic tracking device (e.g. a radio frequency identification (RFID) tag with battery power) on a package for security purposes. This could not be added to a package until the safety assessment of the package included the presence of the attached or embedded device, and the impacts this could have on the performance of the package under routine, normal and accident conditions of transport as applicable to the individual package design.

Where there is the possibility of inconsistency between specific package design features for safety and those imposed for security, the operator will need to coordinate the development of its package and transport system with the relevant competent authorities to resolve those inconsistencies. Compensating security features may need to be added to the overall package design to satisfy the combined set of transport safety and transport security requirements. However, the addition of security features to a package requires demonstrating that they do not affect the safety functions of the packages.

5.12. STOWAGE AND RETENTION OF PACKAGES DURING TRANSPORT

For stowage, an inconsistency may arise with the transport safety–security interface. If a stowage inconsistency arises, the carrier and consignor may need to work together to resolve the interface issue. For example, with respect to stowage operations, some producers of radioactive material may consign many small packages onto a single road vehicle. In this event, a common practice is to reduce the radiation exposure to the vehicle drivers by placing those packages with the lowest levels of external radiation (e.g. I-White labelled packages) at the front of the enclosed cargo vehicle, while placing those producing the higher levels of external radiation (e.g. II-Yellow and III-Yellow labelled packages) to the rear of the vehicle. Loading II-Yellow and III-Yellow labelled packages rearmost may satisfy requirements for radiological protection of operators but result in those packages being more accessible to theft or sabotage.

The retention of packages can also prove to be complex, especially when the type of material considered in this publication is contained in light weight, small packages where tie down systems are generally not incorporated into the package design. From the perspective of security, it may be desirable to use a more robust retention system than for safety purposes.

For safety:

- Paragraph 554(a) of SSR-6 (Rev. 1) [1] states (italics omitted):

  "Supplementary requirements for loading, stowage, carriage, handling and unloading of the package, overpack or freight container, including any special stowage provisions for the safe dissipation of heat (see para. 565 [of SSR-6 (Rev. 1)]), or a statement that no such requirements are necessary".

- Also, para. 564 of SSR-6 (Rev. 1) [1] states that consignments "shall be securely stowed".
- Paragraph 638 of SSR-6 (Rev. 1) [1] further states that (italics omitted) "Any tie-down attachments on the package shall be so designed that, under normal and accident conditions of transport, the forces in those attachments shall not impair the ability of the package to meet the requirements" of SSR-6 (Rev. 1).

For security, para. 2.60 of Ref. [4] states:

"the tie-downs required to secure a package to the conveyance can also be suitable for affixing security equipment such as locks. However, not all tie-downs are suitable for security purposes, such as those constructed of webbing or other materials that are not resistant to cutting."

Thus, the design of retention systems needs to be such that they do not impair the ability of the package to meet its regulatory design requirements. In most respects, no inconsistency exists with the transport safety–security interface with respect to the stowage and retention.

5.13. LOCKS AND SEALS

For safety, para. 637 of SSR-6 (Rev. 1) [1] states that the outside of Type A and Type B packages is required to incorporate a feature such as a seal that is not readily breakable and which, while intact, will be evidence that the package has not been opened.

For basic security, the integrity of the locks and seals needs to be verified before dispatch, before leaving any stopping point en route, and upon arrival. Security measures need to provide detection such as tamper indicating devices and seals (packages and conveyances). These devices, while intact, can demonstrate that the package has not been opened.

In most respects, no inconsistency exists with the transport safety–security interface with respect to the addition of locks and seals for security. However, steps need to be taken to ensure that any such additions do not compromise safety. If the addition of the locks and seals could in some way comprise a safety function of the package, such an issue will need to be identified, and the operator will need to coordinate the addition of the locks and seals with the package designer and relevant competent authorities in order to resolve any interface issues prior to undertaking a shipment (see Section 5.11 for more details on this procedure).

5.14. MONITORING AND TRACKING OF PACKAGES AND VEHICLES

There are no safety requirements with respect to monitoring or tracking of packages and vehicles, or with respect to leaving vehicles unattended. Establishing surveillance protocols during shipment for security purposes does not compromise transport safety, and in fact, can enhance safety during transport. Care needs to be taken to ensure that packages or conveyances containing radioactive material are not left unattended for any longer than is absolutely necessary.

For shipments requiring basic transport security level measures, the use of a simple tracking system may need to be considered that can determine when the consignment has departed, when it is in transit and when it has been received. However, if monitoring or tracking requires additions be made to a package, such additions may compromise safety. If the addition of the monitoring or tracking devices could in some way comprise a safety function of the package, this will need to be identified, and the addition of the monitoring or tracking devices will need to be coordinated with the package designer and, as appropriate, with relevant competent authorities in order to resolve any package design interface issues prior to undertaking a shipment (see Section 5.11 for more details on this procedure).

5.15. IN-TRANSIT STORAGE OF RADIOACTIVE MATERIAL DURING TRANSPORT

For safety, the scope of SSR-6 (Rev. 1) [1] (see para. 106) includes in-transit storage. Therefore, all SSR-6 (Rev. 1) requirements are applicable for in-transit storage to ensure radiological and criticality safety.

For security, the UN Model Regulations [2] specify in para. 1.4.1.3 that operators are to have, for all shipments of radioactive material other than those with UN Numbers UN 2908, UN 2909, UN 2010 (less than $10^{-3}A_2$), UN 2911

(less than A_2), UN 2912 (LSA-I) and UN 2913 (SCO-I), transit sites such as airside warehouses, marshalling yards and other temporary storage areas properly secured, well lit and, where possible, not accessible to the general public.

For shipments requiring only prudent management practices, operators need to secure and store packages during in-transit storage, not leaving packages unattended for any longer than is absolutely necessary.

For shipments requiring basic transport security level measures, while in storage that is incidental to transport, operators need to apply security measures where these measures are consistent with the category of the material and measures that are applied during use, storage and transit.

In-transit storage may introduce transport safety–security interface inconsistencies that will need to be identified and resolved.

5.16. COMMUNICATIONS

For safety, Annex I of SSR-6 (Rev. 1) [1] details the prior notification provisions by type of package. It further notes that there may be deviations (exceptions, additions, etc.) relative to:

(a) National regulations relating to safety;
(b) Carrier restrictions;
(c) National regulations relating to security, physical protection, liability, insurance, pre-shipment notification and/or routeing and import/export/transit licensing.

Specifically, prior notification is required for Type B(U) and Type C packages containing radioactive material with an activity greater than $3000A_1$ or $3000A_2$, as appropriate, or 1000 TBq, whichever is the lower; Type B(M) packages; and shipments under special arrangement only.

Annex I of SSR-6 (Rev. 1) [1] also notes that additional measures may need to be taken:

> “to provide appropriate physical protection in the transport of nuclear material and to prevent acts without lawful authority that constitute the receipt, possession, use, transfer, alteration, disposal or dispersal of nuclear material and which cause or are likely to cause, death or serious injury to any person or substantial damage to property”.

For shipments requiring only prudent management practice, carriers need to provide drivers of road conveyances with effective communication capabilities that are routinely tested before each shipment commences.

For basic transport security level shipments, operators need to cooperate with each other and with appropriate authorities to exchange information on applying security measures and responding to security incidents. In addition, crew members need to have the capability to communicate with their company or law enforcement personnel in order to request assistance. However, with all of these communications, sensitive information, including that related to transport operations, needs to be protected.

If the relevant domestic and international transport safety and security regulations with respect to pre-shipment notifications are complied with, the security provisions may either complement or be inconsistent with those for safety. There may be inconsistencies with respect to communications and the protection of sensitive information, including inconsistencies related to specific pre-shipment notification security and safety measures. In these cases, the operator will need to coordinate the pre-shipment notification information with the relevant competent authorities to resolve those inconsistencies and to ensure that the exchange of information on applying security measures and responding to security incidents is handled appropriately, that sensitive information is provided only to those who have a need to know, and that the crew members have the ability to effectively communicate with their company or law enforcement.

If a non-compliance with respect to excessive radiation levels or contamination is identified during the shipment, SSR-6 (Rev. 1) [1] requires that the non-compliance be reported to both the consignor and the relevant competent authorities. This notification "shall be made as soon as practicable and shall be immediate whenever an emergency exposure situation has developed or is developing" (see para. 309 of SSR-6 (Rev. 1) [1]).

5.17. WRITTEN INSTRUCTIONS AND DOCUMENTATION

For safety, SSR-6 (Rev. 1) [1] specifies the detailed contents of transport documents (paras 546–553); information to be provided to carriers (paras 554–556); and requirements for notification of competent authorities of shipments (paras 557–560), on possession of information by the consignor (para. 561), and for retention of shipping documentation by carriers (para. 584–588).

For security, when applying prudent management practices, an operator would normally be expected to develop safety and security documentation and maintain records associated with the shipment of a consignment.

For shipments requiring basic transport security level measures, carriers need to provide appropriate crew members with written procedures on required security measures, which need to include information addressing how to respond to a security incident during transport.

