Safety of Transport of Radioactive Material

Proceedings of an international conference Vienna, 7–11 July 2003

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SAFETY OF TRANSPORT
OF RADIOACTIVE MATERIAL

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INTERNATIONAL MARITIME ORGANIZATION
AND UNIVERSAL POSTAL UNION,
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FOREWORD

Radioactive material is used throughout the world for many applications that benefit humankind, encompassing agriculture, industry, medicine, electric power generation and research. In almost all cases, the materials are generated in locations other than those where used, and the resulting radioactive wastes are usually moved to other locations. The transportation of the radioactive material places it outside of controlled facilities, in the public domain, and often entails movement between countries.

As the peaceful uses of radioactive material grew, the international community recognized early on that rigid and uniform standards were needed to ensure the safety of handlers, the public and the environment. The International Atomic Energy Agency was assigned the task, within its statutory mandate, of developing, maintaining and providing the application of safety standards for the transport of radioactive material. These standards were first issued almost 50 years ago, and have since been updated periodically to account for the changing environment in which the material is transported, changes in the types of material transported, and in the modes by which they are transported (road, rail, inland waterway, sea and air).

Many millions of packages of radioactive material are shipped every year. As a result of the development of the transport safety standards by the IAEA and their application at the international level by other involved United Nations bodies, at the national level by IAEA Member States, and by consignors, carriers and consignees, an enviable record of safety in the transport of radioactive material has resulted. However, the IAEA and its Member States recognized that efforts to ensure safety must continue. To this end, the standards for transport safety are reviewed continually and revised as need is determined by international experts; supportive guidance material is provided, a comprehensive training programme is available from the IAEA to Member States, and research is encouraged as needs dictate.

Despite the excellent safety record and efforts to ensure its continuance, the IAEA's General Conference — in Resolution GC(45)/RES/10 — noted and welcomed the convening by the Secretariat of a Conference on the Safety of Transport of Radioactive Material in 2003. To accomplish this task, the IAEA arranged for the Government of Austria to host the conference at its Austria Center Vienna facilities, and welcomed co-sponsorship by the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO) and the Universal Postal Union (UPU). In addition, the International Air Transport Association (IATA) and the International Organization for Standardization (ISO) cooperated in convening the conference.

Although many conferences and symposia have been convened in the past on the topic of the packaging and transport of radioactive material, this one was unique in that it involved detailed planning by a large body of experts who served as the Technical Programme Committee, and focused on technical and non-technical sessions summarizing invited and contributed papers with a view to maximizing participant opportunities for discussing key issues from the floor with key experts at the head table.

The conference consisted of an opening session, a background session, an explanatory topical session on liability, a round table on communication with the public and between governments, seven technical sessions, two panel discussions and a closing session. With the exception of contributed papers on liability, the opportunity was given to each author of a contributed paper to present that paper in a poster session the day before the session on their topic. For contributed papers on liability, authors were given the opportunity to briefly summarize their positions during the session itself, which occurred on the afternoon of the opening day. In some cases, to provide technical balance within a session, authors of contributed papers were invited to present their results, whereas experts were invited to summarize — on behalf of the authors — many of the contributed papers.

These proceedings contain the conference summary and findings, the opening speeches, invited papers and summaries of the discussions. The contributed papers and presentations, as well as the complete text of the printed volume, are provided on a CD-ROM that accompanies this volume.

The IAEA gratefully acknowledges the support and extensive efforts of all who contributed to the success of the conference.

EDITORIAL NOTE

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CLOSING SESSION

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The International Conference on the Safety of Transport of Radioactive Material took place in Vienna, Austria, from 7 to 11 July 2003, and was hosted by the Government of Austria. It was co-sponsored by the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO) and the Universal Postal Union (UPU). The International Air Transport Association (IATA) and the International Organization for Standardization (ISO) cooperated in the organization.

The officers of the conference were as follows:

President: M.W. Hughes, Ambassador, Permanent Mission of Australia to the IAEA.

Chairperson of the Technical Programme Committee: P.J. Colgan, Australian Radiation Protection Nuclear Safety Agency, Australia.

Co-Chairperson of the Technical Programme Committee: A.N. Nandakumar, Radiological Safety Division, Atomic Energy Regulatory Board, India.

Rapporteur of the Technical Programme Committee: J. Lopez Vietri, Autoridad Regulatoria Nuclear, Radiological and Nuclear Safety, Argentina.

Members of the Technical Programme Committee: H.R. Paláez, Permanent Mission of Argentina to the IAEA, Argentina; N.C. Bruno, National Nuclear Energy Commission, Brazil; C. Moura, Permanent Mission of Brazil to the IAEA, Brazil; N. Todorov, Committee on the Use of Atomic Energy for Peaceful Purposes, Bulgaria; G.M. González Bulo, Permanent Mission of Chile to the IAEA, Chile; G. Torres Oviedo, Permanent Mission of Chile to the IAEA, Chile; C. Arevalo Yépes, Permanent Mission of Colombia to the IAEA, Colombia; J. Gauvain, Direction Génerale de la Sûreté Nucléaire et de la Radioprotection, France; E. Mignot, Ministère des Affaires Etrangères, France; J.-C.M. Mourlon, Permanent Mission of France to the IAEA, France; S. Hamada, Ministry of Economy, Trade and Industry, Japan; M. Kato, Foreign Policy Bureau, Ministry of Foreign Affairs, Japan; M. Nawano, Overseas Reprocessing Committee, Japan; B. Okamura, The Federation of Electric Power Companies, Japan; H. Tani, The Federation of Electric Power Companies, Japan; N.S. Carmine, Permanent Mission of New Zealand to the IAEA, New Zealand; C. Azurín Araujo, Permanent Mission of Peru to the IAEA, Peru; S. Regaldo-Campana, Instituto Peruano de Energía Nuclear, Peru; G. Vieru, Institute for Nuclear Research, Romania; V.N. Ershov, Ministry of Atomic Energy of the Russian Federation, Russian Federation; I. Koca, Permanent Mission of Turkey to the IAEA, Turkey; T.J. Andrews, Permanent Mission of the United Kingdom to the IAEA, UK; M. Oman, Department of Trade and Industry, UK; C.N. Young, Department for Transport, UK; J.L. Blaha, Permanent

Mission of USA to the IAEA, USA; D.W. Pstrak, US Nuclear Regulatory Commission, USA; T.I. Dixon, World Nuclear Transport Institute; P. Malesys, International Organization for Standardization; X. Bernard-Bruls, International Atomic Energy Agency; M.T.M. Brittinger, International Atomic Energy Agency; R.B. Pope, International Atomic Energy Agency; H. Schmid, International Atomic Energy Agency.

Session Chairpersons: O. Kervella, United Nations Economic Commission for Europe (UNECE); R. Elk, National Nuclear Regulator, South Africa; A. MacLachlan, Nuclionics Week, France; J. Joly, Institut de Radioprotection et de Sûreté Nucléaire, France; C. Pecover, Department for Transport, UK; T. Saegusa, Central Research Institute of Electric Power Industry, Japan; R. Boyle, US Department of Transportation, USA; R.W. Clark, Transport Canada, Canada; N.C. Bruno, National Nuclear Energy Commission, Brazil; J.T. Duffy, Radiological Protection Institute of Ireland, Ireland; F. Nitsche, Federal Office for Radiation Protection, Germany; J. Turnbull, National Radiation Laboratory, New Zealand.

Co-Chairpersons: F. Abdel-Rahman, Egypt; S. McIntosh, Australia; A. Hart, Peru; P. Bubar, USA.

Rapporteurs: S.M. Magnusson, The Icelandic Radiation Protection Institute, Iceland; M. Kubo, Japan Nuclear Cycle Development Institute, Japan; B.G. Dekker, World Nuclear Transport Institute, Netherlands; S.P. Agarwal, Atomic Energy Regulatory Board, India; H. Basaez Pizarro, Chilean Nuclear Energy Commission, Chile; J. Aguilar, Direction Génerale de la Sûreté Nucléaire et de la Radioprotection, France; B. Droste, Bundesanstalt für Materialforschung und -prüfung (BAM), Germany; M. Miller, British Nuclear Fuel Ltd. International Transport, UK.

The topics covered in the conference were:

Opening Session

— Welcoming addresses
— Addresses by co-sponsoring organizations

Background Session

— Addresses by cooperating organizations
— Addresses by invited speakers on radioactive material transport safety history and issues

Explanatory Topical Session

— Liability

Round Table

— Communications with the public and between governments

Technical Sessions

— Effectiveness of radiation protection in transport;
— Compliance and quality assurance
— Packaging and transport of radioactive materials (fuel cycle and non-fuel cycle)
— Packaging and transport of non-standard radioactive materials
— Effectiveness of the regulatory process
— Adequacy of safety requirements
— Emergency preparedness and response

Panel Sessions

— Assessment of regulatory criteria
— Identifying areas for potential improvement of the regulatory regime.

These proceedings follow the above outline of topics covered, and include the invited papers that were presented and a summary record of the discussions that ensued in each session. The contributed papers are provided on a CD-ROM attached to the inside of the back cover of this publication.

SUMMARY AND FINDINGS OF THE CONFERENCE PRESIDENT[1]

A. INTRODUCTION AND SUMMARY OF THE NON-TECHNICAL SESSIONS

1. INTRODUCTION

The International Conference on the Safety of Transport of Radioactive Material took place in Vienna, Austria, from 7 to 11 July 2003. There were 534 nominated participants from 82 States, 9 intergovernmental organizations (IGOs), 5 non-governmental organizations (NGOs), and 132 contributed and invited papers. The conference was organized by the International Atomic Energy Agency (IAEA) and was co-sponsored by the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO) and the Universal Postal Union (UPU); it was convened in co-operation with the International Air Transport Association (IATA) and the International Organization for Standardization (ISO).

The objective of the conference was to foster information exchange by providing an opportunity for representatives of IAEA Member States and international organizations to discuss critical issues relating to the safety of transport of radioactive material by all transport modes and to formulate findings, as appropriate, based on the papers contributed and the discussions held.

2. SUMMARY OF BACKGROUND SESSION

Radioactive material has been transported for decades within and between countries as its use to benefit humankind has expanded. Many types of material for many different applications are transported by all the major modes of transport.

Among the organizations in the United Nations system, the IAEA has the statutory function to establish or adopt standards of safety for the protection of health from the effects of ionizing radiation. This includes

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[1] The views and recommendations expressed in this summary are those of the President of the Conference and the participants, and do not represent those of the IAEA.

standards of safety for the transport of radioactive material. Since the first edition was published in 1961, the IAEA's Regulations for the Safe Transport of Radioactive Material (IAEA Transport Regulations) have served as the basis for safety in the transport of radioactive material worldwide. Provisions compatible with (often identical to) the IAEA Transport Regulations have been incorporated into national requirements by most of the IAEA Member States. In addition, the IAEA Transport Regulations serve as the basis for the United Nations' "model regulations" on the Transport of Dangerous Goods. These in turn serve as the basis for the international modal regulatory documents issued by ICAO for transport by air, the IMO for transport by sea, the United Nations Economic Commission for Europe for transport by road, rail, and inland waterway in Europe, and the UPU for transport by post. The Member States of these "modal organizations" are, therefore, generally bound to regulate in accordance with the requirements of the IAEA Transport Regulations. IATA publishes its Dangerous Goods Regulations, providing airlines with an easy-to-use manual based upon the ICAO Technical Instructions; and the ISO publishes standards for use by industry and regulators in supporting effective and consistent application of safe transport practices.

The application of the regulatory requirements in a safety-conscious work environment by the transport industry — consignors, carriers and consignees — has resulted in an outstanding safety record for the transport of radioactive material. In fact, over several decades of transport, there has never been an in-transit accident with serious human health, economic or environmental consequences attributable to the radioactive nature of the goods. Despite this safety record, it is incumbent upon regulators and industry to continue to be vigilant about transport safety and to continually reassess practices in the light of changes in technology and advances in assessment techniques.

Although the terrorist attacks of 11 September 2001 have led to increased attention being paid to the security of all nuclear activities, including transport, international concern about the security of radioactive material in transport is not new. Prior to 11 September 2001, a robust international strategy of protection existed for the transport of certain types of radioactive material. As for all industrial activities, however, there is a need to reassess the adequacy of previous approaches in the light of changing threat levels. Although the high level of interest in security matters was recognized, it was noted that many of the security issues are broader than transport safety issues and are in a state of evolution.

3. SUMMARY OF EXPLANATORY TOPICAL SESSION ON LIABILITY

There remain considerable uncertainty and debate related to the implementation of a comprehensive regime to deal with the legal liability resulting from an accident during the transport of radioactive material. A number of liability-related conventions exist, to which many States are party but many others are not. More than half of the world's operating nuclear power reactors are located in States that are not party to any nuclear liability convention. This lack of broad adherence to a global liability regime creates uncertainty as to the legal consequences of a transport accident. There was agreement that the current situation regarding liability for an accident with radiological consequences during transport is not satisfactory to either shipping States or coastal States, and that a widely adhered-to comprehensive modern nuclear liability regime is desirable. In that regard, adherence by major nuclear power generating States should encourage other States to join the regime.

Participants noted that, in order to provide the basis for such a comprehensive nuclear liability regime, the international community negotiated — under the auspices of the IAEA — revisions to the Vienna Convention and a new Convention on Supplementary Compensation for Nuclear Damage (CSC). The revisions to the Vienna Convention and the CSC specifically included provisions to attract broader adherence by coastal States. The revisions to the Vienna Convention and the CSC were adopted at a diplomatic conference in 1997 and are now open for ratification by all States; however, neither has yet entered into force. The 2002 General Conference stressed the importance of wide adherence to the international nuclear liability regime. Separately, there has recently been agreement on similar modernization of the Paris Convention.

The provisions of the liability conventions, and the relationships between them, are not simple to understand. In that regard, the president concluded that the preparation of an explanatory text for these instruments would assist in developing a common understanding of what are complex legal issues, and thereby promote adherence to these instruments. The IAEA Secretariat should prepare such an explanatory text, with the assistance of an independent group of legal experts appointed by the Director General. Extra-budgetary contributions towards funding for that group would be welcome.

4. SUMMARY OF ROUND TABLE SESSION ON COMMUNICATION WITH THE PUBLIC AND BETWEEN GOVERNMENTS

Although radioactive material is in common use, its transport receives much more attention than that of other dangerous goods. Increased public and media interest has prompted new initiatives or reconsideration of existing communications policies. The conference noted examples of successful communications policies in some States.

The communication objectives and messages for a regulator may necessarily be quite different from those for industry. A general principle of good regulation, which applies equally to transport, is transparency (or openness) — at least to the extent permitted by security considerations — such that safety decisions can be accessed and understood by both the regulated industry and the public when necessary. The conference welcomed the proposal to extend the INES nuclear incident reporting scale to transport incidents, in the interests of transparency and communication with the public.

Because of the international nature of the transport of radioactive material, effective and efficient communication between governments is essential. Important topics of communication include the current status of introduction of IAEA requirements into national requirements, and safety information on transport and incidents or accidents. In that regard, the TranSAS missions to a number of States had enhanced transparency and confidence regarding those States' regulations and practices in the transport of radioactive material.

The conference discussed freedom of the sea and the right of free passage of ships; although some believed that ships bearing radioactive material merited special status, most participants recognized that ships bearing radioactive material could be treated in a manner similar to those bearing other dangerous goods. The conference noted that while the Agency has specific competence in respect of the transport of radioactive material, rights of passage for ships and ship operations fall outside its competence.

In relation to the general issue of communication between States on safety issues related to transport, the president concluded that there was scope for additional efforts to communicate the complex technical issues involved. He considered that it would be useful if the IAEA were to hold a seminar to discuss the latest information on these issues and extend invitations to relevant experts and to concerned States.

There was agreement that the provision by shipping States of appropriate and timely information to en route States is desirable, as long as the provision of such information does not jeopardize security and recognizes rights of free navigation. Extensive discussions were held during the conference on ways of enhancing the present practice of some States of providing information on a voluntary basis. Considering the contents of Operative Paragraph 12 of Part B of Resolution GC(46)/RES/9, the president recommended that informal discussions should continue among concerned States on this subject after this conference, with IAEA involvement.

B. FINDINGS[2] FROM THE TECHNICAL SESSIONS AND PANEL DISCUSSIONS

1. FINDINGS OF RELATED PROGRAMMATIC SESSIONS (TECHNICAL SESSIONS 1, 2 AND 7)

1.1. Radiation protection programmes

The conference found that, in general, the individual and collective doses both to workers and to members of the public from the transport of radioactive material are very low, but there are some exceptions.

A number of papers reported doses to workers involved in the transport of particular types of radioactive material by road to be 10 mSv or more in a year. Such material is in small packages and is for medical or industrial use. The explicit introduction of radiation protection programmes was in general seen as a very positive element in the optimization of protection of transport workers.

In some cases where doses are small due to limited handling of packages, especially in the nuclear fuel cycle, questions were raised about the value of routine individual monitoring. In such cases, the need for individual monitoring should take account of the possibility of unforeseen doses (from sources other than the packages being handled, or from accidents).

However, the International Basic Safety Standards require only assessments of doses to workers working in supervised areas on the basis of monitoring the workplace or the individuals.

The conference encouraged broader application of the requirement for radiation protection programmes to be established based on prior risk assessment, and the appropriate collection, analysis, and dissemination of radiation exposure data. Such radiation protection programmes, which should lead to improvement of the protection of the public and workers, involve the

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[2] The findings of the conference are specifically identified with italicized text.

provision of appropriate information and training to all concerned and the establishment of arrangements for emergency preparedness and response.

1.2. Compliance assurance and quality assurance programmes

The public and other involved parties are, quite rightly, concerned to know that stringent applicable regulations — those of the IAEA and others — are being effectively and consistently applied. *The conference found that robust compliance assurance and quality assurance programmes are essential foundation stones in building trust and confidence in the safety and effective regulation of the transport of radioactive material.*

The IAEA Transport Regulations recognize that safe international commerce in radioactive material depends on a high level of trust among States, especially regarding the adequacy of packaging, event response and compliance with import/export laws. The IAEA publications Safety Series Nos 112 and 113 are valuable to the radioactive material transport industry and to the relevant authorities. Their review, updating and publication should be completed as soon as possible. The request for a guidance document for competent authority assessors should be considered by the IAEA Secretariat, and suitable material developed if need is confirmed.

The IAEA Transport Safety Appraisal Service (TranSAS) is an important tool for assessing and assuring compliance at the State level. It can provide Member States, upon request, with an appraisal of their activities in comparison to the IAEA Transport Regulations and related safety standards, thus evaluating their compliance assurance programmes. The TranSAS process could benefit from review, taking into account the example of the ICAO Universal Safety Oversight Audit Programme and the experience of the TranSAS missions carried out thus far. The IAEA Secretariat could also consider ways of improving the TranSAS process, so as to be able to carry out more missions.

In the area of quality assurance (QA), the conference recognized the essential contribution of such programmes to the continuing safe and controlled transport of radioactive material.

1.3. Emergency preparedness and response

The conference found that IAEA guidance provides a framework for a comprehensive strategy for anticipating and dealing with transport accidents involving radioactive material.

The IAEA Transport Regulations recognize the need for relevant national and international organizations to establish and implement emergency provisions to prepare for transport accidents involving actual or potential radioactive release. The IAEA guidance recognizes differences between the potential consequences of road, rail, ship and air transport accidents and recommends a “command and control” mode to ensure that coordination, direction and communication strategies are properly employed.