If the relevant domestic and international transport safety regulations with respect to documentation are complied with, the security provisions for written instructions and shipment documentation may either complement or be inconsistent with those for safety. Where there are transport safety–security interface inconsistencies between specific written instruction and documentation requirements for safety and those for security, the consignor or carrier will need to coordinate the pre-shipment notification contents of planning documents with the relevant competent authorities to address those interface issues. In addition, consideration could be given to developing a series of separate documents, each of which may be provided only to those who need to know about the aspect of planning it addresses.

5.18. MARKING AND LABELLING OF PACKAGES, AND PLACARDING OF VEHICLES AND FREIGHT CONTAINERS

For safety, it is important that the packaging and freight containers be clearly labelled as hazardous, so as to reduce the likelihood of an error due to a lack of information about the contents. For safety purposes, SSR-6 (Rev. 1) [1] specifies that the following are required:

(a) Markings on packages to facilitate understanding by all involved in transport of the package of the contents of the package;
(b) Labelling of packages to facilitate radiological safety, communicating the dose rate outside the package and the specific contents of the package;
(c) Placarding of vehicles and freight containers to facilitate communication of potential hazards to emergency responders in the event of an accident.

For security, labelling and placarding might provide a potential adversary with information that could assist the adversary in a performing a malicious act. Removal of labels, placards or both for security purposes reduces the ability to communicate radiological protection and emergency response information to operational personnel, freight handlers and emergency response personnel.

Where a possible inconsistency exists between safety and security measures involving placarding and/or labelling, para. 2.62 of Ref. [4] states:

> "if a State were to determine, based on an analysis of the threat, to remove (on an exceptional basis) any markings, placarding or labelling placed externally on the package or the vehicle with information on the hazards of the material, compensatory measures should be applied such as escorting personnel who can provide information on the nature and hazards of the material to emergency responders. Solutions to potential conflicts such as these should be assessed and approved by the regulatory bodies responsible for transport safety and security."

Where it is determined that there is an inconsistency when satisfying safety hazard communication through the use of markings, labelling or placarding, then compensatory measures approved by competent authorities will need to be applied through alternative communications methods which ensure that in the event of an accident or emergency, lifesaving emergency response actions can take place.

5.19. IDENTIFICATION OF CONSIGNEES AND AUTHORIZATION REQUIREMENTS

There are no apparent inconsistencies with the transport safety–security interface relative to the identification and authorization of consignees. Establishing identification and authorization requirements for consignees for security purposes can, in fact, enhance safety during transport.

For safety, with respect to the consignee, para. 546 of SSR-6 (Rev. 1) [1] requires that (italics omitted) "The consignor shall include in the transport documents with each consignment the identification of the consignor and consignee, including their names and addresses…".

SSR-6 (Rev. 1) [1] also specifies the following (italics omitted):

> "583. Where a consignment is undeliverable, it shall be placed in a safe location and the appropriate competent authority shall be informed as soon as possible and a request made for instructions on further action."
>
> …….
>
> "585. The information applicable to the consignment shall accompany the consignment to its final destination. This information may be on the

transport document or may be on another document. This information shall be given to the consignee when the consignment is delivered."

For shipments requiring prudent management security practices, the consignor needs to know the consignee as would be the case for shipments of any valuable commodities.

For shipments requiring basic transport security level measures, consignors needs to ensure that consignees are properly identified, authorized and prepared to receive the consignments.

5.20. SURVEILLANCE

Reference [4] does not specify surveillance of shipments that require prudent management practices or the basic or enhanced security levels. However, if additional security measures are determined to be necessary by a competent authority owing to changes in threat levels or other factors, then para. 5.65 of Ref. [4] indicates that surveillance is an additional measure that might be considered. An inconsistency between safety and security if surveillance is required is unlikely to occur.

6. PROCESS FOR ADDRESSING TRANSPORT SAFETY–SECURITY INTERFACE ISSUES

Operators need to ensure that all transport safety requirements and national security requirements are satisfied and the associated transport safety–security interfaces are appropriately addressed.

For safety, consignors are required to provide transport documents (see paras 545–553 of SSR-6 (Rev. 1) [1]). These can serve as a basis for managing their operations consistently with the application of a management system (see para. 306 of SSR-6 (Rev. 1)) for transport (e.g. TS-G-1.4 [14]).

Similarly, for security, the relevant IAEA recommendation and guidance publications, and the requirements that emanate from the UN Model Regulations [2] and relevant modal regulations as established in State regulations specify similar actions.

This section describes a process to be followed by the operators submitting these transport documents and working with the safety and security authorities to address interface issues between safety requirements and national security

requirements. The operators must comply with all national safety and security requirements. Any non-compliance with safety or security requirements will involve compensatory measures which must be approved by the national safety and security competent authorities. For safety, the compensatory measures may include the requirement to ship under a special arrangement approval, which must be accomplished before the shipment begins.

Figure 1 applies to operators resolving such non-compliances, and to the safety and security competent authorities in providing resolution to such situations. This decision chart illustrates a logical process that operators, working with safety and security competent authorities, can follow to identify and resolve, for each of the 20 transport tasks outlined in Section 5, possible issues with the transport safety–security interface for normal commercial shipments of radioactive material where additional security measures (Ref. [4]) are being considered.

The identification of a potential interface issue will depend on the specifics of the consignment being planned. Here, all parties need to consider many factors, including the following:

(a) The chemical and physical forms of the radioactive contents in a package;

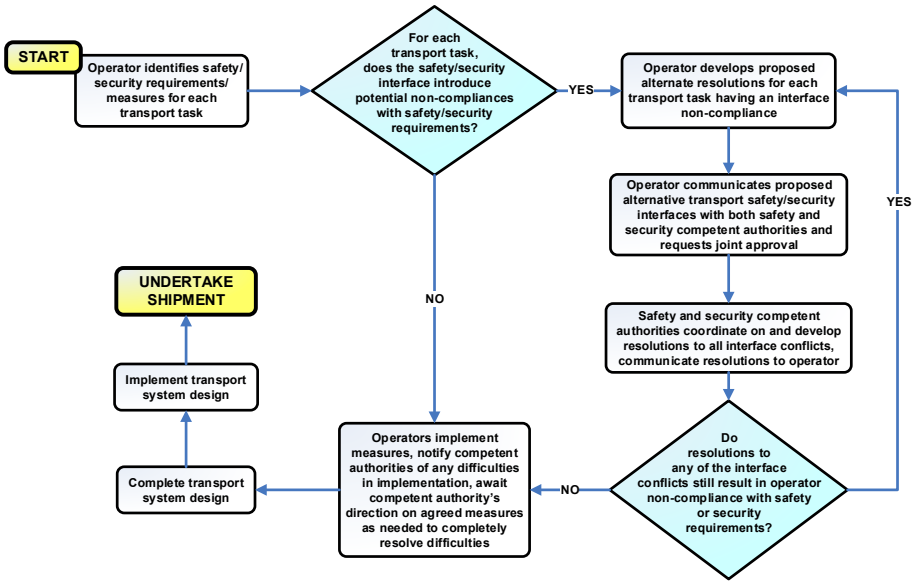


FIG. 1. Process for operators and safety and security competent authorities to follow in addressing transport safety–security interface issues.

(b) The details of the package design that have been established to satisfy the safety requirements specified in relevant transport safety regulations;
(c) The type(s) of conveyance, mode(s) of transport and routes to be used.

The implementation of prudent management practices for security as detailed in Ref. [4] can enable compliance with all the transport regulatory requirements specified in SSR-6 (Rev. 1) [1] to be achieved. The implementation of additional security measures may introduce scenarios in which the transport safety requirements cannot be met, and in these situations this lack of compliance will require discussion between the competent authorities for safety and security to identify and agree on the compensatory safety measures needed.

If additional security measures are deemed necessary by the transport security competent authority, advice and agreement involving other competent authorities for safety and security will need to be sought (see Fig. 1). The operators should be informed of the additional security measures and the compensatory safety measures determined necessary by both the security and safety competent authorities.

If additional, compensating safety measures are deemed necessary by the transport safety competent authority, advice and agreement by other involved competent authorities will need to be sought. The operators should be informed of the agreed compensatory safety measures as determined necessary by both the security and safety competent authorities.

As shown in Fig. 1, the operator should assess if any additional security measures compromise compliance with the safety regulatory requirements (including any notified compensatory safety measures), or whether any safety requirements compromise compliance with national security requirements. If compliance with safety requirements or national security requirements is compromised, then the operator should follow the approach shown in Fig. 1, preparing proposed compensatory measures, communicating those to the safety and security competent authorities and awaiting notification of agreed measures from both competent authorities before the shipment commences.

For safety, this is advised because any resulting non-compliance with the transport safety requirements would be illegal unless the compensatory measures have been approved by safety competent authorities, a special arrangement approval has been issued to the operator, and any changes to national emergency response arrangements have been implemented. Similarly, for security this is advised to ensure compliance with national security requirements set by the State.

Therefore, the resolution process will need to be focused on the design of the transport system, considering the changes in the details of the interface between safety and security. The topically related example questions provided

in Appendix I can be used with the decision chart in Fig. 1 to further facilitate addressing such issues.

Appendix I

EXAMPLE TRANSPORT TASK QUESTIONS FOR ADDRESSING TRANSPORT SAFETY–TRANSPORT SECURITY INTERFACE ISSUES

Section 5 discussed 20 safety–security interface tasks that will need to be considered when addressing potential interface issues. As applicable, it considered, for security, both normal commercial shipments of radioactive material requiring only prudent management practices and those requiring both prudent management practices and basic transport security level measures.