National infrastructure for emergency response must anticipate a range of accident scenarios and ensure that human resources, equipment, medical response, remediation and waste storage are made available and capacity maintained. Training of emergency response personnel is seen as a critical component of the programme and which must be maintained, especially through frequent practical courses and simulation exercises.

A further key element of emergency response planning is to recognize the importance of confidence building, especially within government, with the public, media and all other potentially affected parties. Progressive movement in terms of the sophistication of emergency response capability was discussed, with recognition of need to develop more integrated international emergency response plans, including integration of national resources information sharing, and mutual capability building.

The conference found that additional dialogue is warranted to improve overall international emergency response capability, especially with respect to potential maritime incidents; coordinated management between agencies and governments, accident notification, communication, environmental monitoring and salvage/remediation issues were especially considered.

The conference observed that multiple applicable documents and conventions exist that do not necessarily clarify the roles of States with respect to leadership in the management of an incident in international waters. It was further noted that affected parties may include consignor, carrier, shipping State, State of vessel registry and the nearest State(s) to the location of the incident. The possible involvement of multiple entities was considered to be a source of possible confusion and a hindrance to an effective response initiative.

It was noted that response capability varies considerably across States. If States are to develop an improved local emergency response capability, it may be that access to external assistance will be required. It was further noted that while some States or organizations felt that they could support a global emergency response initiative, this was unacceptable for others. It was concluded by all that further discussion was required among States in order to develop an international response capability that should become part of an integrated global emergency response capability.

It was noted also that issues of prior notification and informal information sharing for planning purposes was useful in managing emergency response plans, especially with respect to communication. Finally, the conference concluded that the IAEA had a vital role to play in facilitating the development of model plans for international emergency responses and to facilitate the development of regional plans that satisfy the concerns and needs of States within regions.

2. FINDINGS OF PACKAGING SESSIONS (TECHNICAL SESSIONS 3 AND 4, AND PANEL 1)

2.1. Broadly effective packaging regulations

The conference found that the current IAEA Transport Regulations provide safe packaging options for the entire spectrum of radioactive material: nuclear fuel cycle material; medical and industrial sources; naturally occurring radioactive material; and non-specification material (particularly "orphan" sources). Packages both for fuel cycle and non-fuel-cycle material have been safely operated for many years throughout the world. The basic approach in the IAEA Transport Regulations is that the package is the primary means of providing the necessary safety during incident-free transport and during accidents. All packages are designed and built to comply with the requirements set out in the Transport Regulations.

The Transport Regulations apply a graded approach to packaging, with design criteria and approval requirements commensurate with the hazards represented by the radioactive contents. Several contributed papers discussed the high degree of safety and the positive experience in maritime, surface and air transport in general, and the survivability and crashworthiness of Type B packages in particular. The conference welcomed the fact that the Transport Regulations give industry, with a regulator's approval, flexibility to use a range of methods for demonstrating compliance with design requirements. For all Type B package transport, including irradiated fuel transport, the regulatory standards have been shown to encompass the possible structural or thermal forces generated in well over 99% of real-world accident situations.

2.2. The increasing global marketplace for radioactive material

The conference called for the development of new strategies for facilitating transport operations, without compromising safety, in an environment of increasing international commerce.

The IAEA had the foresight to envisage an approach to facilitating international transport by adopting the concept of "unilateral approval". In practice, however, the unilateral approval approach has not been universally accepted and may not be accomplishing its original objective or producing the optimum balance between national authorities' and shippers' needs. In particular, under the current transitional arrangements for packages designed according to different editions of the Regulations, many are of types that must be revalidated by each State and are not covered by the unilateral approval concept.

It was noted that the nuclear industry and other industries using radioactive material are facing a reduced availability of transport modes and carriers as a result of decisions by commercial carriers, ports and handling facilities not to accept radioactive material. The conference suggested that the IAEA should work more closely with the modal organizations and with NGOs to determine why shipments of radioactive material are being denied, and develop a strategy for addressing this issue. Greater efforts to explain the use of the IAEA Transport Regulations to wide public and industry audiences, including the staff of carriers at ports and other handling facilities, may contribute to a better understanding of the safety level the Regulations provide.

The possibility of further harmonization of the international and modal application of the regulations should be explored through the IAEA, with a view to simplifying multiple licensing processes.

2.3. Assessment of regulatory criteria

A number of contributed papers discussed the high degree of safety of maritime transport in general and of Type B packages in the maritime environment in particular. In addition, transport through the Panama Canal was reviewed. *The conference found that, relative to maritime transport, the test requirements for Type B packages (thermal test and 9-metre drop test) are based on proven science and engineering.* The integrity of packages for transporting irradiated nuclear fuel, plutonium, or high-level waste was highlighted, as was the survivability and stability of purpose-built vessels in severe ship–ship collisions.

The TranSAS mission to Panama held in June 2003 was discussed. It was noted that the pre-mission questionnaire was an important tool in assisting the host State when considering the purpose of certain existing regulatory activities. *The conference suggested that Member States speak to those who have hosted TranSAS missions regarding the benefits of such missions.*

2.4. Non-routine transport (discovered sources)

The conference found that guidance would be beneficial for ensuring safe transport and consistent application of the IAEA Transport Regulations for "orphaned" or lost and discovered sources. The number of discovered sources (e.g. "orphan" sources, including those detected in scrap metal) has significantly increased in recent years. The need for their prompt removal from the public domain can outweigh regulatory considerations related to their transport. For example, there may not be available packages, or even package designs, for some orphan sources, or a lost source may be detected in scrap metal at a mill or border crossing and rejected by the consignee, necessitating new transport. The States in which discoveries occur may not have the programmes, regulatory infrastructure or resources to accomplish the needed transport. The conference recognized that the discoveries to date have often been resolved successfully through ad-hoc procedures; however, it noted the potential benefit of standard, written principles. The conference stressed that the transport aspects of orphan and discovered sources are a small part of the broader source-control issue.

2.5 Reconsidering applicability of transport regulations to naturally occurring radioactive material

The conference identified a need for additional research to relieve unnecessary regulatory burdens related to the transport of very low activity naturally occurring radioactive material.

Since the 1996 edition of the IAEA Transport Regulations introduced radionuclide-specific exemption levels in lieu of the single 70 Bq/g value, ores, tailings and backfill from large mining operations (e.g. phosphate, coal, gold, monazite) have been brought within the scope of the Regulations. To address this situation, the 1996 Regulations included an allowance for a factor of 10 higher than the exemption quantities for naturally occurring materials, provided they are not intended to be processed to extract the radionuclides. The conference noted the potential inconsistency between this provision and the developing international guidance on the more general issue of the scope of regulatory control (DS161), the problems associated with determining the ultimate use of the material, and the inconsistency of exempting doses associated with some types of source (e.g. naturally occurring radioactive material (NORM)) but not doses of the same magnitude from other types of source. The conference suggested that the full impact of, and technical basis for, the "factor of 10" exemption be thoroughly researched.

3. FINDINGS OF REGULATORY ISSUES SESSIONS (TECHNICAL SESSIONS 5 AND 6, AND PANEL 2)

3.1. Providing a sound regulatory process

The conference found that the IAEA Transport Regulations provide an excellent basis for the establishment of an effective regulatory process. Nevertheless, there are States in which such a process needs to be put into practice. This may require the empowerment of regulatory bodies. For international shipments, differences in interpretation by the relevant competent authorities may result in delays and higher costs for international shipments.

The conference found that industry can play a positive role in the improvement of the regulatory process and that transparency is a way to credibility and confidence building with benefits for all parties involved. The radioactive material transport industry is fully committed to meeting its obligations in this area. It is working to ensure that it meets all regulatory requirements and is seeking opportunities to increase dialogue with intergovernmental organizations and national competent authorities in order to reduce differences in the interpretation and implementation of the Regulations.

The development of guides, as recommended in the IAEA Safety Requirements on legal and governmental infrastructure for safety (Safety Standards Series No. GS-R-1), is one of the key roles to be played by regulators in order to provide designers, manufacturers, testers, consignors and carriers with adequate and timely tools to comply with regulations. A standardized format and review process, including performance criteria for packaging, was presented and a Standard Review Plan developed on this basis was outlined. Consistent formats and acceptance criteria would lead to better utilization of resources and improve overall package systems.

Double hulls, reliable power systems, radiation shielding, cargo cooling and fire detection/firefighting are all vital to assuring safety during transport of irradiated nuclear fuel (INF) cargoes by sea. In the event of an accident, an emergency response plan and notification of the nearest coastal State are crucial for avoiding or mitigating consequences.

3.2. Key factors to evaluate the adequacy of the regulatory regime

The conference found that, by following the requirements of the IAEA Transport Regulations, the designer of a package for the transport of radioactive material strives not only to meet the requirements of the regulatory tests, but also to produce a package that is safe under all conceivable conditions. This is confirmed by a number of transport-risk studies that have demonstrated that the current Regulations are sufficient to provide adequate protection of public health and safety during the transport of radioactive material. Examples discussed at the conference that support this view included: reports on severe accidents that have shown that the accident environments were bounded by the test conditions in the Transport Regulations; tests on uranium hexafluoride packages that have demonstrated that they meet the new IAEA regulatory requirements; and evaluations showing that implementation of administrative procedures and training and control measures based on the Transport Regulations have resulted in minimal contamination levels connected with the transport of spent fuel.

With regard to new regulatory requirements, it was reported that a methodology for validation and verification of the safety of Type C packages for air transport of fresh nuclear fuel has been developed. Furthermore, experience in the implementation of the new modal regulations has been positive. However, through this process it has been learned that sufficient time will be needed in future to ensure common implementation of new requirements and, in the case of industry, to provide for necessary changes, including staff training, re-design and/or re-approval of packages, and updates to operating procedures. It was indicated that additional training might be needed to ensure the desired high level of compliance, specifically for those involved in the transport of radioactive material by air.

The test protocols of the US Nuclear Regulatory Commission package performance study, which have been developed through a public participation process, foresee fire and drop tests of large irradiated nuclear fuel flasks for road and rail transport to levels well in excess of the environments provided by the Transport Regulation tests. It was noted that the full-scale testing of these flasks in such extreme conditions will be carried out mainly for the purpose of improving public confidence. It was noted that, for demonstrating compliance with regulatory requirements, designers of packages and regulators usually find that alternative methods, including model testing and/or analyses, are adequate.

The conference found that there may be a need to pursue with a higher priority the already approved co-ordinated research project on severe accident studies of radioactive material transport packages. Completing this effort would ensure the compilation and documentation of the severe accident testing data that have been obtained over the years, any new relevant data that may become available, and the results of current risk studies, all with a view to building further confidence with regard to the level of safety provided by the Transport Regulations.

3.3. Areas for improving the transport regulatory regime

The conference found that the current regulations provide a high level of safety and are implementable by Member States and industry. However, the developers of the Regulations should consider the need for additional flexibility in the light of the broad range of materials to which they apply. Some participants recognized that a “one size fits all” approach to regulation can be unnecessarily burdensome for particular applications.

Specific approaches were discussed for improving dialogue on the regulatory review process at the international level, with a view to ensuring that the process remains robust and consistent. Several papers also stressed the need for greater attention to consistent and timely application of the IAEA Regulations by States. *The conference found that the regulatory process for transport should be sufficiently flexible to take into account the latest developments, while providing sufficient stability in the Regulations themselves.*

3.4. Addressing problems with refusal of shipments

The conference suggested that the IAEA convene a discussion forum between relevant entities (which may include the IMO, ICAO, IATA, IFALPA, World Customs Organization (WCO)), shipping companies (with a specific focus on air and maritime carriers, ports and handling facilities) and national regulatory authorities to assist in alleviating problems associated with refusals by carriers, ports and handling facilities to accept consignments of radioactive material. The conference further found that enhanced efforts or separate treatment may be warranted for the transport of radioactive material for medical applications.

The growing problem of refusal by carriers, ports and handling facilities to transport radioactive material received a great deal of attention during the conference. A number of papers focused on the increasing frequency of use of radioactive material in medical applications, including life-saving measures requiring urgent transport, and the difficulties that are being experienced in accomplishing those transports. The current regulatory system provides adequate safety, but does not include special provisions to facilitate the rapid distribution of medical-use isotopes when warranted. In addition, it was noted that shipments of radioactive material for industrial purposes, especially those in large quantities regularly requiring transport by sea, are also sometimes refused. The conference recognized that there is a growing need for improved and more specific communication between all parties involved, including enhanced dialogue between consignors and carriers. However, it was further recognized that such dialogue is necessary also with regulatory authorities and other governmental organizations (e.g. customs and security organizations), both at the national and international levels.

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OPENING SESSION

Chairperson

M.W. HUGHES
Australia

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WELCOMING ADDRESS

M. ElBaradei
Director General,
International Atomic Energy Agency,
Vienna

Abstract

The safety of transport of radioactive material is discussed in historical terms and with reference to current international institutional infrastructure. Areas of concern and opportunities for improvement are highlighted.

1. INTRODUCTION

The subject of this conference, the safety of transport of radioactive material — despite a long history of excellent technical performance and strong interactions among regulatory bodies at the international and national levels, and wide application of well-developed safety standards — continues to generate concern.

Around the world, tens of millions of shipments of radioactive material are made each year. These shipments serve a broad range of applications that benefit humankind, in fields such as medicine, industry, agriculture and electricity generation.

2. HISTORY AND BACKGROUND

The transport of radioactive material has been subject to regulation for many decades, and the International Atomic Energy Agency, working with its Member States and all relevant international governmental organizations, has played a key role in fostering the establishment of those regulations and providing for their application.

Soon after the creation of the United Nations more than 50 years ago, the international community initiated efforts to harmonize practices for the safe transport of hazardous goods, including radioactive material. The United Nations Economic and Social Council (ECOSOC) appointed a Committee of Experts to lead this effort, and for over four decades the Committee has co-ordinated with the IAEA on safety standards covering the national and international carriage of radioactive material by all modes of transport. First published in 1961, the IAEA's Regulations for the Safe Transport of Radioactive Material are periodically revised to incorporate technical advances, operational experience and the latest radiation protection principles.

3. CURRENT INTERNATIONAL FRAMEWORK

These Transport Regulations address all categories of radioactive material. Although recommendatory in nature, they constitute the basis for national regulations in many Member States, and generally become mandatory through the legally binding instruments of the relevant modal bodies, such as the International Maritime Organization or the International Civil Aviation Organization. In some cases, these instruments take the form of universal conventions, such as the Convention on International Civil Aviation or the International Convention for the Safety of Life at Sea; in other cases, they take the form of regional agreements, such as the European Agreement Concerning the International Carriage of Dangerous Goods by Road. Overall, twenty-one universal instruments and twenty-two regional instruments are in force applying, directly or indirectly, to the safe transport of radioactive material.

This current worldwide system of regulatory control, while not without shortcomings, has achieved an excellent safety record. Over several decades of transporting radioactive material, there has not been an in-transit accident with serious human health, economic or environmental consequences attributable to the radioactive nature of the transported goods. In recognition of this fact, the United Nations Committee on the Effects of Atomic Radiation has noted these transport activities as having no radiological impact.

This excellent record demonstrates the positive influence of the IAEA's Regulations for the Safe Transport of Radioactive Material. However, even the best standards cannot ensure safety if they are not widely and uniformly interpreted and applied. The IAEA's experience shows that this is not always the case today.

To help transporting countries assess their effectiveness in implementing the Agency's transport standards, the IAEA provides Transport Safety Appraisal Service (TranSAS) missions. TransSAS missions were carried out last year in Brazil and the United Kingdom and completed this year in Turkey and Panama. A mission for France is planned for 2004.

It is important that Member States — and especially transporting countries — make use of this valuable service. It is particularly relevant for countries with large programmes in transporting radioactive material to help ensure that the best international practices are employed, thereby increasing transparency and helping to raise confidence in the safety of transport activities. But it is also important for smaller shipping and receiving countries, where the quality of the infrastructure and the level of experience may be less advanced in ensuring the safety of transport operations.

4. CONCERNS AND AREAS FOR IMPROVEMENT

However, despite the strong safety record and general good performance in this area, concerns remain regarding the transport of radioactive material, as evidenced by discussions of this topic at IAEA General Conferences in the past few years. While a number of governmental and non-governmental bodies have safety and security concerns, others feel that the current regulatory structure is adequate. Nonetheless, it is clear that these concerns are having an increasing impact, manifested in such actions as the denial of service by airline pilots and truck drivers, or refusals by various carriers, ports and handling facilities to deal with radioactive material. I should add that the IAEA is, in some cases, experiencing difficulties in fulfilling its technical cooperation commitments to developing Member States as a result of these denials of service.

It is my hope that this conference will serve as a forum in which to better understand these concerns and to answer relevant underlying questions. For example:

— Are the existing regulatory requirements comprehensive, consistent and clear? If not, what improvements are needed?
— Are the safety standards applied uniformly by all carriers and all States — shipping as well as receiving States?
— How can the adequacy of the regulations and the manner in which they are applied be demonstrated with transparency?
— Why has so much concern been expressed over the transport of plutonium, irradiated nuclear fuel and high-level waste? How can those concerns be addressed?
— Is the current international regime for emergency notification and response suitable for emergencies involving the transport of radioactive material? If not, what improvements should be made?

Outside these technical areas, I would hope that your discussions will cover related issues such as liability and communication. The adequacy of the current regime to deal with the liability resulting from an accident during the transport of radioactive material has been widely debated. While the IAEA has no direct mandate for these liability issues, it is clear that the absence of a comprehensive liability regime, in terms of coverage and participation, affects the degree of confidence placed in transport operations.

Similarly, there is an apparent need for timely and effective communication between concerned governments, and between these governments and the public at large, on the transport of radioactive material. With the increasing concern about nuclear security and the prevention of nuclear terrorism, communication decisions are sometimes complex. Clear advance notification of shipments is desirable; however, this objective competes with the need, from a safety and security perspective, to withhold such information from all but authorized government personnel. This issue requires further in-depth discussion, with a view to reaching an agreed understanding on how to reconcile the need for transparency with the requirements for security.

Clearly, more remains to be done to facilitate the transport of radioactive material for the benefit of humankind, while continuing to ensure safety and security for people and the environment. This is a continuing process.

5. CONCLUSION

I would like to conclude by thanking our co-sponsors, the International Civil Aviation Organization, the International Maritime Organization and the Universal Postal Union — also the International Air Transport Association and the International Organization for Standardization — for their co-operation in organizing this conference. It is good to see participation by such a large number of qualified experts, a fact that illustrates the importance of this subject and of the IAEA's role in this field.

Naturally, the success of this conference will be measured by the degree to which the participants work together in an open and transparent manner, focusing on understanding the issues and identifying solutions to existing concerns. I wish you every success.

WELCOMING ADDRESS

M.W. Hughes
Ambassador,
Permanent Mission of Australia to the IAEA

Abstract

The evolution of the conference is described, as are the Programme Committee and underpinning technical issues. Representatives of Member States are encouraged to contribute to an events database. Conference procedural aspects are discussed in detail; the objective is to encourage the broadest possible participation from the delegates.

1. INTRODUCTION

When the Secretariat proposed the conference in its Planning and Budget document a few years ago, the Member States of the IAEA embraced the concept enthusiastically. I believe it was recognized by all involved during the lengthy planning process that there would be many challenges to successfully convening the conference. That has been achieved.