For shipments that require only prudent management practices, the safety–security interface will probably not introduce interface issues.

However, for shipments requiring both prudent management practices and basic transport security level measures, a consignor may consider applying the security measures set forth in Ref. [4], following consultation with and approval by relevant safety and security competent authorities if the adoption of such measures would result in a non-compliance with safety requirements. For basic transport security level shipments, para. 5.9 of Ref. [4] states:

> "At the basic transport security level, the regulatory body should require that shippers, carriers, receivers and others engaged in the transport of radioactive material implement security systems or other arrangements to deter, detect, delay and respond to malicious acts affecting the conveyance or its cargo, using a graded approach. These arrangements should be operational and effective at all times and include training and regular briefings to assist personnel in maintaining awareness and vigilance."

Finally, a competent authority may require a consignor to apply additional security measures owing to an arising threat or risk in the State or States where normal commercial shipments of radioactive material are to occur. The relevant competent authorities will specify the basis for determining the necessary level of security and the appropriate security measures for a given shipment. If these measures lead to a non-compliance with safety requirements, this will need to be accompanied by any required compensatory safety measures that are to be applied, as prescribed by the safety competent authority.

To assist operators in fulfilling these requirements, subsections I.1–I.20 elaborate upon the 20 tasks discussed in Section 5, providing a brief summary of potential interface issues, and then lists in the left column one or more typical questions that can be used in an action list to facilitate demonstration of compliance with relevant safety requirements/security recommendations prior

to undertaking a shipment. This table could also assist operators in identifying safety–security interface issues and addressing those issues with their relevant competent authorities.

Operators and competent authorities may explore these typical questions for each of the tasks listed in subsections I.1–1.20, responding to each question in the three blank columns in the table (i.e. providing answers for safety, security and the interface), thereby helping them to better understand the safety–security interface. Specifically, application of this table could be useful to the operators when preparing to undertake normal commercial shipments of radioactive material. For example, for these shipments, providing answers to the questions in the subsections that follow could facilitate the preparation of necessary transport documents by operators, incorporating safety–security interface information associated with the shipments while concurrently providing a basis for demonstrating compliance with safety requirements and security measures to competent authority inspectors.

In utilizing this tool, prior to preparing its shipment, the consignor needs to determine whether only prudent management practices are to be followed for transport security, or whether both prudent management practices and basic transport security level measures are to be followed; Table 23 in Appendix II can further assist the user in this process. The consignor also needs to determine whether the contents of the shipment pose other dangers and, if so, will need to determine what additional security measures if any need to be applied owing to those subsidiary hazards.

I.1. GENERAL INTERFACE BETWEEN SAFETY AND SECURITY

Compliance with all relevant dangerous goods transport regulations is necessary to ensure that transport security measures are implemented so as to not detract from safety. Thus, the provisions set forth in all relevant transport safety and security regulatory documents need to be implemented so as to provide a high level of safety and security, while any interface issues between safety and security are resolved by the relevant competent authorities working closely with the consignor and carriers.

Both transport safety regulations and transport security recommendations and guidance specify that radioactive materials shall be shipped where security provisions recognize and accommodate safety provisions, and safety provisions recognize and accommodate security provisions.

The general interfaces between transport safety and security are structured with a view to ensuring one does not detract from the other. Complying with all relevant dangerous goods transport regulations can provide a high level of safety,

while any interface issues introduced by security will need to be addressed. Table 2 contains example questions to assist stakeholders in addressing issues with the general interface between safety and security.

I.2. REGULATIONS AND COMPLIANCE

For a given normal commercial shipment of radioactive material, relevant domestic and international transport safety and security regulations apply. Safety and security regulations may emanate from different competent authorities that are governed by different legal and regulatory regimes, making it difficult for operators to develop an understanding of how to fully comply with both sides of the regulatory framework.

For transport safety, all relevant requirements imposed by regulations must be satisfied. Similarly, for transport security, all relevant security measures imposed by relevant regulations must be satisfied. If a failure to comply with requirements is identified, this will need to be communicated to the relevant safety and security competent authorities.

For international shipments it is possible that consignors and carrier(s) may operate under regulatory regimes based upon different editions of SSR-6 (Rev. 1) [1] for safety, and national requirements for security that meet the IAEA security recommendations in part or in full. Possible interface issues in the international transport safety–security interface for a shipment will need to be identified and resolved. Non-compliance with safety requirements would be expected to result in the issuance of a special arrangement approval by the safety competent authority. This special arrangement approval requires multilateral approval by all countries through or into which the package is shipped.

TABLE 2. EXAMPLE QUESTIONS: GENERAL INTERFACE BETWEEN SAFETY AND SECURITY

Issue	Safety	Security	Interface
Q1.1: What steps have been taken to address applicable safety requirements and security recommendations for the transport by all involved stakeholders commensurate with their responsibilities?			
Q1.2: What steps have been taken to resolve outstanding safety–security interface issues?			

Where an interface issue is identified between specific security and safety measures, steps will need to be immediately taken to initiate resolution of the interface issue between the consignor and carriers and the relevant competent authorities. Giving early priority to highlighting the transport safety–security interface problem and striving to evaluate and resolve the problem in an expeditious manner makes it possible to identify choices/alternatives. Resolution needs to be agreed with the involved competent authorities and implemented before final plans and actions are taken for the shipment. Table 3 contains example questions to assist stakeholders in addressing issues with regulations and compliance.

I.3. THREAT ASSESSMENTS

There may be a safety–security interface between the package safety performance and the threat to the package during transport that will need to be resolved. The relative robustness of a given package design satisfying SSR-6 (Rev. 1) [1] requirements, determined by its contents and design for satisfying the safety regulatory requirements, may very often be useful to the designer of a transport security system in addressing specific issues that result from security threat and accident assessments.

The transport safety regulations require testing to demonstrate the ability of transport packages to withstand normal conditions of transport, and, for some packages, additional tests for demonstrating the ability of transport packages to withstand accident conditions of transport. These tests, which are applied following a graded approach to the design of packages, have been historically

TABLE 3. EXAMPLE QUESTIONS: REGULATIONS AND COMPLIANCE

Issue	Safety	Security	Interface
Q2.1: Have both the consignor and carriers determined the requirements and recommendations they are required to satisfy for both safe and secure transport of this shipment?			
Q2.2: What steps have been taken to resolve differences that may have arisen if different versions of the regulations and recommendations are imposed by different involved regulators?			

demonstrated to address the threat posed by accidents by considering routine, normal and accident scenarios and the contents of a specific package.

Paragraph 5.10 of Ref. [4] specifies that those responsible for transport of radioactive material may need to take into consideration all available security threat information, including threat information provided by the regulatory body, when applying necessary security measures to protect the material being shipped.

In addition, the relative robustness of a given package determined by its contents and design for satisfying the safety regulatory requirements may very often be useful to the designer of a transport security system in addressing specific issues that result from security threat and accident assessments. Table 4 contains example questions to assist stakeholders in addressing issues with threat assessments.

I.4. MANAGEMENT OF SECURITY RELATED INFORMATION

The management of sensitive, security related information can potentially introduce a transport safety–security interface issue. The potential interface issue involves the transmittal of transport specific information to meet safety requirements that may be inconsistent with the challenges of maintaining control of this information for security purposes. Specifically, in some cases the transfer of information may not be consistent with the need to protect security sensitive information which may only be shared with those having a 'need to know'.

Detailed safety information is to be included in the transport documentation, including shipment notifications that are to be made, and sets forth those entities that need to possess the information in the transport documents.

For transport security where only prudent management practices are to be applied, the operator needs to apply normal and sound business practices with respect to how it manages sensitive information. For basic transport security level shipments, operators need to take appropriate measures to protect sensitive

TABLE 4. EXAMPLE QUESTIONS: THREAT ASSESSMENTS

Issue	Safety	Security	Interface
Q3.1: Has the consignor considered the robustness of the package when making a threat assessment?			
Q3.2: Has the consignor considered information such as schedule, route and package design in the threat assessment?			

information relating to transport operations, such as information on the schedule and route that could be used by an adversary to plan a malicious act.

Where transmitting information results in transport safety–security interface issues, the consignor and carriers will need to coordinate their transport documents and other communications relating to a shipment with the relevant competent authorities to address those issues. Table 5 contains example questions to assist stakeholders in addressing issues with management of security related information.

I.5. OPERATIONAL CONTROLS

Normal commercial shipments of radioactive material need to be undertaken in accordance with applicable dangerous goods regulations, both from the perspective of safety and security. Multiple operational controls are specified in the transport safety regulations, which are generally viewed as satisfying prudent management practices. For shipments requiring basic transport security level measures, additional operational controls are needed.

Although operationally related controls for safety do not generally introduce issues with the transport safety–security interface, and the interface between the two generally complements the operationally related controls for security, steps need to be taken to ensure that no interface issues exist. Tables 6 and 7 contain example questions to assist stakeholders in addressing issues with operational controls for shipments requiring only prudent management practices, and for basic transport security level shipments, respectively.