Interest in this subject is evidenced by the registered attendance: over 500 people from more than eighty States and fourteen international organizations. The remaining challenge is for us, the participants, to ensure a successful result.

Many issues face those involved in safely transporting radioactive material. These issues have been highlighted in the transport safety resolutions passed annually by the IAEA General Conferences since 1997. The numerous and complex issues that have consumed many hours in these General Conference deliberations, the other debates that have occurred outside of the General Conference in other international forums, and the reflection of some of these issues on the ability of all involved to expeditiously transport radioactive materials to the benefit of humankind make the convening of this conference very timely.

I would like to acknowledge that views differ on the safety of transport of radioactive material. In his opening remarks, the Director General highlighted some of those views. It is worthwhile, however, in setting the stage for the conference, to expand upon these and briefly review the issues that have come forth from the General Conference deliberations. Therefore, I will take a few minutes to review some of issues resulting from the transport-safety portion of Resolution GC(46)/RES/9 that was adopted in September 2002.

The convening of that General Conference was welcomed and those involved in the deliberations looked forward to constructive discussion of the various issues; Member States were urged to participate with a view to comprehensively addressing all of the issues in the conference programme. I will come back to those points at the end of my remarks as I address the manner in which we intend to run this conference.

2. PROGRAMME COMMITTEE

It is noteworthy that one of the largest, if not *the* largest, technical programme committees that have been convened at the IAEA for planning a conference established the conference programme. The programme committee that planned this conference in March 2003 involved almost forty people from nineteen Member States and three international organizations. States on differing sides of various issues were represented. As the president of the conference that resulted from the deliberations of this committee, I would like to thank those who participated for their contributions to this undertaking. Those individuals who have contributed to the planning and preparations for this conference are identified in the programme in your registration package.

3. TECHNICAL ISSUES

Last year's resolution highlighted a number of technical and less-technical issues, including the following:

- The need to continue to review and — as needed — revise the IAEA Transport Regulations with a view to examining and optimizing those standards, especially for maritime transport, and to work towards ensuring that all Member States have regulations consistent with current international standards;
- Concerns about the transport of radioactive material by sea and the importance of ensuring safety during such activities consistent with applicable navigation rights and freedoms as provided in international law, under which States are obliged to protect and preserve the marine environment; international cooperation in this area is important;
- Member States were encouraged to make use of the IAEA's Transport Safety Appraisal Service (TranSAS) and to act on the findings documented in TranSAS mission reports to improve their regulation of transport;

- Concerns of some States with regard to perceived need to provide assurances, as appropriate, that national regulations take into account the IAEA's Transport Regulations, and a desire for advanced notification of international shipments while acknowledging that such notifications should not contradict established measures for physical protection and safety;
- Need for effective communication, dialogue and consultation at the international level;
- Encouragement of efforts towards drawing up an effective liability regime for accidents or other incidents, especially during maritime transport.

It is noteworthy that all of these issues are topics that will be addressed this week at this conference.

4. EVENTS DATABASE

With the assistance of the Secretariat, I would like to briefly mention three other noteworthy areas that were addressed in the resolution but are not specifically on the conference agenda.

First, the resolution encouraged continued development of an events database at the IAEA and the need for participation of Member States to provide information for it. As a result of discussion with IAEA staff, I would like to report, on their behalf and on behalf of participating States, that significant progress has been made in the past few months. I would, however, like to note that effort is now needed at the State level to populate this database. Otherwise, the request for this effort, which arose from the States themselves, will become meaningless.

Second, the resolution requested the Secretariat to seek regularly from each Member State data on how each State regulates its transport activities. For the third successive year, the Secretariat has solicited such information from its Member States, yet, after three years of effort, less than half have responded. Again, let me note that this request comes not from the Secretariat but from States themselves through the resolution. Therefore, in my view, enhanced attention to this call for data is needed at the State level. The States have been requesting that this information be compiled by the Secretariat, so they should be more responsive than in the past.

Third, the resolution emphasized the need for a strengthened, effective educational and training programme at the international level. The Secretariat reports that efforts at the IAEA during the past few months have been focused on updating the training material with modern software for consistency with the current regulations. The results of those efforts are now available. The updated training manual and supporting visuals are on display here, and a supplementary video has just been completed and will be available for viewing during the conference. Efforts in coming years will need to focus on using these materials to provide training to key personnel at the State level.

5. CONFERENCE PROCEDURE

5.1. Structure and operational aspects

More than 100 papers were contributed. Those that were applicable to the topic of the conference were accepted, assigned by subject to the appropriate session and are included in the publication of contributed papers, a copy of which you each received upon registration. Because a primary purpose of this conference is to have extensive open dialogue on the issues, most of these papers are not to be presented in oral sessions. With the exception of the authors in the last session today, each author of a contributed paper was invited to present her/his paper in a poster session in the late afternoon preceding the day of the subject session. Almost half of the contributing authors have taken that opportunity; therefore, I encourage all participants to avail themselves of the opportunity to visit these posters and discuss their contents one-on-one with the presenting authors.

In the subject session, an expert will briefly review most of the contributed papers, a limited number of the contributed papers will be presented, and experts on the relevant subject will present a few invited papers. Approximately half of the time in each session has been reserved for open discussion, questions and answers.

What I have just described applies to all but today's opening and background sessions, in which only a limited amount of time will be available for floor discussion at the end of the background session. The opportunity for contributing authors of papers on the subject of liability did not exist since that session occurs late today; therefore, those contributing authors have each been allocated five minutes to briefly summarize key issues.

5.2. Constructive engagement

Many divergent views exist on the subjects that are to be addressed, and I encourage all to be open-minded and to work towards constructive engagement rather than confrontation. I would like to see all participants who desire it having the opportunity to share their views.

At the same time, we recognize that technical work is the foundation of a sound safety culture; therefore, the technical aspects of the transport safety regulatory regime will be a focus for detailed exploration.

5.3. Conference report

We ask each chairperson, with the assistance of the co-chairperson, rapporteur and IAEA Scientific Secretariat support, to assist me in preparing a summary of what transpired in their session, and — for the technical sessions and panels — a summary set of findings. These will all serve as a basis for my report to you at the end of the conference, and that report will then be carried forward to the forthcoming September IAEA Board of Governors meeting and General Conference.

5.4. Constructive dialogue

Although this is a technical conference, we want to avoid erecting barriers to communication. We need to address the socio-political issues that apply to the technical issues if we are to establish a collegial atmosphere. I encourage those who desire to enter into the discussions at the end of each session to take a collegial approach, to keep their contributions brief and their questions short and focused. In turn, I ask those sitting at the head table in each session to keep their responses focused and brief. The expression of alternative views is important if we are to be effective this week; we all need to recognize that this is an important, and possibly unique, opportunity to establish constructive dialogue for addressing issues of concern.

6. BUILDING ON POSITIVE DEVELOPMENTS

An issue that has been raised in the resolutions I discussed earlier involves welcoming the practice of some shipping States and operators of providing timely information and responses for the purpose of addressing concerns regarding safety and security. This was noted with a view to improving mutual understanding and confidence regarding shipments of radioactive material. The World Nuclear Transport Institute, working with its sponsoring shipping companies, has, during the past year, arranged for visits by a number of concerned individuals to their facilities and conveyances. This effort has certainly enhanced communication between the shippers and those who participated, and broadened understanding of the issues involved and the capabilities of the consignors and carriers. I compliment the World Nuclear Transport Institute and those who visited for their efforts in this exercise in communication and education.

I would also like to highlight the growing interest in TranSAS missions as an important development that we can support as a means of building confidence and improving communication.

We will be judged at the end of this conference on the basis of whether we built on these positive developments in the spirit of the last General Conference Resolution, which for the first time attracted a wide consensus bridging all sections of opinion.

Finally, I want to announce that — in the interest of enhancing dialogue on topics that are to be addressed early in this conference — informal consultative sessions will be open to registrants.

I now call upon the representatives of our three co-sponsoring international organizations to address this opening session: Ms. Kathryn Rooney of the International Civil Aviation Organization, Mr. Irfan Rahim of the International Maritime Organization, and Mr. Eppe Andersen of the Universal Postal Union.

ADDRESS BY CO-SPONSORING ORGANIZATION

THE ROLE OF ICAO IN REGULATING THE AIR TRANSPORT OF RADIOACTIVE MATERIAL

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Abstract

A brief history is given of the International Civil Aviation Organization, a specialized agency of the United Nations. Recent initiatives in relation to safety and security are discussed.

1. INTRODUCTION

The year 2003 marks 100 years of aviation. Many people from many nations contributed to the successful achievement of human-accompanied flight. Figure 1 shows a steam-powered monoplane built by Alexander Mozhaisky in Russia in the late 1890s. It took off from a jump ramp and flew for approximately 30 m. Otto Lilienthal in Germany was the first to actually launch himself into the air using gliders made from cloth stretched over a willow framework. From 1891, he made over two thousand glider flights and unfortunately died during one of them in 1896.

An Australian—showing the diversity of the nationalities—Laurence Hargrave invented the box kite, a remarkably stable form that generated a lot of lift. It had a huge influence on the design of the first aeroplanes.

Figure 2 suggests that aviation was using the 9 m drop test in advance of the regulations requiring such, but this shows Frenchman Ferdinand Ferber who, in June 1903, built a copy of a Wright glider, attached a motor to it and attempted to fly tethered to a crane. Unfortunately, he was unsuccessful.

And so we arrive at what we now call International Aviation Day within the International Civil Aviation Organization (ICAO). On 17 December 1903, Orville Wright made the first powered, fully controlled flight (Fig. 3). Its total duration was 12 s, covering 120 ft. Developments continued at pace. There was

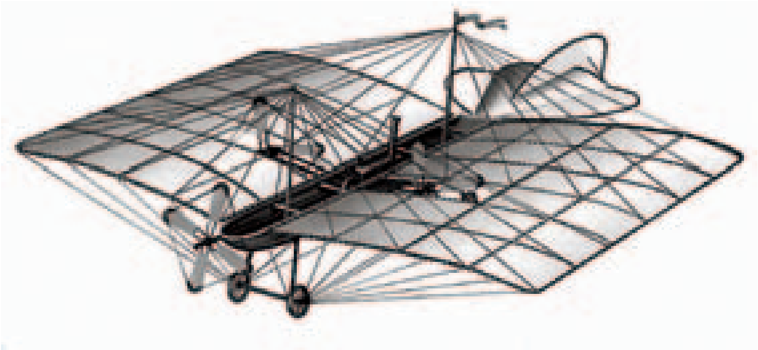

FIG. 1. Alexander Mozhaisky's steam powered monoplane.

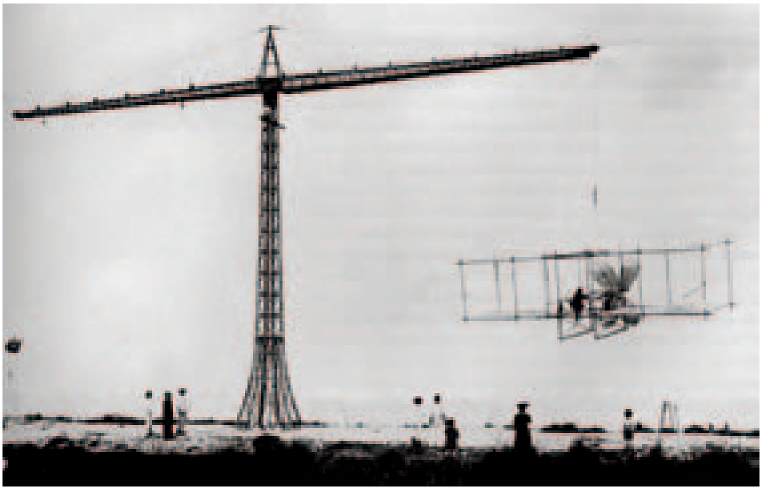

FIG. 2. Ferdinand Ferber attempting to fly a motorized Wright glider.

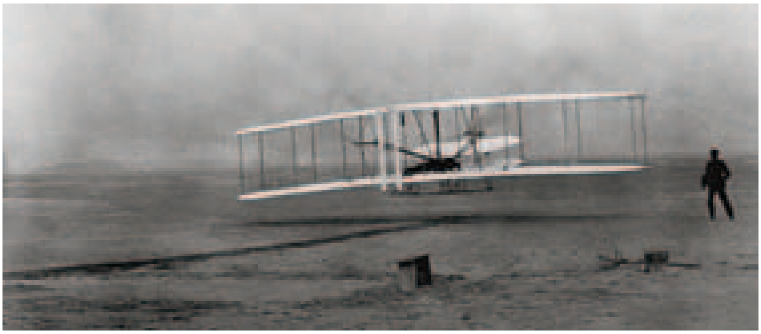

FIG. 3. First powered flight in a controllable aircraft.

FIG. 4. An early example of a (small) passenger aircraft.

a major psychological breakthrough in 1909, when Louis Blériot crossed over the English Channel in a monoplane.

Figure 4 provides an example of an early passenger aircraft, albeit rather limited in capacity. It shows Mr. Wright with his sister Catherine, whose skirts were tied down to prevent them from getting in the way of the controls.

In 1910, the first aircraft radio communication with the ground was achieved by Canadian James McCurdy. The first international airmail flight, between Vancouver, Canada, and Seattle, United States of America, was piloted by William Boeing—a well known name in aviation circles—and Eddie Hubbard in 1919. However, there is no record of whether radioactive material was transported on that historic flight. In 1927, Charles Lindbergh made the first solo non-stop transatlantic crossing, taking 33½ hours.

2. THE CHICAGO CONVENTION

All this activity in the new world of aviation led to needs for rules and controls, which resulted in the meeting of 52 national delegations in Chicago, USA in 1944 (Fig. 5). On 7 December 1944, the Convention on International Civil Aviation was signed. On seeing Fig. 5, some may have a sense of deja vu. It shows the ballroom of the then Stephen's Hotel, now the Hilton, where the

FIG. 5. Signing of the Convention on International Civil Aviation, 1944.

International Symposium on the Packaging and Transportation of Radioactive Materials (PATRAM) was held in 2001, one of the many links between ICAO and the transport of radioactive material.

One of the basic tenets of the Convention lies in Article 37: each contracting State will attempt to secure the highest practicable degree of uniformity in regulations, standards, procedures and organization in relation to aircraft and personnel so as to facilitate and improve air navigation.

3. THE ROLE OF ICAO

ICAO is a specialized agency of the United Nations similar to IAEA. It was created with the Convention in 1944 and a provisional ICAO was in existence by June 1945. It became fully operational in 1947, with 52 contracting States. There now are 188 contracting States. The aims of ICAO are to develop the principles of international air navigation and to foster planning and development of air transport so as to promote the safety of flight, to improve aircraft design and operation and to ensure safe, regular, efficient and economical air transport.

The Convention accepts the very basic principle that every State has complete and exclusive sovereignty over the air space above its territory, and provides that no scheduled international air service may operate over or into that territory without its previous consent. The ICAO achieves its mandate via the creation and updating of the standards and recommended practices (SARPS) in the 18 annexes to the Convention, the most recent of which is Annex 18, the Safe Transport of Dangerous Goods by Air, which became applicable on 1 January 1984. Those involved with transport of radioactive material will be aware that Class 7 is contained within the annexes. In addition to the development of the annex material, guidance material contained within our technical instructions is also developed.

As mentioned, the ICAO has 188 contracting States, representatives of which meet in assembly at least once every three years to review and to provide guidance on the work of the organization in the various technical, economic and legal fields. The Council, however, is a permanent body, which is unusual for a specialized agency, composed of representatives of 36 member States elected by the Assembly for three-year terms. With its subsidiary bodies, it provides continuing guidance for the work of the organization. One of the major tasks of the Council is to adopt SARPS contained within the annexes. Although the Council is responsible for the adoption of the SARPS, the principle body concerned with their development is the Air Navigation Commission (ANC).

The ANC is composed of 15 technical experts, nominated by States but acting in their own personal expert capacity. To assist their work, panels of experts (e.g. for dangerous goods) meet and recommend changes to the annexes.

The Secretariat supports the work of the ICAO. Assad Kotaite is the third president of the ICAO Council. He was elected in 1976 and has been re-elected at each subsequent Assembly. The Secretary General is Costa Pereira.

The ICAO has seven regional offices with a staff of approximately 200, with 550 personnel at the headquarters in Montreal and a further 250 involved in technical cooperation.

4. AVIATION ACCIDENT TREND ANALYSIS

In the past decade, there have been continuous declines both in the number of accidents in which aircraft have been destroyed and in the number of fatalities. The lowest numbers were obtained in 2002 and would be even lower in the absence of charter operations. High profile accidents that are covered in the media at great length generally result from charter flights. In the past decade there has been approximately a 50% reduction in accident number, and the fatal accident rate fell from approximately 2.5 per million departures at the beginning of the decade to a low of 0.81. The rate of destroyed aircraft has similarly been reduced, from a high of about 3 per million departures to about 1.

Concerns over relatively high accident rates in certain regions led to the development of safety oversight assessments: States requested ICAO to visit and assess their organizations, starting in 1995. As a result, a Directors General of Civil Aviation Conference was convened in 1997 at which was recommended the development of a new programme of global capacity for safety oversight. This led to the ICAO Assembly of 1998 and Assembly Resolution A32/11, which led to the permanent establishment of an ICAO universal safety oversight audit programme. It was launched in January 1999 and ordered States' oversight capabilities with three of our annexes, those for personal licensing, Annex 1, operations of aircraft, Annex 6, and worthiness of aircraft, Annex 8. Almost all contracting States have undergone an initial audit and some are undergoing follow-up missions.

In 2001, under Assembly Resolution A33/8, the ICAO continued expansion and a further three annexes were added to the audit list for air-traffic services, for aerodromes and for aircraft accident investigation. Our original assessments were similar to the appraisals organized by the IAEA. Initially voluntary, the assessments are now mandatory. They were confidential whereas now there is a large degree of transparency, and they were originally funded by contributions from the member States but are now part of our regular programme. In the original assessment period between March 1996 and December 1998, 85 requests were received, and 67 contracting States were assessed. The programme principles include such items as State sovereignty, which goes back to Article 1 of the Convention. Universality is covered under Assembly Resolution A33/11, which explicitly states that the ICAO will conduct regular and mandatory safety oversight audits, covering aspects of transparency of disclosure of information, timeliness, objectivity and fairness: each contracting State is given every opportunity to respond to the audit and to comment on its quality. The items contained in the audits are in compliance with the Chicago Convention and State regulations, they conform to ICAO standards and adhere both to recommended practices and relevant industry practices. We looked at national aviation legislation and attendant regulations and examined the organizational structure and legal status of the States' civil aviation authorities and what systems were in place for certification and continued surveillance of aircraft, personnel and operators.

Regarding implementation of the critical safety standards, as of March 2003, 181 member States had been audited with follow-ups completed in

80 member States. Findings revealed lack of implementation of ICAO SARPS and failures to implement critical elements of the safety oversight system. One lesson learned is that problems are not limited to any one region and a link exists between audit findings and regional accident rates, although it is not possible to draw a direct statistical correlation. This supports the conclusion that ICAO audits can be an effective tool for identifying deficiencies and enhancing aviation safety.

5. SECURITY IN AIR TRANSPORT

The attacks of 11 September 2001 had a dramatic impact on aviation security. Our thirty-third Assembly started two weeks to the day of 11 September and Resolution A33/1 contained an immediate plan of action that included convening a high-level ministerial conference on aviation security and an aviation security plan of action that included strengthening Annex 17 SARPS, development of new standards in other annexes (including Annex 6), reinforcement of cockpit doors and development of the universal security audit programme. The latter includes examination of security at the national level, organization, administration and cooperation with other States, and at the airport level, organization, access control, security—passenger, cabin baggage and hold baggage—in-flight security, and cargo security which of course includes dangerous goods and radioactive material, and responses to acts of unlawful interference and contingency arrangements.

As of last week, 63 AVSEC experts had been trained and certified as security auditors. Eight audits have been conducted and it is our intention to have 20 more completed by the end of 2003, and 40 more in 2004. A five-year cycle will be introduced during which all 188 Member States will be audited.

Cargo security is covered in Annex 17 and, at the United Nations Committee of Experts in December, 2002, new provisions were introduced on the security during transport of dangerous goods. The Dangerous Goods Panel will meet in October and November 2003, when one of the main issues for discussion will be whether such material should be in Annex 17 or Annex 18. It is an ongoing process for ICAO, based on the inextricable links between security and safety.

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ADDRESS BY CO-SPONSORING ORGANIZATION

RADIOACTIVE MATERIAL TRANSPORT SAFETY AND SECURITY ACTIVITIES AT THE IMO[1]

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Abstract

The International Maritime Organization (IMO) is a specialized agency of the United Nations devoted exclusively to maritime matters. An overview is provided of the provisions that govern the safe and secure transport of Class-7 radioactive material by sea.

1. INTRODUCTION

Provisions that specifically govern the carriage of radioactive material by ship may be found in the:

— International Convention for the Safety of Life at Sea (SOLAS), 1974;
— International Maritime Dangerous Goods (IMDG) Code;
— International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code);
— Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide);
— International Ship and Port Facility Security (ISPS) Code.

[1] The views expressed in this paper are those of the author and do not necessarily reflect those of the International Maritime Organization.

2. THE CONVENTION ON THE LAW OF THE SEA

The International Convention for the Safety of Life at Sea, 1974, currently in force, was adopted on 1 November 1978 by the International Conference on Safety of Life at Sea, which was convened by the IMO, and entered into force on 25 May 1980. It has since been amended twice, by means of protocols in February 1978 and November 1988. In addition, the 1974 SOLAS Convention has been amended by means of resolutions adopted either by IMO's Maritime Safety Committee (MSC) in its expanded form specified in SOLAS Article VIII or by conferences of SOLAS contracting governments, also specified in Article VIII, on a number of occasions.

Chapter VII of SOLAS deals with the carriage of dangerous goods and the revised part A, which is now in parts A and A-1, is envisaged to enter into force from 1 January 2004. Part A deals with the carriage of dangerous goods in packaged form and part A-1 with the carriage of dangerous goods in solid form in bulk. Part D deals with special requirements for the carriage of packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes on board ships. In this context, other relevant regulations are I/12, I/13, I/19 and XI/4, which address issues related to the endorsement of certificates, control of certificates, and port State control on operational requirements.

3. THE INTERNATIONAL MARITIME DANGEROUS GOODS CODE

The IMO has harmonized its IMDG Code with UN recommendations on the transport of dangerous goods, and the relevant provisions of the IAEA Safety Standards Series No. ST-1 have been incorporated in the new IMDG Code. This has been possible through, amongst others, close cooperation with the modal agencies including the IAEA. The IMDG Code, 2002 edition, is expected to attain mandatory status from 1 January 2004 under the umbrella of the parent convention SOLAS 1974. However, the Code's provisions may be applied from 1 January 2003 on a voluntary basis, to facilitate the multimodal transport of dangerous goods.

As the relevant provisions of the IAEA Safety Standards Series No. ST-1 have been incorporated in the IMDG Code, which deals with the stowage, segregation, packaging, classification, labelling, marking and placarding of dangerous goods, including Class-7 radioactive material, these attain mandatory status as well. The Code is updated every two years to reflect advances in maritime technology and the relevant decisions of the UN Committee of Experts on the transport of dangerous goods.

It is worth remembering a basic rule of thumb regarding the mandatory entry into force dates of the amendments to the IMDG Code: From 1 January of an even-numbered year, the provisions of the new amendment to the Code enter into force as mandatory provisions; however, these may be applied on a voluntary basis a year earlier, from 1 January of an odd-numbered year.

4. THE INF CODE

The International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes On Board Ships, the INF Code, is mandatory under SOLAS 1974 and entered into force in January 2001. This Code, as its name suggests, addresses issues related to the safe transport of packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes carried as cargo, in accordance with Class-7 provisions of the IMDG Code. It is important to note that, in addition to compliance with the requirements of the INF Code, the provisions of the IMDG Code apply to the carriage of INF material.

The INF Code has eleven chapters and an appendix that cover a wide range of pertinent and relevant issues. Chapter 1 deals with definitions of the main terminology used throughout the Code, application of the Code, survey and certification of ships carrying INF material. Chapters 2 to 8 deal with requirements relating to ship design, construction and equipment, and it is appropriate to state that these provisions are more stringent than those specified in SOLAS 1974 for cargo ships.

Management and training for a ship carrying INF cargo should be to the satisfaction of the administration, taking into account developments at the IMO. Such a ship shall carry a shipboard emergency plan that, if required by other instruments, may be combined into a single plan entitled Shipboard Marine Emergency Plan.

The reporting requirements under regulation VII/7-1 of SOLAS 1974 apply both to loss or likely loss of INF cargo overboard and to any incident involving a release or probable release of INF cargo, whatever the reason for such loss or release, including for the purpose of securing the safety of the ship or saving life at sea.

The appendix to the INF Code provides a form for the International Certificate of Fitness for the Carriage of INF Cargo, which must be drawn in the official language of the issuing country. If the language used is neither English, French nor Spanish, the text should include a translation into one of these languages.

5. SUPPORTING GUIDELINES

The International Maritime Organization has prepared a number of guidelines, and compliance with their provisions contributes towards safer and more secure carriage of dangerous goods. They include:

- Guidelines for structure of an integrated system of contingency planning for shipboard emergencies [A.852(20)];
- Guidelines for developing shipboard emergency plans for carriage of materials subject to the INF Code [A.854(20)];
- Guidelines for voyage planning [A.893(21)].

The IMO has prepared emergency response procedures for ships carrying dangerous goods, including schedules to be followed in the case of incidents involving dangerous goods regulated under the IMDG Code. The guidance provided is mainly in two parts, "F" and "S", the former information on action to be taken in the event of fire and the latter on action to be taken in the event of spillage. Schedules "F-I" and "S-S" deal with incidents involving fire and spillage of radioactive material and have been prepared in consultation with the IAEA.

6. THE NEW SHIP AND PORT FACILITY SECURITY CODE

The terrorist attacks of 11 September 2001, amongst other incidents, led to the development of the International Ship and Port Facility Security (ISPS) Code, which was adopted at IMO on 12 December 2002, after almost a year of intense work. Part A of this Code is envisaged to attain mandatory status from 1 July 2004 under the umbrella of SOLAS 1974.

The objectives of the Code are mainly to establish an international framework to detect/assess security threats and take preventative measures during security incidents affecting ships or port facilities used in international trade, to establish roles and responsibilities for parties concerned, and to have appropriate plans.

The achievement of these objectives is through the designation of appropriate officers/personnel on each ship, in each port facility and in each shipping company to prepare and to put into effect the security plans that will be approved for each ship and port facility.

7. CONCLUSION

In the author's view, compliance with all relevant IMO and IAEA provisions will result in safer, securer, efficient and pollution-free carriage of radioactive material by sea.

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ADDRESS BY CO-SPONSORING ORGANIZATION

RADIOACTIVE MATERIAL TRANSPORT BY POST: THE ROLE OF THE UPU

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Abstract

The Universal Postal Union (UPU), part of the United Nations system, serves as a primary vehicle for cooperation among its 189 member countries in providing a universal communications network of quality and secure postal products and services. To accomplish this, the UPU has formed a Postal Security Action Group (PSAG) to oversee actions needed to enhance the security and integrity of international mail services, and has recently joined with the International Atomic Energy Agency (IAEA) in a memorandum of understanding with a primary goal of fighting illicit transport of radioactive material. The PSAG also has a Project Group on Dangerous Goods that provides coordination with the IAEA in aspects of transport of radioactive material. This paper outlines the role of the UPU in ensuring safety and security in the postal transport of dangerous goods in general and specifically of radioactive material.

1. THE ROLE OF THE UNIVERSAL POSTAL UNION

Postal services form part of the daily routine of people, businesses, science and industry all over the world. The Universal Postal Union (UPU), with headquarters in Bern, Switzerland, is the specialized agency of the United Nations that regulates this truly universal service.

In 1874, the Treaty of Bern succeeded in unifying a conflicting international maze of postal services and regulations into a single postal entity that became the UPU. The UPU joined the United Nations system as a specialized agency in 1948 and continues today to be a primary vehicle for cooperation among its 189 member countries with the major goal of providing a universal communications network of quality with secure products and services.

Safety and security, recognized as critical to the success of any communications network, provided the genesis for the creation of the Postal Security Action Group (PSAG) of the UPU.

In its thirteenth year of operation following its creation by the Washington UPU Congress in 1989, which focused the efforts of representatives of sixty-one member countries, thirty-five observer countries and ten participating international organizations, PSAG seeks to enhance the security and integrity of international mail services. The working premise of PSAG is that security is crucial to customer confidence in the post and to the quality of service that is core to the continued viability of this medium.

The Postal Security Action Group truly believes that postal security makes business sense. Since its inception, its security mission has been based on four guiding objectives.

— Preventing injuries due to dangerous goods in the mail. Under the umbrella of this objective, PSAG has worked to clear the post of drug trafficking, mail bombs, illicit transportation of radioactive material and the unsanctioned shipment of chemical, biological and infectious materials. We are committed to ensuring the safety of customers and employees.
— Preventing the loss or theft of mail entrusted to the post by our customers. This effort is core to the business of the post and the satisfaction of the mailing public.
— Preventing revenue and asset losses to postal administrations. The health of the post depends upon revenue, and one aim of PSAG is to plug leaks due to fraud, waste or abuse.
— Preserving customer confidence in the post. This broad objective overlaps with the other three.

The overall goals of PSAG are accomplished by the efforts of seven problem-focused subgroups.

2. THE INTERAGENCY PROJECT GROUP ON DANGEROUS GOODS

I am pleased to chair the UPU/PSAG Interagency Project Group on Dangerous Goods. The most active of the working groups, the DG Subgroup, is charged with addressing the first priority of PSAG and is the focal point for our joint work with the IAEA.

This group has taken measures to aid postal administrations in contingency planning and protecting the post from bio-terrorism and other hazards through detection and screening methodologies. Key initiatives have encompassed safe packaging, acceptance and transport of mailable dangerous goods. This initiative has been in close partnership with the World Health Organization.

Last year the UPU joined with the IAEA in signing a memorandum of understanding primarily to fight the illicit transport of radioactive material.

The Dangerous Goods subgroup has sponsored several informational seminars, dangerous goods documents, and training for security specialists and acceptance personnel.

The member postal administrations that make up the Universal Postal Union form the world's largest transportation chain. More than six million postal employees work in over 700 000 postal outlets to ensure that some 430 billion mail items are processed and delivered each year.

The UPU and the PSAG realize that quality of service, safety and security support the foundation of our viable business, the safety of our employees and the trust of our customers. We also realize that we cannot meet these goals alone. We have reached out to all of our stakeholders in the regulatory, transportation and security fields to achieve partnership and improve cooperation. Safety and security, after all, are key to the interests of all.

The world's posts also realize that our services are not best suited for the transport of more than very limited quantities of radioactive material. Other transportation options are much better suited for this need. The UPU and its members wish to direct customers to the best transportation options and products to suit their shipping needs. It is important, therefore, to have current information and active communication channels with suppliers offering dangerous goods transportation.

We are, however, committed to supporting our partners in strong and proactive initiatives to combat the illicit trafficking or inadvertent shipment of radioactive material that would threaten the safety and health of the public and our employees. We understand that, if we fail to offer the best options to our customers, we will encourage the illicit transportation of dangerous goods.

We value our continuing partnership with the IAEA and pledge future cooperation with all our colleagues working towards the safe and secure transport of radioactive material.

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BACKGROUND SESSION

Chairperson

O. KERVELLA
United Nations Economic Commission for Europe

Co-Chairperson

F. ABDEL-RAHMAN
Egypt

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ADDRESS BY COOPERATING ORGANIZATION

THE ROLE OF THE AIRLINE INDUSTRY IN THE SAFE AND EFFICIENT CARRIAGE OF RADIOACTIVE MATERIAL

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Abstract

For the transport of dangerous goods, including radioactive material, the International Air Transport Association (IATA) — representing its member airlines — works towards greater standardization, streamlining of traffic-handling procedures, more automation, reduced government-clearance procedures and documentary requirements, improved handling at airports, and adequate terminal facilities. The paper provides an overview of how IATA works with other international agencies to accomplish these goals and how it reflects the IAEA Transport Regulations in the IATA Dangerous Goods Regulations.

1. INTRODUCTION

To make the world air transport system more efficient, continued efforts are being directed by the International Air Transport Association (IATA) member airlines towards greater standardization, streamlining of traffic-handling procedures, more automation, reduced government-clearance procedures and documentary requirements, improved handling at airports, and adequate terminal facilities.

2. BACKGROUND

Airfreight is no longer a means of transport to be used in emergencies or when costs are unimportant. On the contrary, it is very often the most economically advantageous option for a very large section of the shipping public.

Dangerous goods (DG) must be transported by air because they are vital to our safety and well-being. Flammable liquids are used in solvents, paints and medications, toxic substances in pesticides and drugs, radioactive material in hospitals to treat patients, and explosives are used in car airbags and other restraint systems that save lives. Fifty years ago, when IATA began developing regulations for transporting DG by air, very few countries permitted such carriage and no international regulations were in existence to provide a supporting legal framework. Without regulation, States and airlines were without instruments with which to control air transport of DG.

3. THE ROLE OF IATA

In the light of increasing demands for air transport of DG and to facilitate international trade, IATA took up the challenge. Only a handful of States had regulations to serve as a starting point. Of those, the United States of America had the most detailed regulations, which had been designed for railroad transport and subsequently adopted for civil aviation. The first set of IATA regulations, the Restricted Articles Regulations published in 1956, were based largely on the US policy, which did not take account of pressure changes and vibration that occur in air transport. Therefore, IATA, in many cases, required double or triple packaging for dangerous goods. In the 1960s, IATA began to refine packaging requirements. The solution at that time was not a system of performance tests, but rather a detailed, hazard-specific set of package specifications.

The International Air Transport Association soon initiated a programme to secure formal approval of the Restricted Articles Regulations by governments as part of their aeronautical legislation or through the issuance of a permit authorizing air carriers to carry DG as defined by those regulations. By mid-1970, it was generally recognized that a more permanent arrangement — embracing all ICAO Member States — was desirable, particularly considering that a significant and increasing volume of DG was being carried by air.

The Pan Am accident involving DG was the catalyst for ICAO to become actively involved in regulation to provide a document that governments could adopt with hopes of wider adherence to DG air-transport regulations. To this end, ICAO established in 1976 a group of experts, the Dangerous Goods Panel (DGP), to develop recommendations covering the transport of DG by air. After five years of work, the DGP produced, with the active involvement of several governments and IATA, a new Annex 18 to the Chicago Convention on International Civil Aviation, titled The Safe Transport of Dangerous Goods by

Air, together with an associated document called Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284). In order to assist in achieving compatibility with the regulations covering the transport of dangerous goods by other modes of transport, the provisions of Annex 18 and associated Technical Instructions (TI) are based on, and kept aligned as far as possible with, the Recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods and the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material. The use of these common bases for all forms of transport ensures, to the maximum extent possible, safe inter-modal transport of DG by air, road, rail and sea. Where appropriate, additional requirements and restrictions have been introduced as a result of the special conditions prevailing in air transportation.

By the early 1980s, the IATA regulations had become the industry standard and more than seventy governments had approved them, even though they were not governmentally developed. But some nations, such as the USA, had not adopted the IATA's non-governmental document. That is where ICAO gained its strength. The ICAO Technical Instructions grew from the UN Recommendations for the Transport of Dangerous Goods. These recommendations differed from the IATA regulations, chiefly in that, rather than having packaging specifications, the new international regulations incorporated UN-developed performance testing for packages.

The ICAO Annex 18 and its TI were formally adopted in the early 1980s by the ICAO Council to become the governing legal requirements for the carriage of DG by all ICAO Member States. The first ICAO TI became effective on 1 January 1983, but compliance was not mandatory until 1984. As the industry standard, IATA needed to incorporate the new international requirements, and do so consistently; it changed terminology from "restricted articles" to "dangerous goods" in 1983, but, more importantly, that year it also significantly revamped its requirements. Overnight, and, as of 1 January 1983, IATA completely aligned its requirements with ICAO's.

From the very beginning, the IATA Dangerous Goods Regulations were binding upon all IATA member airlines in scheduled and non-scheduled operations as well as upon non-IATA carriers participating in the IATA Multilateral Interline Traffic Agreement – Cargo.

The importance and need for developing regulations covering the acceptance of radioactive material was recognized by IATA in the late 1950s, particularly in the light of increasing demands from air transport for carriage of a wide range of radioactive isotopes for commercial, medical, research and other peaceful purposes.

Originally, the IATA requirements for radioactive material — one of the nine classes of articles covered by the IATA Restricted Articles Regulations — had largely been based on the US Department of Transport Regulations. The new regulations for radioactive material became effective on 1 June 1958, and provided for shipment of larger sources and higher activity than previously permitted.

At the same time, new and detailed packaging provisions were introduced for these larger quantities of radioactive material. One such requirement was that the container should be of such mechanical strength and design as to minimize the likelihood of breakage or leakage in a severe accident or fire. Shippers and producers were also required to supply the accepting carrier with a certificate in duplicate (original to accompany the consignment), issued and signed by the appropriate government authority in the country of origin, testifying that the container complied with all the requirements specified. This certificate was in addition to the standard shipper's declaration required for the carriage of restricted articles.

In the early 1960s, IATA followed developments with great interest and participated in the research work carried out by the IAEA to develop a set of standards and procedures for the safe transport of radioactive material by all means of transport. The expanding use of radioactive material for peaceful purposes, coupled with the many technical and other problems posed in international transport, clearly demonstrated the need for uniform regulations.

Over a period of four years, the IATA Restricted Articles Board held numerous meetings with representatives of the IAEA and the atomic energy authorities of the main isotope-producing countries to discuss matters of mutual interest and to formulate industry requirements pertaining to air transport. The final provisions of the IATA Regulations on Radioactive Material, embodying the IAEA principles, were published in the eleventh edition of the IATA Restricted Articles Regulations, effective 1 October 1967. The IAEA regulations were periodically updated to take into account the latest safety information, practices and technologies related to packaging and transport of radioactive material. The updated regulations were then incorporated into requirements of individual Member States and international modal organization agreements, conventions and requirements.