TABLE 5. EXAMPLE QUESTIONS: MANAGEMENT OF SECURITY RELATED INFORMATION

Issue	Safety	Security	Interface
Q4.1: What steps have the consignor and carrier taken to ensure that shipping documents are accurate and complete?			
Q4.2: What steps have the consignor and carrier taken to appropriately identify, protect and communicate sensitive information?			

TABLE 6. EXAMPLE QUESTIONS: OPERATIONAL CONTROLS — PRUDENT MANAGEMENT PRACTICES

Issue	Safety	Security	Interface
Q5.1: What basic control and normal commercial practices have been applied to protect the material against unauthorized removal or sabotage as would be the case for any valuable commodity?			
Q5.2: What appropriate security controls have the consignor and carrier established to secure packages while in transit and storage in a manner that impedes unauthorized removal (e.g. in a locked conveyance or storage area)?			
Q5.3: What steps has the consignor taken to ensure that the carrier is well known and experienced?			

I.6. CARRIER QUALIFICATIONS

The use of appropriately identified carriers and the exercise of proper control over the transfer of materials to and between authorized operators does not create an interface issue between transport safety and transport security. Such actions generally complement both safety and security. However, steps need to be undertaken to ensure no interface issues exist. Table 8 contains example questions to assist stakeholders in addressing issues with carrier qualifications.

I.7. TRAINING AND TRAINING RECORDS

For all shipments of radioactive material other than those with UN Numbers UN 2908 through UN 2913, section 1.4.2 of the UN Model Regulations [2] specifies that safety training shall also include elements of security awareness addressing the nature of security risks, methods to address and reduce such risks, and actions to be taken in the event of a security breach. It further specifies that such training needs to be provided or verified upon employment in a position involving dangerous goods transport and needs to be periodically supplemented with retraining.

The UN Model Regulations [2], applicable IAEA Nuclear Security Series publications [4, 6] and SSR-6 (Rev. 1) [1] all specify that records of training need to be maintained and made available upon request by the employee and

TABLE 7. EXAMPLE QUESTIONS: OPERATIONAL CONTROLS — BASIC TRANSPORT SECURITY LEVEL

Issue	Safety	Security	Interface
Q5.4: What steps has the competent authority taken to ensure that consignor and carrier personnel are appropriately trained?			
Q5.5: What steps have the consignor and carrier taken to establish effective procedures for all phases of the transport, including a procedure for communications during transport?			
Q5.6: What steps has the consignor taken to confirm the suitability or ability of the consignee to take receipt of the consignment, if appropriate?			
Q5.7: At the basic security level, what steps has the competent authority taken to ensure that the consignee has procedures to act, as appropriate, upon receipt or non-receipt of the consignment?			
Q5.8: At the basic security level, what steps has the competent authority taken to ensure that the consignor and/or carrier are prepared to act appropriately if notified of non-receipt of the consignment by the consignee?			

competent authorities. Table 9 contains example questions to assist stakeholders in addressing issues with training and training records.

I.8. PERSONNEL TRUSTWORTHINESS

The need for establishing the trustworthiness of personnel involved in normal commercial shipments of radioactive material is only set forth in security related publications. For basic security level shipments, personnel trustworthiness need to be addressed. Also, para. 5.12 of Ref. [4] indicates that trustworthiness determination is an important element in addressing and controlling insider threats. Table 10 contains example questions to assist stakeholders in addressing issues with personnel trustworthiness.

TABLE 8. EXAMPLE QUESTIONS: CARRIER QUALIFICATIONS

Issue	Safety	Security	Interface
Q6.1: What steps has the consignor taken to appropriately ensure that the carriers are suitably qualified and experienced to carry out the duties of a carrier in accordance with the consignor's quality management system? Furthermore, if required by national regulations, has the consignor verified that the carrier is certified, registered or appropriately trained?			
Q6.2: What steps have the competent authority and the consignor taken to ensure that the use of public transport (e.g. buses) for packages with an I-White label has been precluded unless specifically allowed by national regulations?			
Q6.3: At the basic security level, what steps have the consignor and carrier taken to implement any supplementary security requirements specified by the competent authorities?			
Q6.4: What steps have the consignor and carrier taken to implement the requirements of a special arrangement approval issued by the safety competent authority to compensate for the supplementary security measures implemented by the security competent authority.			

I.9. PERSONNEL IDENTIFICATION

For basic transport security level shipments, each crew member of any conveyance transporting radioactive material need to carry means of positive identification during transport. There are no requirements for establishing personnel identification for safety. Table 11 contains an example question to assist stakeholders in addressing issues with personnel identification.

I.10. SAFETY AND SECURITY INSPECTIONS

The safety and security inspection provisions may complement each other. Some security features may need to be added to inspection procedures. Inspections need to ensure both the transport safety and transport security

TABLE 9. EXAMPLE QUESTIONS: TRAINING AND TRAINING RECORDS

Issue	Safety	Security	Interface
Q7.1: What steps have been taken to ensure that involved employees have been trained with respect to both safety and security for this shipment as required by regulations?			
Q7.2: What steps have been taken to ensure that records of all training of involved employees have been maintained as required by regulations?			
Q7.3: What steps has the operator taken to ensure that the training records can be made available to either or both the employee or the competent authority upon request?			

TABLE 10. EXAMPLE QUESTIONS: PERSONNEL TRUSTWORTHINESS

Issue	Safety	Security	Interface
Q8.1: What steps has the operator taken to ensure that the trustworthiness of employees has been established commensurate with the employee's responsibilities and consistent with national regulations?			
Q8.2: Does the trustworthiness process address insider threats?			

TABLE 11. EXAMPLE QUESTION: PERSONNEL IDENTIFICATION

Issue	Safety	Security	Interface
Q9.1: When possible, what steps has the operator taken to provided positive identification for all crew members involved in basic transport security level shipments?			

systems are complete and functional and that appropriate corrective actions have been completed and documented.

If additional security measures due to an arising threat or risk are required that introduce features that are not included in safety requirements, the inspections will need to incorporate these security measures. In some situations, different inspectors may be needed since some security features may not be divulged to safety inspectors.

The consignor and carriers need to coordinate their pre-shipment planning with all the relevant competent authorities to ensure adequate inspection prior to undertaking a shipment. Table 12 contains example questions to assist stakeholders in addressing issues with safety and security inspections.

I.11. DESIGN OF TRANSPORT PACKAGES

For all shipments of radioactive material, the transport safety regulations specify design requirements for transport packages following a graded approach. For security, the design of a transport security system needs to take into account the design features of the packages being used.

Compensating security features may need to be added to the overall package design to satisfy the combined set of transport safety requirements and transport security recommendations. The addition of security features to a package could require demonstrating that they do not affect the safety functions of the package.

TABLE 12. EXAMPLE QUESTIONS: SAFETY AND SECURITY INSPECTIONS

Issue	Safety	Security	Interface
Q10.1: For basic security level shipments, what steps have the operators taken to perform and document, as required by relevant regulations, safety and security inspections from initiation to completion of this shipment, to confirm safety and security measures are functioning?			
Q10.2: What steps has the carrier taken to carry out visual inspection of the package or conveyance to ensure that nothing has been tampered with and that nothing has been affixed to the package or conveyance that might affect the security of the consignment?			

If interface issues arise between specific package design features for safety and those imposed for security, the operator will need to coordinate the development of its package and transport system with the relevant competent authorities to resolve those issues. Table 13 contains example questions to assist stakeholders in addressing issues with design of transport packages.

I.12. STOWAGE AND RETENTION OF PACKAGES DURING TRANSPORT

The potential for transport safety–security interface issues exists when dealing with the stowage and retention of packages. Thus, attention may be needed to the methods used for stowage and retention of packages in a conveyance and during in-transit storage and how these may affect satisfying safety requirements and security recommendations. Table 14 contains example questions to assist stakeholders in addressing issues with stowage and retention of packages during transport.

TABLE 13. EXAMPLE QUESTIONS: DESIGN OF TRANSPORT PACKAGES

Issue	Safety	Security	Interface
Q11.1: If additional features have been added to the package design to satisfy security recommendations, what steps has the consignor taken to ensure that the additional features have been assessed by the package designer and are included in the certificate of conformity or competent authority package design approval certificate, thereby ensuring the package is certified as meeting the prescribed regulatory safety requirements?			
Q11.2: How has the consignor resolved any safety–security interface issues that have been introduced by adding additional package design features?			
Q11.3: For any modification to the package design, what steps has the consignor taken to satisfy the transport safety regulatory requirements and the security recommendations?			

TABLE 14. EXAMPLE QUESTIONS: STOWAGE AND RETENTION OF PACKAGES DURING TRANSPORT

Issue	Safety	Security	Interface
Q12.1: What steps has the operator taken to ensure that stowage and retention of packages in a conveyance and in-transit storage (if applicable) has not detracted from satisfying safety requirements and security recommendations?			
Q12.2: When packages have been altered to accommodate retention systems for security purposes, have these alterations been approved by both the package designer and the relevant safety competent authority?			
Q12.3: What documented evidence of approval of the alterations to the package is available for inspection?			

I.13. LOCKS AND SEALS

For safety, other than excepted and industrial package Types 1 and 2 (Type IP-1 and Type IP-2) packages, packages shall incorporate a feature on the outside of the package such as a seal that is not readily breakable and which, while intact, will be evidence that the package has not been opened. Such tamper indicating devices may also be required for security purposes but may need to be modified. Locks, not required for safety, may need to be used for security on the retention systems or the cargo compartment. Steps need to be taken to ensure that any locks and seals added to a package to satisfy security recommendations do not compromise safety requirements.

The integrity of any locks and seals needs to be verified before dispatch, before leaving any stopping point en route, and upon arrival. Table 15 contains example questions to assist stakeholders in addressing issues with locks and seals.

I.14. MONITORING AND TRACKING OF PACKAGES AND VEHICLES

There are no safety requirements with respect to monitoring or tracking of packages and vehicles, or with respect to leaving vehicles unattended. Steps need to be taken to ensure that packages or conveyances containing radioactive material are not left unattended for any longer than is absolutely necessary. For

TABLE 15. EXAMPLE QUESTIONS: LOCKS AND SEALS

Issue	Safety	Security	Interface
Q13.1: For basic security level shipments, if any modifications have been made to seals for security purposes, has the consignor resolved any interface issues with safety?			
Q13.2: For basic security level shipments, how will the operator establish proper controls to ensure the integrity of seals and of any locks used prior to and during shipment, and upon delivery to the consignee?			
Q13.3: For basic security level shipments, in the event that the integrity of a seal or any locks used is determined to be violated, what actions will the operator take?			

shipments requiring prudent management level measures, package tracking systems are not required. For shipments requiring basic transport security level measures, carriers need to consider using a simple monitoring system such as a package tracking system that can determine when a consignment has departed, when it is in transport and when it has been received.

If the addition of monitoring or tracking devices could in some way comprise a safety function of the package, this compromise will need to be identified and addressed. The addition of the monitoring or tracking devices will need to be coordinated with the package designer and, as appropriate, with relevant competent authorities. Table 16 contains example questions to assist stakeholders in addressing issues with monitoring and tracking of packages and vehicles.

I.15. IN-TRANSIT STORAGE OF RADIOACTIVE MATERIAL DURING TRANSPORT

For shipments requiring only prudent management practices, during in-transit storage, operators need to secure and store packages, not leaving packages unattended for any longer than is absolutely necessary.

For shipments requiring basic transport security level measures, while in storage that is incidental to transport, operators need to apply security measures where these measures are consistent with the category of the material and measures that are applied during use, storage and transit. Table 17 contains

example questions to assist stakeholders in addressing issues with in-transit storage of radioactive material during transport.

I.16. COMMUNICATIONS

If the relevant domestic and international transport safety and security regulations with respect to pre-shipment notifications are complied with, the security provisions may either complement or be inconsistent with those for safety. For shipments requiring only prudent management practice, carriers need

TABLE 16. EXAMPLE QUESTIONS: MONITORING AND TRACKING OF PACKAGES AND VEHICLES

Issue	Safety	Security	Interface
Q14.1: For basic security level shipments, if monitoring or tracking systems are in place consistent with security requirements, how does this affect the transport safety–security interface?			
Q14.2: For basic security level shipments, have the procedures for operating any monitoring or tracking systems been evaluated for their potential impacts on transport safety?			

TABLE 17. EXAMPLE QUESTIONS: IN-TRANSIT STORAGE OF RADIOACTIVE MATERIAL DURING TRANSPORT

Issue	Safety	Security	Interface
Q15.1: Have the consignor and consignee determined (a) the adequacy of planned in-transit storage sites; (b) whether the packages are capable of being properly secured consistent with the category of the material and measures applied during use, storage and transit; and (c) if there are any safety related issues with the sites?			
Q15.2: What measures are in place to verify that the carrier retains control and security of the package(s) when placed in in-transit storage?			

to provide drivers of road conveyances with effective communication capability. For basic transport security level shipments, operators need to cooperate with each other and with appropriate authorities to exchange information on applying security measures and responding to security events.

If the relevant domestic and international transport safety and security regulations with respect to pre-shipment notifications are complied with, the security provisions may either complement or be inconsistent with those for safety. Specifically, there may be interface issues with respect to communications and the protection of sensitive information, including those related to specific pre-shipment notification security and safety measures.

In the event that a non-compliance with respect to excessive radiation levels or contamination is identified during the shipment, the non-compliance will need to be reported as soon as practicable to both the consignor and the relevant competent authorities. Table 18 contains example questions to assist stakeholders in addressing issues with communications.

I.17. WRITTEN INSTRUCTIONS AND DOCUMENTATION

If the relevant domestic and international transport safety regulations with respect to documentation are complied with, the security provisions for written instructions and shipment documentation may either complement or be inconsistent with those for safety.

For shipments requiring only prudent management practices, an operator would normally be expected to develop safety and security documentation

TABLE 18. EXAMPLE QUESTIONS: COMMUNICATIONS

Issue	Safety	Security	Interface
Q16.1: What steps have the consignor and carrier taken to establish appropriate communication capability consistent with both the safety requirements and security recommendations considering the mode(s), route(s) and jurisdictions involved in this shipment?			
Q16.2: For known parts of the route where communication is not possible, have arrangements been put in place for communications to be transmitted immediately before entering and immediately upon leaving such parts of the route?			

and maintain records associated with the shipment of a consignment. For shipments requiring basic transport security level measures, carriers need to provide appropriate crew members with written procedures on required security measures, which need to include information addressing how to respond to a security incident during transport.

Where there are transport safety–security interface issues with respect to specific safety written instruction and documentation requirements and those for security, the consignor or carrier will need to coordinate the pre-shipment notification contents of planning documents with the relevant competent authorities to address these interface issues. Table 19 contains example questions to assist stakeholders in addressing issues with written instructions and documentation.

I.18. MARKING AND LABELLING OF PACKAGES, AND PLACARDING OF VEHICLES AND FREIGHT CONTAINERS

There is the potential for a transport safety–security interface issue resulting from the marking and labelling of packages, and the placarding of vehicles. For safety there is a need to mark and label packages, and placard vehicles to identify their contents to emergency responders. For security, marking, labelling and placarding can highlight the contents of the conveyance to a potential adversary.

When it is determined by the safety and security competent authorities that safety hazard communication through the use of markings, labelling or placarding should not be used by consignors and/or carriers, compensatory safety measures need to be issued to the operators by the safety competent authority to enable shipments to take place. Table 20 contains example questions to assist

TABLE 19. EXAMPLE QUESTIONS: WRITTEN INSTRUCTIONS AND DOCUMENTATION

Issue	Safety	Security	Interface
Q17.1: Has the operator verified that all written instructions are consistent with relevant safety regulations and security recommendations?			
Q17.2: How do the consignor and carrier provide to conveyance operators appropriate operational instructions and written procedures on how to respond to an incident or emergency?			

stakeholders in addressing issues with marking and labelling of packages, and placarding of vehicles and freight containers.

I.19. IDENTIFICATION OF CONSIGNEES AND AUTHORIZATION REQUIREMENTS

There are no apparent interface issues with the transport safety–security interface relative to the identification and authorization of consignees. Establishing identification and authorization requirements for consignees for security purposes can enhance safety during transport.

For shipments requiring prudent management security practices, the consignor needs to know the consignee as would be the case for shipments of any valuable commodities. For shipments requiring basic transport security level measures, consignors need to ensure that consignees are properly identified, authorized and prepared to receive the consignments.

TABLE 20. EXAMPLE QUESTIONS: MARKING AND LABELLING OF PACKAGES, AND PLACARDING OF VEHICLES AND FREIGHT CONTAINERS

Issue	Safety	Security	Interface
Q18.1: If labels or placards have been removed for security purposes, what compensatory measure have been implemented?			
Q18.2: Do the additional security measures and the safety compensatory measures implemented comply fully with the measures issued by the security and safety competent authority respectively?			
Q18.3: Has removal of labels or placards and implementation of compensatory measures been approved by relevant competent authorities?			
Q18.4: For international shipments, are arrangements in place to re-attach the marking, labelling and placarding before packages are loaded onto aircraft, sea vessel, road vehicle or rail conveyance before entering another State?			

In the event that any identification provisions imposed for security compromise safety requirements, the operator will need to resolve those issues with relevant competent authorities prior to undertaking a shipment. Table 21 contains an example question to assist stakeholders in addressing issues with identification of consignees and authorization requirements.

I.20. SURVEILLANCE

The development and application of commercially available surveillance and alarm systems in road vehicles are becoming increasingly common. Although the use of surveillance and alarms for normal commercial shipments of radioactive material is not typically required by safety regulations or security recommendations, consignors might consider their use if they are available on the road vehicles offered by carriers.

Specifically, chapter 8.4, para. S21 of the European Agreement Concerning the International Carriage of Dangerous Goods by Road [18] requires that most packages in transport shall be subject at all times to supervision to prevent any malicious act and to alert the driver and competent authorities in the event of loss or fire unless the packages are carried in a locked compartment or are carried otherwise to protect against illicit unloading. Table 22 contains an example question to assist stakeholders in addressing issues with surveillance.

TABLE 21. EXAMPLE QUESTION: IDENTIFICATION OF CONSIGNEES AND AUTHORIZATION REQUIREMENTS

Issue	Safety	Security	Interface
Q19.1: How has the consignor identified the consignee for this shipment, and how has the consignor communicated to the carrier at what times the facility is able to receive the consignment?			