In 1996, the IAEA published an updated edition of its Transport Regulation ST-1, which was reissued as TS-R-1, to supersede Safety Series No. 6 (SS6), the 1985 (as amended 1990) regulations. Difficulties were anticipated when switching from the 1985 edition of the IAEA transport regulations to the 1996 edition. These difficulties came mainly from the differences between the two sets of regulations, e.g. the definition of radioactive material with new nuclide-specific exemption levels, new values for A_1/A_2, annual dose limits, related documentation, labelling requirements for fissile material package, changes in UN number and proper shipping names, shipment of fissile material by air, etc.

Originally, a worldwide adoption date of 1 January 2001 was recommended for incorporation of TS-R-1 into modal and State requirements. Despite efforts at an international level to support a uniform implementation date, this soon proved not to be practical. Individual Member State intentions remained less defined, as the timing and extent of incorporation of TS-R-1 is governed by national legislative procedures.

The initial dates for permitting use of TS-R-1 were subsequently deferred and synchronized to 1 July 2001 for cases of the ADR (European agreement concerning the international shipment of dangerous goods by road), RID (regulation concerning the international shipment of dangerous goods by rail) and the International Civil Aviation Organization (air mode). In the case of the air mode, no transition period was adopted, so that air shipments of radioactive materials aligned with TS-R-1 started on 1 July 2001. For land transport and sea transport (International Maritime Dangerous Goods Code of the International Maritime Organization), the beginning dates for use of TS-R-1 and the ending dates for use of SS6 were staggered, so that during the "transition period" either TS-R-1 or SS6 could be applied.

From the outset, for a given shipment, use of a single set of regulations for non-air shipments during the transition period was strongly encouraged. It was considered that the set of regulations chosen should apply to the shipment from its origin to its destination. This meant that a shipment made pursuant to TS-R-1 during the transition period should comply with TS-R-1 only, and not comply with SS6 (complete, concurrent compliance with both TS-R-1 and SS6 is not possible). It was considered that complying with sections of TS-R-1 for certain requirements and sections of SS6 for other requirements (e.g., picking the most restrictive A_1/A_2 value for each nuclide) was a practice that should be strongly discouraged because it is practically and administratively confusing and burdensome, has a high potential for actual or perceived non-compliance, and represents a possible challenge to shipment safety. A shipment made during the transition period utilizing TS-R-1, as a matter of compliance, needs to comply with TS-R-1 in total. This means that the new requirements of TS-R-1, such as radiation-protection programmes, need to be in place to enable a shipment to be in compliance with TS-R-1. The practical impact of this is that, for a consignor and carrier to use TS-R-1 during the transition, he or she will have had to review their programmes for compliance possibly even before the transition period began. This was particularly important for air shipments, because ICAO did not have a transition period for the change to TS-R-1.

To help in the transition from SS6 to TS-R-1, IATA published in the autumn of 2000 a special edition of its 2001 Dangerous Goods Regulations (42nd DGR), which contained the SS6 provisions remaining in effect until 30 June 2001 and the new TS-R-1 provisions that became effective on 1 July 2001. This simplified training requirements and allowed the airline industry to take proactive steps to inform its users, including shippers, operators (carriers), consignees, package designers and emergency responders, of the pending changes to the regulations.

The new provisions of TS-R-1 introduced several changes that affected the airlines. As a result of the changing definition of radioactive material, with radionuclide-dependent material specific activity exemption limits and exempt consignment activity in TS-R-1, materials that were previously not defined as radioactive under Safety Series No. 6 could now be defined as radioactive under TS-R-1, and vice versa. Because of the revised A-values there were new conveyance limits for LSA/SCO. All packages used for air transport of radioactive material by air need to retain their content under a reduction in ambient pressure to 5 kPa. In TS-R-1, the transport index is used solely for radiation control. A new index, the criticality safety index (CSI), is used for criticality control. The CSI effectively replaces the TI for criticality control used in Safety Series No. 6 as the limit on the sum of TI and the limit on the sum of CSI on a conveyance are not necessarily the same.

Radiation protection programmes are explicitly required by TS-R-1 for the transport of radioactive materials. The revised Basic Safety Standards set a 20 mSv annual exposure limit (averaged over five years), with a maximum of 50 mSv in any one year. The elements of a radiation protection programme may differ substantially, according to the nature and number of transport and their radiological significance.

4. CONCLUSION

Looking back, one could say that the transition to the new IAEA provisions happened with a minimum of fuss for the air mode. This is probably because of the advance communications, arrangements and training provided to the industry, and the decisions to streamline acceptance using one set of regulatory requirements. This one decision allowed the industry to concentrate their training efforts on a single set of requirements, which led to less confusion and, therefore, to greater safety.

Looking forward, we expect the thirteenth edition of the UN Model Regulations (publication due in 2003) to be consistent with the 2003 edition of the IAEA Transport Regulations. This will lay the foundation for the 2005 edition of the international modal transport regulations.

Accordingly, it is anticipated that, on 1 January 2005, the air mode will adopt the 2003 edition of the IAEA Transport Regulations. It is also expected that the same schedule will apply to the marine mode and to countries that implement the European road and rail regulations.

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ADDRESS BY COOPERATING ORGANIZATION

PROMOTING THE SAFE TRANSPORT OF RADIOACTIVE MATERIAL
Activities of the ISO

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Abstract

Standards help to make life simpler and to increase the reliability and effectiveness of goods and services. The International Organization for Standardization (ISO) plays a key role in developing standards at the international level, including those that apply to the packaging and transport of radioactive material. Such standards can have positive effects, not only on engineers and manufacturers, but also on society as a whole. ISO standards are useful to industrial and business organizations of all kinds, to governments and other regulatory bodies, to trade officials, to conformity-assessment professionals, to suppliers and customers of products and services both in the public and private sectors, and, ultimately, to consumers and end-users in general. The paper outlines the role ISO is playing in this field and summarizes the status of standards that apply to the packaging and transport of radioactive material.

1. INTRODUCTION

Standards make enormous contributions to many aspects of our lives, although, very often, those contributions are invisible. In their absence, their importance becomes apparent. For example, we soon notice when products we purchase and use turn out to be of poor quality, do not fit, are incompatible with equipment we already have, are unreliable or dangerous. When products meet our expectations, we tend to take it for granted. We are usually unaware of the role played by standards in raising levels of quality, safety, reliability, efficiency and interchangeability — as well as in providing such benefits economically.

For example, the format of the credit cards, phone cards and "smart" cards that have become commonplace is derived from an international standard developed by the International Organization for Standardization (ISO). Adherence to the standards that define such features as optimal thickness (0.76 mm) means that the cards can be used worldwide.

International standards thus contribute to making life simpler, and to increasing the reliability and effectiveness of the goods and services we use, and have important economic and social repercussions. They make a positive difference, not just to engineers and manufacturers for whom they solve basic problems in production and distribution, but to society as a whole.

The international standards that ISO develops are useful to industrial and business organizations of all kinds, to governments and other regulatory bodies, to trade officials, to conformity-assessment professionals, to suppliers and customers of products and services in both public and private sectors, and, ultimately, to consumers and end-users in general.

This paper describes benefits that accrue from international standards with respect to the safe transport of radioactive material.

2. THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

International standardization began in the electrotechnical field: the International Electrotechnical Commission (IEC) was established in 1906. The International Federation of the National Standardizing Associations (ISA), which was set up in 1926, carried out pioneering work in other fields. The emphasis within ISA was heavily on mechanical engineering; its activities ended in 1942.

In 1946, delegates from twenty-five countries met in London and created a new international organization, the object of which was "to facilitate the international coordination and unification of industrial standards". The new organization, ISO, officially began operations on 23 February 1947.

ISO is a network of the national standards institutes in 147 countries, on the basis of one member per country, with a Secretariat in Geneva, Switzerland, that coordinates the system. While standardization is the work of several thousands of experts, only about 170 full-time staff are based in Geneva.

ISO is non-governmental. In contrast with the United Nations system, its members are not delegations of national governments. Nevertheless, ISO occupies a special position between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their governments. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations.

Therefore, ISO is able to act as a bridging organization in which a consensus can be reached on solutions that meet both the requirements of business and the broader needs of society, such as the needs of stakeholders' groups like consumers and users.

3. WHAT IS AN INTERNATIONAL STANDARD?

Standards are documented agreements, containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes or services are fit for their purpose.

One important characteristic of an ISO international standard is that it is achieved through consensus at the national and international levels. Each national standards institute has the duty to seek consensus among all the stakeholders in its country. Thereafter, an ISO international standard can be approved and published only when consensus is reached among all involved national delegations.

4. ROLES OF IAEA REGULATIONS AND ISO STANDARDS

With regard to the safe transport of radioactive material, the International Atomic Energy Agency (IAEA) has established the Regulations for the Safe Transport of Radioactive Material, known as TS-R-1, which is the worldwide basis for all national, regional and international regulations, such as the:

- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR),
- Regulations concerning the International Carriage of Dangerous Goods by Rail (RID),
- Technical Instructions (TIs) for the Safe Transport of Dangerous Goods by Air, set forth by the International Civil Aviation Organization (ICAO),
- International Maritime Dangerous Goods (IMDG) Code, set forth by the International Maritime Organization (IMO).

The IAEA regulations acknowledge the importance of standards. Except for the lowest categories of packages, it requires, as stated in para. 638, that "the design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority".

The IAEA regulations are supported by a companion document, namely the Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, known as TS-G-1.1. The rationale for the requirement to use standards is given in para. 638.1 of TS-G-1.1: "Many national and international standards exist covering an extremely wide range of design influences and manufacturing techniques, such as pressure vessel codes, welding standards or leaktightness standards, which can be used in the design, manufacturing and testing of packages. Designers and manufacturers should, wherever possible, work to these established standards in order to promote and demonstrate adequate control in the overall design and manufacture of packages. The use of such standards also means that the design and manufacturing processes are more readily understood by all relevant people, sometimes in different locations and Member States, involved in the various phases of transport; most importantly, package integrity is much less likely to be compromised."

Four ISO standards are included in the IAEA TS-R-1 regulations, while eleven are mentioned in the Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (TS-G-1.1). The four ISO standards included in TS-R-1 are:

— Radiation Protection — Sealed Radioactive Sources — Leakage Test Methods [ISO 9978:1992 (E)],
— Series 1 Freight Containers — Specifications and Testing — Part 1: General Cargo Containers [ISO 1496-1:1990(E)],
— Packaging of Uranium Hexafluoride (UF_6) for Transport [ISO 7195:1993(E)],
— Sealed Radioactive Sources — Classification [ISO 2919:1980(E)].

The eleven ISO standards mentioned in TS-G-1.1 are:

— Series 1 Freight Containers — Specifications and Testing — Part 1: General Cargo Containers [ISO 1496-1:1990(E)],
— Packaging of Uranium Hexafluoride (UF_6) for Transport [ISO 7195: 1993(E)],
— Safe Transport of Radioactive Material — Leakage Testing of Packages [ISO 12807:1996(E)],

— Radiation Protection — Sealed Radioactive Sources — Leakage Test Methods [ISO 9978:1992(E)],
— Series 3 Tank Containers for Liquids and Gases — Specification and Testing [ISO 1496-3:1990(E)],
— Radioactive Materials — Packaging — Test for Contents Leakage and Radiation Leakage [ISO 2855:1976(E)],
— Sealed Radioactive Sources — Classification [ISO 2919:1980(E)],
— Quality Systems — Model for Quality Assurance in Design, Development, Production, Installation and Servicing [ISO 9001:1994(E)],
— Series 1 Freight Containers — Specification and Testing — Part 3 : Tank Containers for Liquids, Gases, and Pressurized Dry Bulk [ISO 1496-3:1995(E)],
— Discussions on a Unified Method of Test for Quasi-Static Fracture Toughness (N128:1994),
— Nuclear Energy — Fissile Materials — Principles of Criticality Safety in Storing, Handling and Processing [ISO 1709:1995(E)].

5. INTERNATIONAL STANDARDS IN SUPPORT OF SAFE TRANSPORT OF RADIOACTIVE MATERIAL

5.1. From requirements to guidance

Clearly, it is the responsibility of the IAEA and the modal regulatory agencies, such as the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO), to establish requirements for safe transport of radioactive material. ISO standards are not requirements per se, they are companions to the IAEA regulations. The following examples illustrate how they support the IAEA regulations. They can be directly associated with the requirements (although, as explained previously, not intrinsic components of the requirements) or be used for guidance.

5.1.1. Requirements

Uranium hexafluoride (UF_6) is transported worldwide using specifically designed equipment that can be accommodated at all of the facilities where it is processed. The international standard is ISO 7195: Packaging of Uranium Hexafluoride (UF_6) for Transport. In the course of its development, all aspects, and particularly hazards, were taken into account. As a consequence of this standard, the IAEA regulations require UF_6 to be transported in packaging that meets the ISO 7195 standard. The ISO standards take into account the toxicity of the material. Compliance with the ISO standard is a requirement of the IAEA regulations (para. 629).

5.1.2. Alternative requirements

The IAEA regulations set forth requirements for what are called industrial packages (IPs).

There is an ISO standard that deals with the freight containers commonly used to ship goods. This standard is ISO 1496: Series 1 Freight Containers — Specifications and Testing — Part 1: General Cargo Containers.

The use of the containers that meet this standard provides a level of safety equivalent to IPs for the transport of low specific-activity (LSA) material or surface contaminated objects (SCOs). This is recognized in IAEA regulations (para. 627) in which compliance with the ISO standard is an alternative requirement to the basic regulations.

5.1.3. Guidance

Eleven ISO standards are mentioned in the guide, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (TS-G-1.1). One of them is the ISO bestseller, ISO 9000, which deals with quality-management systems. This is a good example of how ISO standards provide guidance that is duly recognized in TS-G-1.1.

5.1.4. Additional guidance

Finally, besides IAEA regulations (TS-R-1) and advisory material (TS-G-1.1), ISO international standards provide guidance in many fields. They are routinely used in manufacturing, whether for radioactive material itself or its packaging, or the conveyance carrying the package. This is because ISO standards are available, for example, for welding techniques, but also for measurement, testing and control processes. The accrued benefits, explained in Section 4, are supported in para. 638.1 of TS-G-1.1.

5.2. Domains covered by ISO standards

The safe transport of radioactive material is fostered through a large number of international standards, from very general domains to very specific.

First, transport of radioactive material is a service that has characteristics in common with other services, even those outside the transport domain. Therefore, general standards that apply to all services are applicable also to transport of radioactive material. The ISO 9000 standard — about quality-management systems — is an example of general standards that are applicable to the transport of radioactive material.

Second, transport of radioactive material entails the physical movement of the material. Standards relevant to transport in general apply also to the safe transport of radioactive material. An example is provided by the standard for freight containers, ISO 1496: Series 1 Freight Containers — Specifications and Testing — Part 1: General Cargo Containers, already mentioned in Section 5.1.2.

Third, transport of radioactive material takes account of the characteristics of the radioactive material itself. Standards for, for instance, radioactive sources, are relevant. This is the case of ISO standard 2919, Sealed Radioactive Sources — Classification [ISO 2919:1980(E)], which provides alternative requirements to those of the basic IAEA regulations, duly recognized in para. 709 of the latter, similar to the standard for freight containers, as explained in Section 5.1.2.

Fourth, a few standards are dedicated to the transport of radioactive material. A first typical example of such a standard is ISO 7195, Packaging of Uranium Hexafluoride (UF_6) for Transport, compliance with which is a requirement included in the IAEA regulations. Another example is ISO standard 12807, Safe Transport of Radioactive Material — Leakage Testing of Packages. This standard is mentioned in TS-G-1.1.

5.3. Equipment and methods

Standards fall into two distinct types: the first describes materials and equipment, whilst the second describes methods. The first category describes the nature of a material; the second one describes how to reach an objective.

The first category includes standards like ISO 7195, Packaging of Uranium Hexafluoride (UF_6) for Transport, already mentioned: it provides, among other aspects, specifications (geometry, materials, components, etc.) for the manufacturing of cylinders for transporting uranium hexafluoride.

The second category includes ISO 12807, Safe Transport of Radioactive Material — Leakage Testing of Packages, in which several methods are described. It does not describe the equipment, but specifies expected performance.

6. WHY USE INTERNATIONAL STANDARDS FOR THE TRANSPORT OF RADIOACTIVE MATERIAL?

An international standard is the result of broad consensus within and between countries. The direct consequence is that the contents of the standards are widely recognized, as a result of which benefits are several.

First, using standards allows demonstration to authorities that overall operations have been mastered. This can be true for all phases of transport, ranging from packaging design to package manufacturing, from preparation for shipment to completion of transport.

Second, the use of standards fosters understanding by all directly involved organizations. Transport is an activity involving intervention by many people: they have many positions in many different countries. An international standard is a tool that is easily shared by all.

Finally, using international standards can also increase public confidence in the safety of the transport of radioactive material. International standards are tools that have been broadly discussed and widely accepted.

7. CHALLENGES FOR THE FUTURE

The content of a standard is the best recommendation based on current information. However, techniques and know-how continue to progress. The first challenge is to keep the door open to innovative improvement, even when requiring explicit or implicit implementation of a standard.

The second challenge stems directly from the first. When new solutions are sufficiently developed, it is important that the existing standards are updated rapidly, or that new standards are developed expeditiously.

Finally, it has been mentioned several times that the strength of a standard is largely due to its developmental process: an ISO standard represents a consensus. But a consensus is only valid if a sufficient number of people were involved in its preparation. This means that we can progress if many experts are interested. The last challenge is not the least: the process of preparation of standards must be an endeavour attractive to the most knowledgeable experts.

THE IAEA AND THE SAFE TRANSPORT OF RADIOACTIVE MATERIAL

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Abstract

Within the United Nations family, the International Atomic Energy Agency (IAEA) is solely responsible for establishing standards for the protection of health against the detrimental effects of ionizing radiation. The IAEA is also responsible, at the request of Member States, for providing for the application of its own standards of safety. The paper describes the functions of the IAEA in terms of the safe transport of radioactive material, explaining how its standards interact with regulations and norms for safe handling of dangerous goods in general as established by other international organizations. In addition, a number of recent safety concerns are discussed, especially in relation to maritime transport of radioactive material.

1. INTRODUCTION

Radioactive material is transported around the world in vast amounts. It consists not only of fuel for, and radioactive waste from, nuclear power plants, but also of substances for medical diagnoses and treatment, sterilization, agriculture, food preservation and education, and a plethora of industrial applications including oil production. The presumption underlying this paper is that transport of radioactive material is necessary for many beneficial purposes. The role of the IAEA is to assist Member States in ensuring that the transport of such material occurs under internationally recognized conditions of radiation safety.

In addition to radioactive material, eight other classes of dangerous goods are recognized as requiring special safety precautions. From a global perspective, radioactive material constitutes less than 15% of transported dangerous goods. Within this small fraction, the largest number of packages (around 10% of the total) is transported by air, not by sea or by land.

This paper will focus mainly on:

— the IAEA's functions relating to radiation safety in the transport of radioactive material,
— international concerns about safety during the transport of radioactive material,
— an outlook for the future.

2. FUNCTIONS OF THE IAEA

Pursuant to its statute, the IAEA:

— establishes international standards of safety for the protection of health against the detrimental effects attributable to radiation exposure,
— provides for the application, at the request of Member States, of the standards of safety established by it.

Also, the IAEA services international conventions under which States assume legally binding obligations relating to radiation safety.

In discharging the above functions, the IAEA operates a programme on the safety of transport of radioactive material, which is part of its programmatic activities in radiation safety.