TABLE 22. EXAMPLE QUESTION: SURVEILLANCE

Issue	Safety	Security	Interface
Q20.1: If the consignor identifies road carriers having surveillance or alarms, has consideration been given to including the use of these in its transport planning and protocols?			

Appendix II

GUIDE TO CLASSIFYING PACKAGES OF RADIOACTIVE MATERIAL FOR DETERMINING THE APPROPRIATE UN NUMBER AND SECURITY REQUIREMENTS

This publication addresses radioactive material, per package, in quantities below $3000A_2$ for most radionuclides or, for a specified limited number of radionuclides, with activities below individually specified 10D values, which may include fissile nuclides (i.e. nuclear material).

If the contents of these packages of radioactive materials also consist of any nuclear material, then this publication only applies to the security of transport of such packages that are categorized below category III as defined in Ref. [5], where the radioactive nature of the material most likely will control the required level of security (for more information, see Ref. [4]).

SSR-6 (Rev. 1) [1] specifies, for transport safety, a comprehensive list of UN numbers of radioactive materials that comply with the requirements for excepted packages, LSA materials and SCOs.

II.1. FLOW DIAGRAM FOR SELECTING PROPER UN NUMBER FOR A GIVEN CONSIGNMENT

Figure 2 contains a flow diagram adapted from IAEA Safety Standards Series No. SSG-33, Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition) [19]. In the figure, four consignments having one of four UN numbers are circled in blue. These are the only ones that always require only prudent management practice security.

II.2. TABLES OF UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS, AND APPLICABLE IAEA PUBLICATIONS

All UN numbers relevant to radioactive material are listed in Tables 23–26. These tables, coupled with the flow diagram in Figure 2 can be used to define the UN number that is applicable to a given package of radioactive material and the level of security required and which IAEA Nuclear Security Series publications provide recommendations on security measures needed.

Tables 23–26 correlate each UN number with the necessary security level or levels. The tables include both those UN numbers for consignments that are

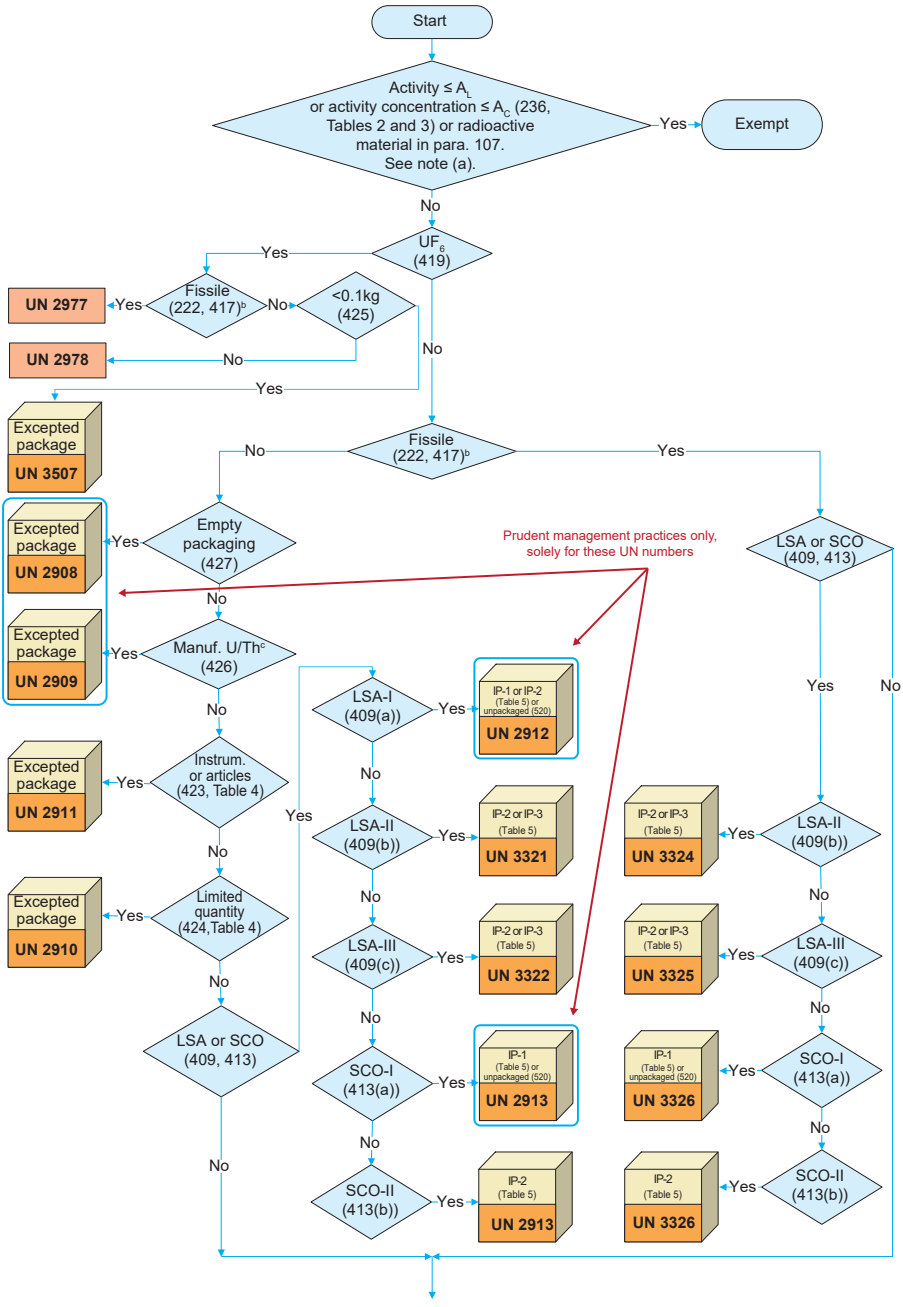
within the scope of this publication and also those which may be beyond the scope of this publication.

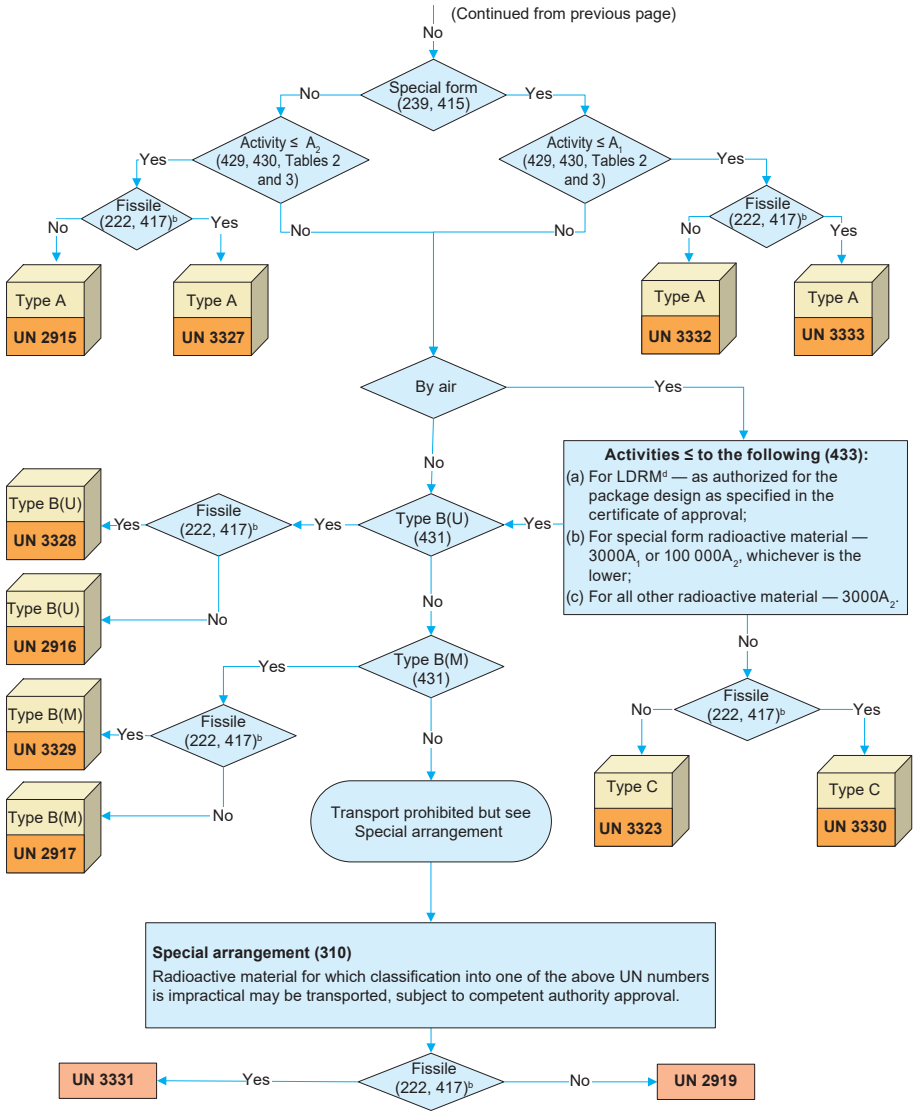
Specifically, the four tables address:

- Consignments, as shown in Table 23, with UN numbers for excepted packages where, since the contents are such that they generally pose a very low potential for radiological consequences from the security perspective and only require prudent management practices, their consideration has been excluded from this publication. The three exceptions in this table are:
  (a) UN 2910 with contents greater than $10^{-3}A_2$;
  (b) UN 2911 with contents greater than A_2;
  (c) UN 2911 with contents greater than 10D.
- Consignments, as shown in Table 24, containing LSA-II and LSA-III material and SCO-II and SCO-III objects where, depending upon the activity and/or material they contain, they may require either just prudent management practices; or prudent management practices and basic security level; or prudent management practices, basic security level and enhanced security level for proper protection from those with malicious intent. For example, they could contain radionuclide(s) with values above 10D.
- Consignments, as shown in Table 25, with UN numbers for Type A and Type B packages where, depending upon the activity or material of contents they may require either prudent management practice and basic security level (i.e. within the scope of this publication); or prudent management practice, basic security level and enhanced security level (i.e. beyond the scope of the publication).
- Finally, as shown in Table 26, consignments with UN numbers for Type C packages (i.e. beyond the scope of this publication), UN numbers for special arrangement shipments (some of which may be within the scope of this publication), and UN numbers for uranium hexafluoride in other than excepted packages (where they will be beyond the scope of this publication due to the toxic nature of the material).

The last two columns of the tables show where recommendations and/or guidance can be found in three of the relevant Nuclear Security Series publications (i.e. Refs [3, 4] for radioactive materials, and Ref. [6] for nuclear material). Reference [6] is included since it provides guidance on how to deal with security for nuclear materials at Category III and below (e.g. see figure 1 of Ref. [6]).

As was noted in Appendix I, a consignor also needs to determine whether the contents of the shipment pose other dangers. If so, the consignor will need to determine what additional security measures if any will need to be applied to adequately address those subsidiary hazards. In particular, a consignor of


Start
Activity ≤ A_L or activity concentration ≤ A_C (236, Tables 2 and 3) or radioactive material in para. 107. See note (a).
Yes
Exempt
No
UF_6 (419)
Yes
Fissile (222, 417)[b]
UN 2977
Yes
No
<0.1kg (425)
No
UN 2978
No
Yes
Excepted package UN 3507
No
Fissile (222, 417)[b]
Yes
Prudent management practices only, solely for these UN numbers
Excepted package UN 2908
Yes
Empty packaging (427)
No
Excepted package UN 2909
Yes
Manuf. U/Th[c] (426)
No
Excepted package UN 2911
Yes
Instrum. or articles (423, Table 4)
No
Excepted package UN 2910
Yes
Limited quantity (424,Table 4)
No
LSA or SCO (409, 413)
No
LSA-I (409(a))
Yes
IP-1 or IP-2 (Table 5) or unpackaged (520) UN 2912
No
LSA-II (409(b))
Yes
IP-2 or IP-3 (Table 5) UN 3321
No
LSA-III (409(c))
Yes
IP-2 or IP-3 (Table 5) UN 3322
No
SCO-I (413(a))
Yes
IP-1 (Table 5) or unpackaged (520) UN 2913
No
SCO-II (413(b))
Yes
IP-2 (Table 5) UN 2913
LSA or SCO (409, 413)
Yes
No
LSA-II (409(b))
Yes
IP-2 or IP-3 (Table 5) UN 3324
No
LSA-III (409(c))
Yes
IP-2 or IP-3 (Table 5) UN 3325
No
SCO-I (413(a))
Yes
IP-1 (Table 5) or unpackaged (520) UN 3326
No
SCO-II (413(b))
Yes
IP-2 (Table 5) UN 3326



[a] A_L — activity limit for an exempt consignment; A_C — activity concentration limit for exempt material; paragraph and table numbers refer to SSR-6 (Rev. 1) [1].

[b] Fissile excepted by para. 417(a)–(f) should be treated as 'No'.

[c] Articles manufactured from natural uranium, depleted uranium or natural thorium.

[d] Low dispersible radioactive material.

FIG. 2. Flow diagram for selecting proper UN number for a given consignment [19].

uranium hexafluoride (UN 2977, UN 2978 and UN 3507) needs to pay special attention to security requirements since these shipments are designated as high consequence dangerous goods shipments irrespective of the quantity of uranium hexafluoride in a package.

II.3. CLASSIFICATION OF NORMAL COMMERCIAL SHIPMENTS OF RADIOACTIVE MATERIAL — TWO EXAMPLES

A consignor needs to determine which UN number applies to its shipment, and that in turn can facilitate determining which security levels are required for that shipment, and in preparing the transport documents required for safety (see paras 545–561 of SSR-6 (Rev. 1) [1]).

Information required for this process includes the following:

(a) The name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides;
(b) Chemical form of the material;
(c) Maximum activity;
(d) UN number;
(e) Proper shipping name;
(f) Subsidiary hazard.

Two examples demonstrating how these parameters are used to classify a consignment considering both safety and security issues are shown in Figs 3 and 4. These examples use the flow diagram (Fig. 2).

Based upon the basic information for the material to be shipped (activity, isotopes, physical and chemical properties, type of source, etc.):

— The transport safety classification can be determined by applying Fig. 2 and Tables 23–26;
— The transport security categorization can be defined by following the procedures provided in sections 3 and 5 of Ref. [4].

Scenario and assumptions

A consignment of 200 kg of soil, slightly contaminated with ^{60}Co (100 Bq/g) is to be shipped to a waste treatment facility.

The total activity in the consignment is $200 \times 10^3 \times 100 = 20$ MBq.

Transport safety classification

The consignment is classified as UN 2910 RADIOACTIVE MATERIAL, LIMITED QUANTITY OF MATERIAL.

Transport security categorization

Because the activity of the soil is far below the level of a Category 5 source, the physical and chemical form do not present a subsidiary risk or special attractiveness.

Thus, prudent management practices will provide the appropriate level of protection for the security of this shipment.

FIG. 3. Example — classification of a consignment of contaminated soil.

Scenario and assumptions

A gamma radiography camera containing a special form ^{137}Cs source of 100 GBq is to be shipped to a plant that is under construction.

Transport safety classification

The gamma radiography source is classified as UN 3332 RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non-fissile or fissile-excepted.

Transport security categorization

The radioisotopes and activity of the source correspond with a Category 3 source (as specified in the IAEA's Code of Conduct on the Safety and Security of Radioactive Sources [20]).

For a normal threat level, the application of prudent management practices and the basic transport security level measures may be needed.

However, before the shipment is undertaken, the consignor needs to verify what security measures are needed and that all the permits, licences and authorizations for transport, possession and use are in place.

FIG. 4. Example — classification of a shipment of a gamma radiography camera.

TABLE 23. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR EXCEPTED PACKAGES

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]
Excepted package						
UN 2908	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — EMPTY PACKAGING	X				X
UN 2909	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM	X			X	
UN 2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — LIMITED QUANTITY OF MATERIAL (less than $10^{-3}A_2$)	X				X
UN 2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — LIMITED QUANTITY OF MATERIAL (greater than $10^{-3}A_2$)	X	X			X
UN 2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — INSTRUMENTS or ARTICLES (less than A_2)	X				X
UN 2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — INSTRUMENTS or ARTICLES (special form, more than A_2)	X	X			X

TABLE 23. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR EXCEPTED PACKAGES (cont.)

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]
UN 2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE — INSTRUMENTS or ARTICLES (more than 10D)	X	X	X		X
UN 3507[a]	URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE (less than 0.1 kg per package, non-fissile or fissile-excepted)	X				X

[a] Owing to its high toxicity, uranium hexafluoride is designated as a high consequence dangerous good for the application of chapter 1.4 of the UN Model Regulations irrespective of the quantity of material per package (see para. 2.0.3.1 and special provision 369 of chapter 3.3 of the UN Model Regulations [2]).

TABLE 24. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR LOW SPECIFIC ACTIVITY MATERIAL AND SURFACE CONTAMINATED OBJECTS

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]
Low specific activity (LSA) material						
UN 2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile-excepted	X				X
UN 3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), non-fissile or fissile-excepted	X	X	*[a]		X
UN 3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), non-fissile or fissile-excepted	X	X	*[a]		X
UN 3324	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE	X	X	*[a]	X	
UN 3325	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), FISSILE	X	X	*[a]	X	

TABLE 24. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR LOW SPECIFIC ACTIVITY MATERIAL AND SURFACE CONTAMINATED OBJECTS (cont.)

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]
Surface contaminated objects (SCO)						
UN 2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I, SCO-II or SCO-III), non-fissile or fissile-excepted	X	*[a]	*[a]		X
UN 3326	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I, SCO-II or SCO-III), FISSILE	X	*[a]	*[a]	X	X

[a] *: may or may not be required. For UN 3321, UN 3322, UN 3324, UN 3325, UN 2913 and UN 3326, the level(s) of security required depend upon the specific radionuclides and the total activity in the package containing that specific LSA material or SCO.