3. ESTABLISHING STANDARDS

The IAEA transport-safety standards form part of a de facto international system of radiation safety standards that works as follows.

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP) constitute the basis of the system. Within the UN family, UNSCEAR provides estimates of health effects attributable to ionizing radiation exposure, which form the basis of all radiation safety standards. These estimates are reported yearly to the UN General Assembly. The ICRP — a professional scientific non-governmental organization — makes recommendations on protection against the detrimental effects attributable to ionizing radiation. The IAEA's Board of Governors has requested that, in preparing its safety standards, the IAEA take account of ICRP's recommendations.

The scientific findings of UNSCEAR and ICRP are provided to the IAEA, which then establishes international radiation safety standards.

The IAEA's process for establishing such safety standards is necessarily complex. Four technical committees are involved: the Nuclear Safety Standards Committee, the Radiation Safety Standards Committee, the Waste Safety Standards Committee and the Transport Safety Standards Committee, this last being the relevant committee in the area of safety of transport of radioactive material. Membership of the committees is open to senior experts nominated by Member States of the IAEA. The committees, drawing on the expertise of their members, prepare the basic drafts of the standards, which are submitted for review to a Commission on Safety Standards, mainly constituted by senior officers of national regulatory bodies. After the Commission has endorsed the safety standards, they are submitted to the IAEA's Board of Governors for formal approval.

The IAEA standards have a hierarchical structure with three levels: fundamentals, requirements, and guides. The more important transport-related documents in the hierarchy are:

— The Radiation Protection Fundamentals (Safety Series No. 120, issued in 1996), which spell out the basic policy of radiation safety and were co-sponsored by all relevant organizations within the UN family;
— The International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources (Safety Series No. 115, issued in 1996), co-sponsored by all relevant organizations within the UN family;
— The Regulations for the Safe Transport of Radioactive Material (issued in 1996 as Safety Standards Series No. ST-1 and re-issued, with minor editorial changes, in 2000 as Safety Standards Series No. TS-R-1 (ST-1 Revised)), which were prepared in cooperation with transport-related organizations with the UN family;
— A large number of safety guides containing instructions directly and indirectly related to transport safety (e.g. on occupational radiation protection).

Given the international dimension of transport, after approval, the transport safety standards established by the IAEA are incorporated into the UN Model Regulations for the Transport of Dangerous Goods. Within the UN family, the UN Economic and Social Council (ECOSOC) is the body that, as early as 1961, requested the IAEA to establish transport safety standards, and the development of the UN Model Regulations is the responsibility of ECOSOC. The UN Model Regulations apply to all nine classes of dangerous goods, and the standards of the IAEA serve as the sole input for the so-called "Class 7 radioactive material".

The UN Model Regulations (and, therefore, the IAEA standards) provide the basis for safety codes for various modes of transport. These are issued by so-called “modal organizations”, agencies within the UN that deal with various transport modes. They include the International Civil Aviation Organization (ICAO), which issues Technical Instructions for air transport, and the International Maritime Organization (IMO), which issues the International Maritime Dangerous Goods (IMDG) Code for maritime transport. (For these two modes of transport in particular, the IAEA’s standards become mandatory via those documents.)

In addition, there are regional bodies that produce regulations for transport of dangerous goods by road, rail and inland waterways. In the case of inland waterways, the UN Economic Commission for Europe (ECE) incorporates the IAEA standards into the European Agreement for the International Carriage of Dangerous Goods on Inland Waterways. The ECE also incorporates the standards into similar regulatory documents relating to road transport. All of these are implemented in accordance with national undertakings, agreements or conventions.

On the basis of these various international requirements, norms are derived for the fabrication of packages and for transport operations. For example, the International Organization for Standardization (ISO) has the responsibility of establishing norms used by the industry. In the case of air transport, the International Air Transport Association (IATA) issues the codes that apply the standards to operation of its associated carrier companies.

Figure 1 shows how the stream of knowledge and specifications flows. The smooth completion of this convoluted process takes time: for instance, the incorporation of the 1996 IAEA Transport Regulations into the UN Model Regulations took three years.

An important aspect of this international system of safety standards for the transport of radioactive material is its universality: the IAEA’s transport safety standards are applied almost all over the world.

Moreover, the international system can show impressive achievements. In its latest report, UNSCEAR did not report on the impact of transport operations, as their radiological consequences are negligible in comparison with those of other sources of radiation exposure around the world.

4. UNDERTAKINGS

It should be noted, however, that the IAEA radiation safety standards for transport and their derivatives — the UN Model Regulations, the codes of modal organizations and the norms issued by industry organizations — are not legally binding, except on certain organizations of Member States pursuant to specific commitments. While there are several legally binding undertakings in the area of transport safety (including the Chicago Convention for air transport, and the United Nations Convention on the Law of the Sea (UNCLOS) for maritime transport), no convention is specifically related to the safety of transport of radioactive material.

However, in relation to radiation safety in general, four main legally binding undertakings, while not being specific to transport activities, can, mutatis mutandis, be applied to transport operations:

— the Convention on Early Notification of a Nuclear Accident (the Early Notification Convention),
— the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (the Assistance Convention),
— the Convention on Nuclear Safety,
— the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the Joint Convention).

FIG. 1. The process of establishing standards.

The Early Notification Convention is certainly applicable to transport: if a transport accident involving transboundary releases of radioactive material occurs, notification must be given. The Assistance Convention also applies: if a transport accident occurs, assistance can be requested.

In addition, a number of obligations under the Joint Convention relate to transport, because movements of radioactive waste and spent nuclear fuel are covered in the Joint Convention.

5. APPLYING THE STANDARDS

Once the standards are established, the next important IAEA function is to provide for their application at the request of Member States. There are five IAEA mechanisms for doing this. The first mechanism is the provision of assistance to requesting States under the IAEA's technical cooperation (TC) programme, usually through TC projects. The second is the fostering of exchanges of information about the standards. The third is the promotion of education and training. The fourth is the promotion and coordination of research and development. Finally, the fifth is the rendering of transport safety appraisal services.

In many radiation safety areas, but not transport, the IAEA's TC programme is extensive. It is rather disappointing that Member States have not requested much assistance related to application of the transport standards.

With regard to the fostering of information exchange, this conference is an example of many IAEA activities. International competent authorities' approval certificates for package designs provide a transparent overview for users of the transport regulations. The list of national competent authorities responsible for package approvals and authorizations is a much-sought IAEA publication.

The IAEA is one of the world's leading institutions for education and training in transport safety. It offers a large number of training courses with standardized curricula and material, helping to ensure that the transport regulations are applied properly.

With regard to research and development, the IAEA's role is to recognize problems with the application of the standards and then to coordinate research and development in solving them. For instance, IAEA coordinated research into surface contamination of transport casks was a controversial issue in Europe a few years ago. In the area of transport by land, much scientific material has been collected, for example through simulated accidents involving trains and trucks impacted with containers. We can learn much from such tests, including how the standards are being applied and whether they are adequate.

In the case of maritime transport, research is much more complicated and expensive. The IAEA supported a coordinated research project on the probability and severity of accidents during maritime transport of radioactive material. The project included modelling of a collision of two ships and the structural and thermal consequences for the cargo. The conclusions, published two years ago, were positive. Unfortunately, many coastal States, although invited, did not participate.

With regard to the appraisal of Member State compliance with its safety standards, the IAEA offers the Transport Safety Appraisal Service (TranSAS) whereby a group of senior experts, as peers of their national counterparts, visits a country to appraise whether it is applying the international safety standards correctly in all operations involving the transport of radioactive material. There have been TranSAS missions to Brazil, Slovenia, Turkey, the United Kingdom and Panama, and a TranSAS mission has been requested by, and is being planned for, France. The results of TranSAS missions are, if the country visited agrees, published in a special IAEA series. As the Director General indicated in his opening address, it is important that Member States avail themselves of TranSAS.

6. ADEQUACY OF THE TRANSPORT SAFETY REGIME: ADDRESSING CONCERNS

The foregoing has been a brief description of the international regime for the safety of transport of radioactive material. An important question has been asked in many countries, especially the coastal States: is this regime adequate? Certainly many members of the public are not convinced that it is, as wide public concern has shown. Technical experts cannot ignore this concern, and perhaps the time has come to address it.

I would like to recall questions asked by the Director General in his opening presentation that will probably be addressed during this conference.

- Is the current regulatory regime sufficient, and, if not, what improvements are needed?
- Do all States apply the safety standards uniformly? We know that minor problems exist, and colleagues who spoke before me mentioned some of them.
- How can adequacy of regulations and of the manner in which they are applied be demonstrated in a transparent manner, and, in particular, can the work done within the framework of the Transport Safety Standards

Committee and the Commission of the Safety Standards and of TranSAS be improved?

— Why has so much concern been expressed about the transport of plutonium, irradiated fuel and high-level waste? This concern is widespread, and we must ask ourselves how it can be addressed.
— Is the present international regime for emergency notification and response suitable for dealing with emergencies involving the transport of radioactive material? When this regime was established, people had in mind accidents like that at Chernobyl (i.e. on land, not on the high seas).[1] However, with adjustments, the regime could be suitable. The question is: what adjustments should be made?

To all such questions, answers can and should be found within the framework of this conference.

7. OTHER ISSUES OF CONCERN

In addition to the above mentioned issues of adequacy of the international transport safety regime, other related issues continue to cause concern.

As mentioned by the Director General, the absence of a nuclear liability regime that is comprehensive in terms of coverage and membership is having a considerable impact on the confidence placed in radioactive material transport operations. The regimes established by the Paris and Vienna Conventions are linked by a joint protocol, but the parties to the Conventions and the joint protocol are limited in number and the coverage is constrained.

Moreover, there seems to be a need for timely and effective communications between concerned governments and between those governments and the public at large. The IAEA's General Conference has recognized this issue. However, while improvement in communications will also improve safety — as people who are well informed can react in a better way — it may jeopardize security. This is an issue of great concern, particularly after the events of

[1] The subject of radiological emergency planning, preparedness and response in the transport area has generated a great deal of interest. Internationally, two conventions are particularly relevant: the Early Notification Convention (eighty-four member countries) and the Assistance Convention (eighty member countries). The IAEA has an Emergency Response Centre that operates 24 h/day, notifying Member States of any emergencies, providing authoritative information and offering assistance in the event of a radiological emergency to all countries that are part of the regime.

11 September 2001. A proper balance must be established between safety and security in relation to communication requirements.

8. OUTLOOK

This conference is intended to foster an exchange of information on the international status of the safety of transport of radioactive material. The IAEA hopes that the exchange of information among senior specialists will lead to important findings that can be submitted to the IAEA's policy-making organs: the Board of Governors and the General Conference. If these organs conclude that there are issues to be addressed by the IAEA, they will probably request the Secretariat to draw up and implement an international action plan accordingly. I believe that this conference will indeed produce important findings and that, therefore, an international action plan may be needed to address them.

The IAEA Secretariat's road map is simple: the conference findings will be submitted in September to the Board of Governors and the General Conference, which may decide to request an action plan; if requested to do so, the Secretariat will, together with outside experts, draw up an international action plan on the safety of transport of radioactive material and submit it for approval to the Board. Approval could occur as early as March 2004.

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RADIOACTIVE MATERIALS TRANSPORT
A summary of the Institution of Nuclear Engineers' Conference in 2002

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Abstract

A number of conferences and symposia have brought together experts in the field of the transport of radioactive material to facilitate communication. The latest of these was the sixth international transport conference arranged by the Institution of Nuclear Engineers, convened in Edinburgh, Scotland, in November 2002. The paper provides an overview of the papers presented and discussions.

1. INTRODUCTION

The International Organization for Standardization (ISO) is a professional institution the aims of which include the promotion and advancement of nuclear engineering and allied branches of science and engineering. Accordingly, ISO arranges conferences on a wide range of nuclear-related topics, and in November 2002, it held its sixth international transport conference, Radioactive Materials Transport — 2002. This paper summarizes recent developments as presented at the conference. The event was open to all, and although guidelines were given, no restriction was placed on the subject matter of papers within the transport field. The papers fell broadly into three subject areas — regulation, packaging and experience — which are retained in this summary paper.

The proceedings of the conference were published by Nuclear Technology Publishing [1], and since they are fully indexed, the papers are not individually referenced here.

2. REGULATION

Regulation of the transport of dangerous goods has a long history; some national regulations are reported to have existed over 225 years ago. The modern basis of regulation, however, has developed since the Second World War. Pope and Rawl describe the harmonized system that we have today, which is based on a combination of national and international regulatory instruments. For transport of radioactive material, the source document is the IAEA regulations, which were first formulated following a request from the United Nations Economic and Social Council. These regulations, which are supported by a range of advisory documents, are incorporated into the United Nations Model Regulations for the Transport of Dangerous Goods, known colloquially as the "orange book". These model regulations are promulgated internationally by the relevant international bodies and agreements, viz. ICAO, IMO, RID/ADR/ and MERCOSUR/MERCOSUL, via the respective conventions, and become binding international requirements. These are incorporated into national legislation in Member States in accordance with their legislative structures. In this way the IAEA regulations are incorporated into the regulatory framework of virtually all Member States.

The introduction of the new IAEA transport regulations into international and national regulatory frameworks has given regulatory affairs a high profile over the last couple of years. This was reflected in a number of papers presented at the Edinburgh conference. In their keynote paper, Davidson and Young explained the regulatory process, and the consequences of the IAEA regulations being implemented not directly but via the international and national modal transport regulations. Hitherto, the IAEA regulations have been updated infrequently, and this has required major readjustments by users of the regulations. The change to the two-yearly review cycle has brought radioactive material transport regulation into harmony with the regulatory process for the transport of other classes of dangerous goods. Considerable work has been involved in the recent developments and some delays have occurred, but the latest review was produced in time for inclusion in the 2003 edition of the UN model regulations. The complexity of the regulatory framework remains, however, and the paper concluded that a simpler system, possibly with a single piece of legislation to cover all transport modes, might be favoured by some businesses.

The complex nature of the regulations and its effect on the user was the subject of a paper by Malesys of Cogema Logistics. The transition from the 1985 to the 1996 regulations was cited as having been particular burdensome, not least because of the differences in the transition timescales across the various transport modes and the variation between States. The introduction of nuclide-specific exemption levels and the revision of the A_1 and A_2 values were two areas that required operator training and special care. The change in the UN number system away from a contents base to a package-type base has caused confusion owing to different interpretation and practices among

Member States. All of these features were reported to have added to the regulatory burden, with the necessity sometimes of changing the package labelling at national frontiers. The writer concluded that the regulatory system has not been user-friendly and the change has been costly. A more unified approach internationally by the industry, for example through the World Nuclear Transport Institute (WNTI), and by safety institutes, Member States and international organizations was seen as the way towards harmonization and simplicity in the future. Poslusny described the USNRC's Strategic Plan that places great importance on increasing public confidence in the regulatory process and on clear communication and reporting of performance.

In a keynote paper, Green of WNTI praised the outstanding safety record of radioactive material transport, which has resulted both from sound regulation and from professionalism among the operators. The need for co-operation between the regulator and the user was emphasized, as was the importance of sharing information and consolidation of industry's position internationally. The national and modal variations in the transition to the new regulations were observed to have been confusing; consistency and predictability are the keys to effective compliance. Security of radioactive cargoes has become a significant issue following recent world events, and the industry is going to have to strike a balance between the traditional safety approach, which requires clear declaration, and the need to maintain security.

Compliance with the regulations is the key to transport safety, and in recognizing this, the IAEA has developed its Transport Safety Advisory Service (TranSAS), described by Pope and Dicke. The TranSAS was initiated in 1999 and is available to any Member State on request. The objective of the TranSAS is to appraise a State's regulatory practices and make appropriate recommendations for possible improvement. TranSAS also has scope for highlighting good practices that might be emulated. The first appraisal was carried out in Slovenia, followed by Brazil and the United Kingdom. The UK appraisal, which addressed the entire regulatory framework but with emphasis on sea transport, was reported in detail, including the scope, the activities and the outcome of the appraisal. Further TranSAS missions have been requested by France, Panama and Turkey.

Continuing the theme of safety in transport, Goodchild recalled the history of the INF Code and explained how it has followed the development of purpose-built vessels capable of withstanding marine incidents and completing their voyage without the need to refuel or enter ports en route. These features are important in gaining public acceptance and contribute to the security of the cargo.

Discussing the transport of non-nuclear radioactive material, a very important sector of the industry sometimes overlooked, Charette described the breakdown of the unilateral approval concept that is provided for in the regulations to facilitate international operations. In practice, a number of States do not accept the unilateral approval granted by the originating country of a package design. This results in repeated validations requiring modifications to safety cases with consequent additional burden on the consignor. Despite frequent adjustments to safety cases, frequently involving additional test work, Charette observed that the package designs themselves have rarely, if ever, required modification to satisfy the differing requirements of the validating authorities. What then, Charette asked, is the benefit of the extra workload when clearly there is no material change in the level of safety?

Developments in radiological protection requirements were discussed in two presentations from the National Radiological Protection Board (NRPB). Hughes et al., in a discussion of non-fixed contamination, described the existing system, the Fairbairn model, which has been in use since the 1960s. Explaining its limitations, including a limited range of radionuclides covered, and its treatment of re-suspension and aerosol characteristics and exposure pathways, the authors concluded that the model is in many ways conservative. A revised model for calculating the dose uptake from surface contamination has been developed and is currently under discussion internationally.

Shaw and Hughes described the development of radiological Basic Safety Standards. Whereas in the 1950s compliance with individual dose limits was considered sufficient protection, the regulations have been developed to embrace the ALARA principle, the justification of practices and, most recently, radiation-protection programmes. Quoting from International Commission on Radiological Protection (ICRP) sources, the authors cited the importance of common sense and good practice in minimizing radiation doses. Looking to the future, they see continued development and use of the Basic Safety Standards with further attention to those workers who receive higher doses, largely from manual handling of medical isotope packages.

3. PACKAGING

Papers on packaging contributed greatly to the conference, and described developments in addressing regulatory concerns such as leaktightness and performance under normal and accident conditions of transport, as well as commercial considerations relating to cost and payload efficiency.

The performance of sealing materials has been under discussion for some years, and the integrity of containment seals over the full range of operating temperatures has been addressed by a number of workers following concern by the United Kingdom competent authority over the effectiveness of fluorocarbon materials at the low temperatures required for Type B(U) approvals. Vince, from the UK competent authority, presented a guide to the suitability of various seal materials in relation to regulatory requirements. The properties of several types of material, including fluorocarbon, ethylene-propylene, and silicone rubbers, were tabulated, covering operating temperature limits, permeation characteristics, responses to radiation, and compression set. Holden and Hall tested sealing materials for specific packaging requirements and have confirmed that a commonly used grade of fluorocarbon loses its efficiency below –24ºC. Ethylene-propylene was found to retain its effectiveness to –40ºC. Although the latter material exhibits a lower tolerance to high temperatures, it was found to withstand up to 330ºC for a sufficient time to meet regulatory requirements for accident conditions of transport. Moving away from the properties of seal materials towards package design and leak-testing techniques, Holden, in a separate paper, described the development of a freight container to meet the leaktightness requirements for Type IP-2 approval. Purcell has investigated the procedure for leak testing of double O-ring seal systems following wet-loading of spent fuel flasks, and proposed a revised procedure including vacuum drying of the test cavity to prevent possible masking of a leak path by water.