TABLE 25. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR TYPE A AND TYPE B PACKAGES

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]
Type A package						
UN 2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non-fissile or fissile-excepted	X	X	*[a]		X
UN 3327	RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE, non-special form	X	X	*[a]	X	
UN 3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non-fissile or fissile-excepted	X	X	*[a]		X
UN 3333	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE	X	X	*[a]	X	
Type B(U) package						
UN 2916	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, non-fissile or fissile-excepted	X	X	*[a]		X
UN 3328	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE	X	X	*[a]	X	

TABLE 25. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR TYPE A AND TYPE B PACKAGES (cont.)

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]
Type B(M) package						
UN 2917	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, non-fissile or fissile-excepted	X	X	*[a]		X
UN 3329	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, FISSILE	X	X	*[a]	X	

[a] *: may or may not be required. For UN 2915, UN 3327, UN 3332, UN 3333, UN 2916, UN 3328, UN 2917 and UN 3329, the enhanced security level should be applied when the content of the consignment is greater than 10D.

TABLE 26. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR TYPE C PACKAGES AND SPECIAL ARRANGEMENT; AND FOR URANIUM HEXAFLUORIDE IN OTHER THAN EXCEPTED PACKAGES

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]	Ref [2]
Type C package							
UN 3323	RADIOACTIVE MATERIAL, TYPE C PACKAGE, non-fissile or fissile-excepted	X	X	X		X	
UN 3330	RADIOACTIVE MATERIAL, TYPE C PACKAGE, FISSILE	X	X	X	X		
Special arrangement							
UN 2919	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, non-fissile or fissile-excepted	X	X	X		X	
UN 3331	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE	X	X	X	X		
Uranium hexafluoride							
UN 2977[a]	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE	X	X	X			X

TABLE 26. UN NUMBERS, RECOMMENDED TRANSPORT SECURITY LEVELS AND APPLICABLE IAEA SECURITY PUBLICATIONS FOR TYPE C PACKAGES AND SPECIAL ARRANGEMENT; AND FOR URANIUM HEXAFLUORIDE IN OTHER THAN EXCEPTED PACKAGES (cont.)

		Prudent management	Basic security	Enhanced security	Ref. [6]	Refs [3, 4]	Ref [2]
UN 2978[a]	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted	X	X	X			X

[a] Due to its high toxicity, uranium hexafluoride is designated as a high consequence dangerous good for the application of chapter 1.4 of the UN Model Regulations [2] irrespective of the quantity of material per package.

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DEFINITIONS

Unless otherwise noted, definitions are from IAEA Safety Standards Series No. SSR-6 (Rev. 1).[1]

carrier. Any person, organization or government undertaking the carriage of nuclear or other radioactive material by any means of transport. The term includes both carriers for hire or reward (known as common or contract carriers in some countries) and carriers on own account (known as private carriers in some countries).

competent authority. For safety, a competent authority is any body or authority designated or otherwise recognized as such for any purpose in connection with the Transport Regulations. For security, a competent authority is a governmental organization or institution that has been designated by a State to carry out one or more nuclear security functions. For example, competent authorities include regulatory bodies, law enforcement, customs and border control, intelligence and security agencies, and health agencies.[2]

consignee. Any person, organization or government that is entitled to take delivery of a consignment. Note: consignee is also known as receiver in security publications.

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

consignor. Any person, organization or government that prepares a consignment for transport. Note: consignor is also known as shipper in security publications.

conveyance.

(a) For transport by road or rail: any vehicle;

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[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, 2018 Edition, IAEA Safety Standards Series No. SSR-6 (Rev. 1), IAEA, Vienna (2018).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA, Vienna (2011).

(b) For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel;
(c) For transport by air: any aircraft.

graded approach. For nuclear security, a graded approach refers to the application of nuclear security measures proportional to the potential consequences of a malicious act.[2] For safety, a graded approach for a system of control, such as a regulatory system or a safety system, is a process or method in which the stringency of the control measures and conditions to be applied is commensurate, to the extent practicable, with the likelihood and possible consequences of, and the level of risk associated with, a loss of control.[3]

insider. An individual with authorized access to associated facilities or associated activities or to sensitive information or sensitive information assets, who could commit or facilitate the commission of criminal or intentional unauthorized acts involving or directed at nuclear material, other radioactive material, associated facilities or associated activities or other acts determined by the State to have an adverse impact on nuclear security.[4] Note: in the context of this publication, 'associated activities' means the transport of nuclear or other radioactive material.

malicious act. An act or attempt of unauthorized removal of radioactive material or sabotage.[5]

management system. A set of interrelated or interacting elements for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner.

normal commercial shipment. For the purposes of this publication, normal commercial shipments of radioactive material are those shipments that consist of one or more packages of radioactive material where the contents of the individual packages do not exceed (a) an activity of 10D for those

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[3] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection, 2018 Edition, IAEA, Vienna (2019).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Self-assessment of Nuclear Security Culture in Facilities and Activities, IAEA Nuclear Security Series No. 28-T, IAEA, Vienna (2017).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA, Vienna (2011).

specific radioactive sources specified in IAEA Nuclear Security Series No. 9-G (Rev. 1)[6], and (b) an activity of $3000A_2$ for all other radioactive material. Note: This terminology is unique to this publication. It was developed based upon the threshold values established in IAEA Nuclear Security Series No. 9-G (Rev. 1) for transitioning from basic security measures to enhanced security measures. Furthermore, although the UN Model Regulations[7] exclude UN 2908, UN 2909, UN 2910 and UN 2911 with an activity level not exceeding A_2, and LSA-I and SCO-I from security provisions, these are all considered in this publication as being normal commercial shipments for which prudent management practices may need to be viewed as applicable security measures.

operator. Any organization or person applying for authorization or authorized and/or responsible for nuclear, radiation, radioactive waste or transport safety when undertaking activities or in relation to any nuclear facilities or sources of ionizing radiation. This includes, inter alia, private individuals, governmental bodies, consignors or carriers, licensees, hospitals, self-employed persons.[8]

prudent management practices. The actions normally undertaken by consignors, carriers and consignees for packages requiring no further security measures other than basic control measures and normal commercial practices. These practices include actions by shippers, carriers and receivers to protect the material against unauthorized removal or sabotage, as would be the case for any valuable commodity. Prudent management practices apply regardless of the radioactive material.[9] Note: This definition is unique to this publication.

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[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Security of Radioactive Material in Transport, IAEA Nuclear Security Series No. 9-G (Rev. 1), IAEA, Vienna (2020).

[7] UNITED NATIONS, Recommendations on the Transport of Dangerous Goods: Model Regulations, ST/SG/AC.10/1/Rev.21, Twenty-first Revised Edition, UN, New York (2019).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection, 2018 Edition, IAEA, Vienna (2019).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Security of Radioactive Material in Transport, IAEA Nuclear Security Series No. 9-G (Rev. 1), IAEA, Vienna (2020).

retention. The use of dunnage, braces, blocks or tie-downs, as appropriate, to restrain the package and prevent movement within or on a conveyance during routine transport.[10]

sabotage. Any deliberate act directed against an associated facility or an associated activity that could directly or indirectly endanger the health and safety of personnel, the public or the environment by exposure to radiation or release of radioactive substances.[11] Note: radioactive substance and radioactive material have the same meaning. Also, in the context of this publication, 'associated activity' means the transport of nuclear or other radioactive material.

shipment. The specific movement of a consignment from origin to destination.

shipper. Any person, organization or government that prepares or offers a consignment of nuclear or other radioactive material for transport (i.e. the consignor).[11]

stowage. The locating within or on a conveyance of a package containing radioactive material relative to other cargo (both radioactive and non-radioactive).[12]

threat. A person or group of persons with motivation, intention and capability to commit a malicious act.[13]

threat assessment. An evaluation of the threats — based on available intelligence, law enforcement and open source information — that describes the motivations, intentions and capabilities of these threats.[13]

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[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition), IAEA Safety Standards Series No. SSG-26, IAEA, Vienna (2014).

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA, Vienna (2011).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition), IAEA Safety Standards Series No. SSG-26, IAEA, Vienna (2014).

[13] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA, Vienna (2011).

transport. The deliberate physical movement of radioactive material (other than that forming part of the means of propulsion) from one place to another.[14]

transport security system. Any integrated set of nuclear security measures.[15] Note: for transport security, this may be interpreted to mean any integrated set of nuclear security measures that are used for the transport of nuclear or other radioactive materials.

[14] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection, 2018 Edition, IAEA, Vienna (2019).

[15] INTERNATIONAL ATOMIC ENERGY AGENCY, Objective and Essential Elements of a State's Nuclear Security Regime, IAEA Nuclear Security Series No. 20, IAEA, Vienna (2013).

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Vienna, Austria: 17–21 October 2016, 29 May–2 June 2017,
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No. 26

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Nuclear safety and nuclear security share the aim of protecting people, property and the environment from harmful effects of ionizing radiation. However, the activities that address nuclear safety and nuclear security are different, and sometimes actions taken to strengthen safety affect security, either positively or negatively, or vice versa. It is therefore essential to establish a well coordinated approach to managing the interface between safety and security of radioactive material in transport.

This publication aims to provide technical guidelines and practical information based on international good practices to assist Member States, competent authorities and operators to facilitate management of the interface between nuclear safety and nuclear security during 'normal commercial shipments' of radioactive material.

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