Numerical analysis techniques have been finding increased application in the development of safety cases and some novel developments were reported. Miyazawa et al. used analytical modelling to assess the effects of condensing water vapour from decomposition of phenolic foam in a uranium hexafluoride overpack when subjected to a fire test. The latent heat of the condensing water was shown to add heat to the package, but the temperature rise was within acceptable limits. Burt et al. used computational fluid dynamics to re-assess fuel pin temperatures in a wet spent-fuel flask. By taking account of convection and phase changes in the flask water, they demonstrated that the fuel pins reached a lower temperature than in previous calculations. The authors cited references for validation and verification of the codes used, which is an important consideration in gaining acceptance of numerical analysis in support of safety cases. Duvall described a simplistic code to assess the performance of shock absorbers as an aid to shock-absorber design and for scoping and sensitivity analysis. Ballheimer et al. studied the effects of movement of contents on impact behaviour, demonstrating that if the contents are allowed to move within the packaging, then a second impact may threaten the integrity of the lid attachment.

The new IAEA guidance document TS-G-1.1 includes a detailed consideration of the use of fracture mechanics for ensuring freedom from susceptibility to brittle fracture at low temperatures. Although performance can often be assured by using materials that retain ductility at low temperatures, for example, austenitic stainless steels, judicious use of fracture mechanics can enable a more efficient use of a material's properties. Zencker et al. used fracture mechanics to assess the safety of ductile cast-iron storage and transport containers. They stressed the importance of verification of methods for each situation, and are planning a series of drop tests to support their fracture assessments. Norton described the formulation of a brittle fracture avoidance plan. Beginning with a basic discussion of fracture principles, the plan proceeds through several stages to ensure freedom from brittle fracture, including material selection, flaw limitation and characterization, and stress limitation. Published standards and codes are used to make a failure assessment on the basis of the material and loading characteristics. Considering more extreme accident conditions, Droste et al. used a combination of test and analysis techniques to show the resistance of spent-fuel transport flasks under explosive and air-crash impact conditions.

Several new packaging developments were described, reflecting new requirements both for cargo types and for increased payload efficiency, as well as regulatory considerations. Dekker described the work of an industry working group set up under the auspices of WNTI in response to the new regulatory requirements for uranium hexafluoride packages. The required valve-protection assembly has been developed, and further work to satisfy thermal test requirements is under way. Increased payload requirements for transport of fresh mixed oxide fuels in Europe were addressed by Lallemant. Two new packagings were described, consisting of concentric steel cylinders with the annulus crossed by copper conducting bars and filled with a neutron-absorbing resin. For irradiated fuels, Kühne et al. discussed the now well established Castor transport and storage flask and the new-concept Constor flask. The former is a ductile cast-iron container, but the Constor is constructed as two steel shells with the interspace filled with concrete for gamma and neutron shielding. This economical construction has been tested against the IAEA requirements and fifteen are in use. The authors envisage a continued need to enhance specifications to cover higher burn-up and higher enrichment fuels, and increased payloads, all with close attention to economic considerations. McWilliam also discussed maximizing capacity in his description of BNFL's new Excellox 8 flask. This flask has been designed to take advantage of the reduced need for very thickly walled flasks resulting from longer cooling times at site. Hence, the reduced packaging weight has scope for increasing payload within the constraints of the existing infrastructure, i.e. rail loading gauge and flask-handling facilities. Carr and Rarok of UK NIREX described a range of containers for intermediate level wastes. The range has been developed in collaboration with customers, and includes drums for compacted waste and liquid waste, and larger containers for general purposes such as decommissioning waste. Emphasis was placed on a high degree of standardization to promote efficiency and economy.

4. EXPERIENCE

As with the regulatory and packaging sessions, this session was dominated by the transport of nuclear material. French and British operators reported their experience with the restart of spent-fuel shipments in Europe following the cessation in 1998 arising from the discovery of flask-surface contamination on arrival at La Hague. Harari, of Cogema Logistics, examined the causes of the contamination problem, concluding that it was linked to loading operations rather than flask leakage. Thus, contamination that was "fixed" at loading may have become non-fixed due to sweating, some non-fixed contamination may have escaped cleaning because of difficult access to certain parts of the flask, and some activity may have come from contaminated handling equipment. Harari emphasized the importance of collaboration between authorities and operators, improved monitoring, and the clear assignment of responsibilities, supported by effective reporting. Cavanagh, of BNFL, explained how the restart of shipments from Germany to the UK has been phased, beginning with cold-flask handling and contamination checks at the loading sites, and progressing through hot handling and test transport operations to routine shipments. A key feature of the new regime has been independent witnessing and increased surveillance by the authorities. Cavanagh explained that the BNFL flask system is inherently clean because the use of multi-element bottles reduces possibilities of contamination and the smooth external surface facilitates effective cleaning. Longfellow and Haslett gave further details of BNFL's handling procedures, describing contamination control, inspection and safety case requirements, and the controls on operator dose uptake. The flask maintenance facility has played a key role in ensuring flasks are rendered "as new".

Noring et al. explained the adaptation of GNB Castor flask lines for the transport and storage of long-cooled fuel from the Italian nuclear power programme. Existing designs were used as the basis for new flasks with payload and shielding properties appropriate to the load to be carried, and loading plans were designed to meet shielding and criticality requirements in the most efficient way possible.

Furthering the topic of transport efficiency, Delannay and Dudragne described a high-capacity fuel flask, the TN24G, holding up to 37 PWR spent-fuel elements. Constructed from forged cylindrical and end components welded together and with resin shielding on the outside, the TN24G has been licensed since 1999 and used successfully following extensive trials. Operator feedback has been a key feature in achieving success.

Moving away from spent-fuel transport, Gray discussed the logistics of transporting large items that arise from decommissioning of facilities. Such items are often surface contaminated and decisions on shipping them whole or in pieces depend on overall dose considerations; alternatively, the item may serve as its own packaging. Several examples were given, including heat exchangers and reactor pressure vessels, for which transporting as whole units was found to be efficient in terms of economics and radiological considerations.

A number of speakers reported on assessments of dose and risk. Wilkinson studied the sources of dose uptake in fuel-cycle transport operations as a key to the implementation of radiation protection programmes as required by the new regulations. Doses arising throughout the transport of fuel-cycle material were examined in some detail and it was concluded that unclassified workers or members of the public are unlikely to receive doses exceeding 1 mSv/a.

Roland titled his presentation, “How comprehensive should a transport system be?” and answered the question by stressing the importance of involvement at all levels. At the highest level, commitments to compliance and environmental protection are key. At the practical level, care is required in all activities including, for example, assurance of effective containment and package tie-down. Effective emergency planning and clear assignment of responsibilities were also stressed.

Hutchinson et al. discussed the Nirex Generic Transport Safety Assessment (GTSA), which is a broadly based assessment of the radiological and non-radiological risks associated with waste transport. Having developed a software tool known as TranSAT (Transport Safety Assessment Tool), the authors reported that it is now practical to assess the impact of individual cases and calculate the cumulative effects of producers’ proposals. In a paper accepted by the conference, but unfortunately not presented verbally, Vieru described a combination of regulatory assessment and probabilistic analysis to assess the safety and the acceptability of proposed radioactive waste shipments in Romania.

The work of the National Radiological Protection Board (NRPB) in documenting and analysing accidents and incidents was reported by Warner-Jones et al. The Radioactive Materials Transport Events Database (RAMTED), maintained by NRPB on behalf of the Department for Transport and the Health and Safety Executive in the UK, contains information obtained over 12 years on incidents during transport of some half a million packages per year. Since the inclusion of transport events in INES, INES ratings have been assigned to RAMTED events and the overwhelming majority are rated at the low levels of zero or 1.

5. CONCLUDING REMARKS

The new regulations, which are coming into closer harmony with other classes of dangerous goods, have been encompassed by the transport industry, notwithstanding some problems in the transition stages and in gaining general acceptance of unilateral approvals. The development of radiation-protection programmes and the refinement of risk-assessment methods, together with the modernization of radiological protection principles, are important features of the new regulatory scenario. Packaging continues to be a very active area and recent developments have centred on the drive towards confirmation of integrity and the pursuit of efficiency. As the nuclear industry matures, the transport of waste arisings and decommissioning items presents fresh challenges in the development both of high-volume systems and custom applications.

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REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIAL
Content and application

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Abstract

The International Atomic Energy Agency (IAEA) provides a set of requirements for the packaging and transport of radioactive material, known as the Regulations for the Safe Transport of Radioactive Material. These serve as the model for other international organizations as they develop regulatory documents relating to dangerous goods, and for individual IAEA Member States for their domestic regulations. This paper briefly discusses the IAEA Transport Regulations and elaborates on how they are applied in Argentina, which both exports and imports radioactive material and which is coastal with some sections of society concerned about the transport of large amounts of such material. From a technical perspective, Argentina understands that the transport of radioactive material, done in compliance with the existing regulations, is safe.

1. INTRODUCTION

For several decades, radioactive material has found peaceful uses in Argentina as in most countries. Consequently, its domestic transport by land, air and water can reach twenty thousand shipments per year. Most of them — approximately 95% — are related to radioisotopes supplied to about fifteen hundred users in medicine, industry and research, widely scattered throughout the country. The remaining 5% is associated with nuclear power stations. In addition, frequent shipments occur to and from the country as part of the large-scale international trade in nuclear material.

Due to its geographical characteristics, its level of development in nuclear matters and the evolution of its regulatory infrastructure, Argentina is a good subject for analysis of regulation of transport of radioactive material.

2. CHARACTERISTICS OF IAEA'S TRANSPORT REGULATIONS

International acceptance of IAEA's Transport Regulations and the high regard in which they are held are based largely on the following features.

The Regulations have a strong multi-modal character, minimizing requirements directed to any single means of transport. The essential safety requirements are in the consignment-preparation phase, with staff proficient in radiation protection, thus transportation of radioactive material does not require either special vehicles, highly qualified workers or sophisticated tools for manipulation.

The principle of intrinsic or by-design safety is applied, which establishes radioactive content limits according to the packaging resistance characteristics. This means that a package not designed to withstand accidents can be used to transport only an extremely limited amount of radioactive material such that radiological consequences of an accident would be irrelevant. On the other hand, amounts of radioactive material above that threshold should be transported in packaging designed to withstand severe accidents. Thus, safety depends fundamentally on the package and is practically independent of the means of transport and/or the driver. In other words, the basis of the regulatory standard is to limit the radioactive content in packaging of intermediate resistance to withstand the possible mistreatment during transport in such a way as to make the radiological consequences of an eventual accident insignificant. On the other hand, it requires that the package transporting radioactive material that exceeds certain amounts shall withstand very severe transport accident conditions without losing its radiation shielding and containment function.

In relation to normal transport conditions, the regulatory standard establishes maximum values for the level of radiation in the proximity of the package and vehicle, and for radioactive surface contamination. It also establishes requirements for the corresponding marking, labelling and placarding of packages, containers and vehicles, and determines the specific obligations of the consignor with regard to the preparation of the transport documentation, the information to be given to the carrier and the notification to the corresponding authorities in cases where required.

It also establishes those cases in which an explicit approval of the package design and shipment must be obtained, the previous control of the shipment and the conditions for segregation of radioactive freight from other goods and from people.

3. SPECIFIC REGULATIONS IN ARGENTINA: STANDARDS AND COMPETENT AUTHORITY

The transport of radioactive material is regulated by a complex spectrum of standards and various application authorities that require appropriate liaison to guarantee a reasonable degree of safety and to avoid ineffective, unnecessary, or even duplicated regulatory requirements. Two aspects have to be considered for regulation of the transport of radioactive material:

— the control of the risks intrinsic to the radioactive material,
— the transportation mode (land, air or water).

Regarding the first item, transportation is just one endeavour in which radioactive materials are involved. Law No. 24.804 of the Nuclear Activity Act, passed in April 1997, states that the Nuclear Regulatory Authority (ARN) is the organization responsible for regulating transport safety. This includes radiological and nuclear safety during the transport and physical protection, as well as control of its use for exclusively peaceful purposes.

In completion of its duties, the ARN applies the requirements of the Regulations for the Safe Transport of Radioactive Material of the IAEA, and has been doing so since the first edition of the document.

The regulatory branch of the Argentine National Atomic Energy Commission (CNEA) has applied the regulations for transport of radioactive materials recommended by the IAEA since the early 1960s. In 1966, following recommendations from the IAEA and other international organizations, the Safety and Inspection Branch (at that time the regulatory authority) included regulations for transport in the Basic Nuclear and Radiological Safety Standards.

On 24 October 1977 Resolution No. 1065 of the Radiological Protection and Safety Branch of CNEA adopted the 1973 revised edition of the IAEA's Regulations for the Safe Transport of Radioactive Material (Safety Series No. 6).

On 11 December 1993, under Resolution No. 169/93, CNEA's Directors Board adopted the 1985 edition (as amended 1990) of the IAEA Transport Regulations (Safety Series No. 6), keeping within the CNEA's regulatory branch the responsibility of its application. This 1985 edition was likewise validated when CNEA's regulatory branch was separated from CNEA by the Board of Directors of the newly created autonomous Nuclear Regulatory Board (Ente Nacional Regulador Nuclear), which issued standard AR 10.16.1 Transport of Radioactive Materials", Revision 0.

On 17 July 2001 the Board of Directors of the Nuclear Regulatory Authority approved standard AR 10.16.1 Revision 1, adopting entirely the Spanish version of IAEA's Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), Safety Standards Series No. TS-R-1 (ST-1, Revised). The revised regulations were adopted within the period from publication recommended by the IAEA.

4. SIGNIFICANT FEATURES OF THE APPLICATION AUTHORITY

Besides the legal framework that establishes its role and responsibilities, historically the Argentine Regulatory Authority has based its work on technical knowledge. In this context, as has happened in other areas, Argentine experts in transport of radioactive material have for decades participated in international forums from which most of the regulations applied by the international community have been derived.

In particular, specialists of the Argentine Regulatory Authority have always been part of IAEA's Transport Safety Standards Committee (TRANSSC, formerly SAGSTRAM). TRANSSC's essential function is to advise the Secretariat on the overall programme on regulatory aspects of transport safety and its primary role lies in the development and continuous revision of the IAEA's transport safety standards.

As in other areas, the Argentine Regulatory Authority has achieved proficiency in the application of the IAEA's Transport Regulations similar to that of other more experienced regulatory authorities. This has allowed the ARN to work on the more complex regulatory processes, for example:

— the licensing of Type B(U) package designs, designs of packages for the transport of fissile materials, and designs for special forms of radioactive material, all designed and built within the country,
— the validation of designs of Type B(U) package and designs of packaging for fissile materials originally developed and licensed abroad.

5. MODAL TRANSPORT REGULATIONS: STANDARDS AND COMPETENT AUTHORITIES

In Argentina, the General Regulation for the Land Transport of Dangerous Goods regulates the transport of all hazardous materials. The competent organizations are the Secretary of Transport and the National Commission for the Regulation of Transport (CNRT) of the Ministry of

Economy and Production. The code refers to all materials defined as dangerous, including radioactive material, and has additional safety regulations for each transport mode.

In the case of river and marine transportation, the standard of application is the one from the International Maritime Organization (IMO) known as the International Maritime Dangerous Goods (IMDG) Code. Another standard that should be complied with is the IMO INF code (International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes in Flask on Board Ships). The responsible authority is the Argentine Coastguard (Prefectura Naval Argentina).

Regarding the transport of dangerous substances by air, the safety regulations applied are those of the International Civil Aviation Organization (ICAO) and the Technical Instructions for the Safe Transport of Dangerous Goods by Air with the Argentine Air Force as the competent authority.

In all cases, the above-mentioned regulation codes are based on those of the United Nations Recommendations on the Transport of Dangerous Goods, also called the “orange book”, coordinated by the Economic and Social Council Committee (ECOSOC) of Experts on the Transport of Dangerous Goods. The ECOSOC recommendations categorize dangerous goods into nine classes, with radioactive materials ranked as Class 7.

It is essential to underline that the recommendations of the Expert Committee of United Nations with reference to Class 7 are consistent in all respects with those of the last edition of IAEA’s Regulations for the Safe Transport of Radioactive Material. Therefore, the requirements for the transport of radioactive material established by any of the modal standards previously mentioned coincide with those of IAEA’s Standards.

6. REGULATORY SITUATION IN THE LATIN AMERICA REGION

Shipments of radioactive material vary widely throughout Latin America, from countries whose shipments cover both ends of the nuclear fuel cycle and those related to production and use of radioisotopes in medicine, industry and research, to those that import small numbers of sources for medical and industrial uses. The same applies to the experience and staff of the regulatory authorities; the proficiency of some allows coverage of every regulatory aspect related to radioactive material transport whereas others fall short.

Argentina collaborates directly and actively with most of the countries of the region, in the transport of radioactive material regulation through ARN specialists and assists IAEA’s efforts in this field. This cooperative approach is based on the assumption that domestic radiological safety is intimately connected to the region's radiological safety. With the objective of giving advice on establishing and improving regulatory infrastructure and harmonizing standards and their application across Latin America, this collaboration includes hosting courses and experts' missions to other countries and personnel training on the application of the IAEA's Regulation for the Safe Transport of Radioactive Material.

7. REGULATORY FRAMEWORK CONSIDERATIONS

In the worldwide regulatory scenario, safety in the transport of radioactive material has a structure similar to that described for Argentina: specific regulations are issued by competent radiological and nuclear safety authorities, and regulations applying to dangerous goods, including radioactive material, associated with particular transport modes are made by the competent modal transport authorities.

The core of these standards for radioactive material is the IAEA's Regulations for the Safe Transport of Radioactive Material, approved and amended when necessary, under the coordination of the IAEA's Secretariat, by experts from all over the world representing not only radiological regulatory agencies but also international organizations concerned with the transport of dangerous goods.

The regulations for modal transport contribute additionally to safety through requirements related to general aspects common to all dangerous materials other than radiological safety aspects, for example, those that concern the condition and qualification of vehicles, equipment and drivers in the case of road transport. Moreover, in the case of sea transport of irradiated nuclear fuel, plutonium and high-activity waste, the IMO Code INF is applied and in addition it requires that vessels be designed and operated according to additional safety measures, which further contribute to safety as a whole.

World statistics on accidents for the past 50 years, currently with an annual average of fifty million shipments of radioactive material, show highly positive results: radiological consequences for the public and the environment, from transport accidents involving radioactive material, are practically non-existent. The normative described and its application by competent authorities are responsible; however, time and results have shown that the IAEA's Transport Regulations are the main contributory factors to this outstanding safety record. Also contributory is the scientific and technical knowledge that is applied to this activity — knowledge that the current regulations reflect.

Some points of view do not accept this safety level, particularly regarding the sea transport of radioactive material associated to the reprocessing phase of the nuclear fuel cycle of some countries. Such opinions are associated, fundamentally, with the risk of potential radiological consequences to the public and the environment due to accidents that are seen as inevitable.

8. CONCLUSION

Argentina is:

- a country that exports and imports radioactive material and, from a technical perspective, accepts that the transport of radioactive material is safe when in compliance with the existing regulations,
- a coastal country where some sections of society are concerned about transport of large amounts of radioactive material.

With this dual situation in mind, Argentine experience shows that authorities have to guarantee normal and safe functioning of the nuclear activity, while addressing and evaluating any genuine concern expressed in local and foreign public opinion. This balance requires at least:

- the establishment of a sound regulatory structure and the application of internationally accepted standards as described above, keeping risks associated with the transport of radioactive material at the lowest level possible,
- the determination of the safety level established by standards must be rigorous and based on scientific evaluation and control of risks, beyond the perception aspect. Issues of public concern must be taken into account while keeping in mind that ever more extreme hypothetical accident scenarios may lead to increasingly rigorous requirements that could become unfeasible,
- the responsible establishment of a safety level through standards from knowledgeable domestic and international agencies,
- the evaluation of any concern related to safety in the transport of radioactive materials by competent official organizations with a working knowledge of the subject, acting independently and objectively.

These conditions will foster the most appropriate decisions for the country and the international community as a whole.

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HISTORY AND DEVELOPMENT OF THE INTERNATIONAL SYSTEM OF TRANSPORT SAFETY REGULATORY REQUIREMENTS AND LEGAL INSTRUMENTS

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Abstract

Safe transport of radioactive material has been ensured for over 40 years through a carefully constructed system of national and international legal instruments and requirements that establish a framework for the binding implementation of consistent detailed transport-safety requirements. To promote consistency and an appropriate level of safety, these detailed requirements are based on the Regulations for the Safe Transport of Radioactive Material, developed by the International Atomic Energy Agency. The development and application of these regulations illustrate how international cooperation has led to effective transport-safety requirements that remain technically up-to-date and ensure an appropriate level of safety for all modes of transport.

1. INTRODUCTION

As early as 1951 it was recognized that the unique properties of radioactive material needed to be addressed to ensure the safety of property, persons and the environment during transport. As countries explored potential applications for nuclear technologies, the need for more comprehensive safety regulations became evident.

In 1953, the United Nations Committee of Experts on the Transport of Dangerous Goods (UNCETDG) [2] was appointed by the Economic and Social Council (ECOSOC) to develop a system of recommendations on the safe transport of all dangerous goods. The International Atomic Energy Agency (IAEA) was established by statute that was approved on 23 October 1956 by the Conference on the Statute of the International Atomic Energy Agency. Among its functions, the Agency was charged to "…establish standards of safety for protection of health…". In 1959, the UNCETDG recognized the desirability of coordination with the IAEA in the drafting of recommendations relating to the transport of radioactive material and subsequently the IAEA was requested to draft such recommendations. This request complemented the IAEA's statutory functions in the establishment of safety standards.

This basic framework of responsibilities still shapes the development and application of detailed requirements for safe transport of radioactive material, and is explained in greater detail in Section 2.

2. INTERNATIONAL LEGAL AND REGULATORY FRAMEWORK [3]

2.1. Regulation of dangerous goods transport safety

The transport of dangerous goods has been subject to regulation for many years. National regulations are known to have existed over 225 years ago. However, not long after the end of World War II, intermodal problems were increasingly encountered in the transhipment of dangerous goods. It was recognized that, in the interests of safety and economics, transport-safety regulations should be harmonized internationally and for the various modes of transport.

The harmonized system of regulatory control that evolved over the ensuing years is based on a combination of national and international instruments. The need for national laws and regulations that are compatible with the international regulations has given rise to a highly interactive global system in which Member States and international organizations perform key roles. Together, these complementary regulatory systems provide an integrated network of safety requirements to ensure safety during the transport of dangerous goods.

While the varieties of dangerous goods that are transported represent a wide spectrum of potential hazards, there are similarities in the controls that need to be exercised to ensure their safe transport. These materials must be suitably classified based on their potential hazard, packaged commensurately, and information communicated about their potential hazard (including emergency measures). Even though radioactive materials present unique hazards during transport, *they are included in the overall system of dangerous goods as one class* among nine that warrant regulation. This allows the radioactive material to be shipped commercially and facilitates their application to beneficial uses.

2.2. National and international roles and responsibilities

National and international laws are based on the willingness of countries to commit themselves to a course of action. *National laws* typically require the passage of legislation or decrees, and frequently require supporting regulations to promulgate the detailed requirements necessary in highly technical areas such as the transport safety of dangerous goods. *International laws* establish legal rights and obligations for States that consent to be bound by them and may also require detailed supporting regulations. Both of these types of laws and their supporting regulations are necessary to ensure a comprehensive system of transport safety for all dangerous goods, including radioactive material. The IAEA Secretariat has prepared the Report on Legally Binding and Non-Binding International Instruments and Regulations Concerning the Safe Transport of Radioactive Materials and Their Implementation (GOV/1998/17 and its attachment), which provides additional detail on the international agreements in this area.

2.3. Binding national requirements

To ensure acceptable transport safety within their own borders, countries adopt lawfully mandated minimum transport-safety regulations. As evidenced by experience in the 1940s, these regulations can lead to a confusing set of varying requirements that is difficult to apply if they are not based on a consistent approach. Most countries have come to rely on the United Nations organizations to assist them in developing a suitable set of safety requirements that can be applied globally to all modes of transport and for all classes of dangerous goods. National dangerous goods transport safety regulations can draw on these international requirements directly (through verbatim incorporation or incorporation by reference) or indirectly (by rewriting them to fit into their national regulations).

2.4. Binding international requirements

The attachment to GOV/1998/17, combined with updated information, identifies the following numbers of *binding international agreements* that directly or indirectly apply to the safe transport of radioactive material:

- — twenty-one worldwide instruments in force;
- — five worldwide instruments that have been prepared but are not yet in force;
- — twenty-two regional instruments in force.

The number of binding instruments is large, and two worldwide modal conventions and several major regional conventions provide the most comprehensive coverage of dangerous goods transport safety. The Convention on International Civil Aviation – Annex 18, The Safe Transport of Dangerous Goods by Air (Chicago, 1945), requires States Parties to make mandatory the International Civil Aviation Authority (ICAO) Technical Instructions for the Transport of Dangerous Goods by Air. The International Convention for the Safety of Life at Sea (SOLAS) and three protocols (London, 1974) and recent action taken by the International Maritime Organization (IMO) require that States Parties make the International Maritime Dangerous Goods Code mandatory by 1 January 2004.

Although some conventions addressing the international inland transport of dangerous goods are open to accession by all UN Member States, most of them, in practice, are of regional application, reflecting the actual geography of international movement of goods by road, rail or inland waterway. Major inland transport agreements include:

— European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) — thirty-seven Contracting Parties from Europe;
— European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterway (ADN) — not yet in force, but applicable effectively through regional or national law on the Rhine and Danube and in the Russian Federation;
— Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) — forty-one Contracting Parties from Europe [4], North Africa, and Western Asia;
— MERCOSUR/MERCOSUL Agreement of Partial Reach to Facilitate the Transport of Dangerous Goods (South America).

Like the Chicago and SOLAS conventions, these regional agreements apply mandatory regulations to the carriage of all dangerous goods.

2.5. UN committee of experts

The UNCETDG was established in 1953 to develop a universal system of recommendations on the transport of dangerous goods. These recommendations were directed at reducing risks and costs in the expanding international trade in dangerous goods and could also be adopted for domestic purposes. A basic approach was developed that could be applied to the packaging and transport of all dangerous goods. The UNCETDG's report took the form of "recommendations", and it was left to the national and international bodies responsible for regulating the carriage of dangerous goods to decide the extent to which these "United Nations recommendations" should be given the force of law.

2.6. IAEA regulations

In 1959, the UNCETDG recognized the necessity of coordination with the IAEA in the drafting of any recommendations relating to the transport of radioactive material. Based on the UNCETDG's recommendations, *ECOSOC requested the United Nations Secretary-General to inform the IAEA of ECOSOC's desire that the IAEA be entrusted with the drafting of recommendations on the transport of radioactive materials,* on the understanding that the recommendations would be consistent with the principles adopted by the UNCETDG and would be formulated in consultation with the United Nations and the relevant specialized agencies. This led to continuous cooperation between the UNCETDG, the IAEA, the relevant specialized agencies (particularly ICAO, IMO and the Universal Postal Union) and various other UN bodies, including the Economic Commission for Europe (UNECE).

The IAEA's founding statute authorizes certain functions, including in Article III.A.6 "…to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property…" Consequently, the ECOSOC request complemented the IAEA's statutory functions in the establishment of safety standards.

Following the ECOSOC decision, the IAEA established and first published its Regulations for the Safe Transport of Radioactive Materials (Safety Series No. 6) in 1961, for application to the national and international carriage of radioactive materials by all modes of transport. Subsequent reviews — conducted by the IAEA's Secretariat in full consultation with IAEA Member States, the relevant specialized agencies and various other United Nations bodies — have resulted in five comprehensively revised versions (published in 1964, 1967, 1973, 1985 and 1996) and several "as amended" minor revisions. All versions of the Regulations have struck a balance between the need to take account of technical advances, operational experience, and the latest radiation-protection principles while maintaining a stable framework of regulatory requirements.

In 1964, when approving the first revised version, the Board of Governors authorized the Director General of the IAEA to recommend that the Regulations "be taken as a basis for relevant national regulations and be applied to international transport". The Regulations, despite the name, have a status similar to that of the UNCETDG recommendations. By 1969, however, they had been adopted by almost all international organizations concerned with transport and were being used by most States for their own regulatory purposes. Worldwide application of the IAEA's Transport Regulations for all modes of transport has resulted in a high standard of safety, as was recognized in IAEA General Conference Resolution GC(42)/RES/13 "…compliance with regulations which take account of the IAEA's Transport Regulations is providing a high level of safety…"

The latest version of the Regulations, approved by the IAEA's Board of Governors in September 1996, and slightly revised in 2000, has been published as Safety Standards Series No. TS-R-1. The format and structure of TS-R-1 is as a "stand alone" document that provides all the requirements for the safe transport of radioactive material.

2.7. Supporting documents to the IAEA transport regulations

Coincident with the development of the 1996 edition of the Regulations, steps were undertaken to develop updated guidance and other supporting documents. Two key guidance documents, developed to be consistent with TS-R-1, have been published and are currently available in English. These are, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, TS-G-1.1 (ST-2), and Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material, TS-G-1.2 (ST-3). Steps are under way to update two other guidance documents, one on quality assurance in transport (currently envisioned to be TS-G-1.3) and one on compliance assurance in transport (currently envisioned to be TS-G-1.4). Other documents intended to assist competent authorities, consignors, carriers and consignees in the proper application of the Regulations are produced as resources allow. These include a number of technical documents (TECDOCs), the National Competent Authorities List, and the results of a detailed survey on the manner in which individual States regulate transport safety. All of these are available from the IAEA in hardcopy and on the web site.

2.8. UN model regulations

In December 1994, the UNCETDG decided that its recommendations were complete enough to be recast as Model Regulations that are addressed to all governments and international organizations concerned with the development of national and international regulations on the transport of dangerous goods. This resulted in restructuring the recommendations so that they can be applied directly. In July 1995 (Resolution 1995/5), ECOSOC agreed with this approach and invited all interested parties "…when developing or updating appropriate codes and regulations, to take full account of the recommendations, including the structure and format of such codes and regulations."

The UN Model Regulations provide a complete set of requirements for the transport of dangerous goods. While they do not have the force of law, they are widely used as the basis for national and international regulations. Their content, format and structure have been closely coordinated with ICAO, IMO and UNECE (for RID, ADR and ADN) to facilitate easy integration into their binding regulations.

To facilitate the integration of the TS-R-1 regulations into the international instruments that cover all classes of dangerous goods, the IAEA and members of its Transport Safety Standards Committee (TRANSSC) worked closely with the UNCETDG to incorporate the TS-R-1 safety requirements into the UN Model Regulations. The IAEA Secretariat prepared a detailed list of recommendations on where the TS-R-1 requirements might be inserted into the Model Regulations and a cross-references was made between the TS-R-1 and Model Regulations paragraphs. Several iterations between the respective Secretariats and their technical review bodies resulted in agreement on how to best incorporate essentially all the TS-R-1 requirements into the Model Regulations. This integration has been completed and the UN Model Regulations now provide a complete set of UN-recommended requirements for all classes of dangerous goods. *This approach has resulted in further strengthening the TS-R-1 requirements as the basis for safe transport of radioactive material worldwide.*

2.9. International harmonization

The UNCETDG, ICAO, IMO and UNECE have worked closely to develop an efficient approach to keeping the dangerous goods regulations up to date and closely coordinated. Discrepancies among the regulations would result in considerable difficulties for shippers using those modes of transport and potentially forcing them to address conflicting requirements.

A two-year revision cycle is used by the UNCETDG to keep the Model Regulations current and avoid a backlog of issues. Similarly, ICAO, IMO and UNECE have adopted two-year revision cycles that commence with the completion of each UNCETDG revision. Thus, the binding international modal requirements are kept up to date and as consistent as possible with the Model Regulations, recognizing that there is a two-year delay as each modal organization goes through its revision process to incorporate changes adopted by the UNCETDG. *This closely coordinated set of revision cycles defines the external environment with which the IAEA Transport Regulations need to effectively integrate if they are to be applied in an internationally binding manner along with other dangerous goods requirements.*

To facilitate harmonization of the safety requirements for transport of radioactive material transport with those of the UNCETDG, ICAO, IMO and UNECE, the IAEA initiated annual coordination meetings among the Secretariats, beginning in 1996, at which mutual problems are addressed and approaches developed for better harmonization of requirements. The other Secretariats expressed a strong desire for the IAEA to cooperate closely with the UNCETDG to facilitate, through integration of the IAEA technical requirements into the Model Regulations, the subsequent automatic integration and implementation of those requirements through the existing international and national legal instruments. This could best be accomplished by modifying the IAEA review cycle to align it with the UNCETDG two-year review cycle, recognizing that, due to legal procedures, the effective implementation of new or revised modal requirements requires an additional two years. Integration of the TS-R-1 amendments into the Model Regulations during the normal course of their two-year revision cycle was recognized as greatly simplifying the task facing ICAO, IMO and UNECE, since:

— The formats of these instruments have been harmonized and are keyed to the Model Regulations (greatly simplifying drafting the necessary revisions),
— Coherence of the modal requirements is enhanced when revised requirements enter into force simultaneously.

Figure 1 shows how the IAEA Transport Regulations and UN Model Regulations are implemented into these binding instruments. Initially, IAEA Member-State transport safety experts and the Secretariat were reluctant to embrace a two-year revision cycle. There were concerns that such frequent revisions would be difficult to implement and would not detract from regulatory stability. However, there was recognition that the previous ten-year cycle had led to significant problems due to backlogged issues and resulting pressure to incorporate proposed revisions rather than delay for another ten years. It was noted that moving to a two-year cycle did not require that the Transport Regulations be revised every two years and it could be considered a “review” rather than a “revision” cycle. This approach would allow the continued publication of “as-amended” versions (containing no comprehensive changes) as well as “revised” versions (containing comprehensive changes).

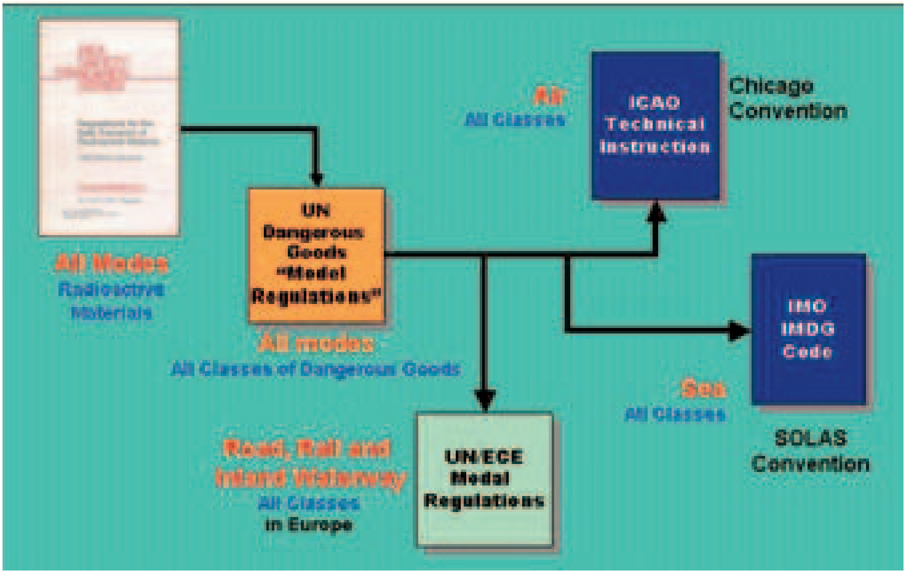

FIG. 1. Flow of TS-R-1 requirements into international regulations.

Since Member States already had procedures in place to accommodate the two-year UNCETDG, ICAO and IMO revision cycles, the transport-safety experts concluded that they would not face significant difficulties if the IAEA cycle was aligned with the others. Ultimately, the Member State radioactive material transport-safety experts and the Secretariat concluded that integration of the IAEA's Transport Regulations into those for other dangerous goods was key to their worldwide implementation in a binding manner. *Consequently, the two-year review cycle was adopted and a detailed schedule was developed that both meets the shorter timeline and includes all the steps needed to comply with the overall IAEA Safety Standards Series publication procedures.*

The UNCETDG, ICAO, IMO and Member States have expressed satisfaction with the coordinated two-year cycle for maintaining the Transport Regulations. The General Conference has recognized both the importance of this coordination with the international organizations (GC(42)/RES/13) and the need for a timetable that is consistent with the schedules of those organizations (GC(44)/RES/17). The first two-year review cycle has been completed, resulting in an "as amended" 2003 version of TS-R-1. Experience gained during that cycle showed that the process can work well.

2.10. National adoption of the IAEA Transport Regulations

Since the IAEA Transport Regulations are fully integrated into the UN Model Regulations and the ICAO, IMO, RID/ADR/ADN and MERCOSUR/MERCOSUL regulations through their respective conventions, their implementation as *binding international requirements* is broadly based. It should also be noted that, although RID and ADR apply only to international transport, these requirements have been made mandatory for domestic transport in all countries of the European Union (through EU Council directives 94/55/EC and 96/49/EC). However, for their coverage to be truly global, Member States also have been encouraged to adopt regulations that are based on the Transport Regulations (GC(44)/RES/17). The methods used by Member States to accomplish this vary and depend on the regulatory structures of the countries as well as the coverage that may be provided by binding international agreements.

A recent survey of Member States [5] resulted in forty-four responses on how those States are regulating the transport of radioactive materials. Every response stated that their *national regulations are based on the IAEA Transport Regulations, either directly or through the binding international requirements.* Of the thirty countries with nuclear power programmes, all thirty are party to the Chicago Convention and all but one (which is landlocked) are also party to the SOLAS convention. *All countries with nuclear power programmes are obligated to have mandatory transport safety regulations for international shipments of radioactive materials by air and, where applicable, by sea.*

3. PRINCIPLES OF THE IAEA TRANSPORT REGULATIONS

The 1961 Transport Regulations established many principles that are still embodied in the regulations of today [6]. Developers of the Transport Regulations realized that for large quantities of radioactive material "…the standard of packaging…must be such that the safety of other goods, the health of transport workers and members of the public is adequately safeguarded under both normal and accident conditions and the testing of transport packages must be related to such expected conditions" [7]. To establish performance requirements in the event of an accident, the concept of "maximum credible accident" was incorporated. The "Type B" package category was established with requirements that there be no significant release of radioactive contents and retention of shielding efficiency "…under conditions…for the maximum credible accident relevant to the mode of transport."

Studies were quickly undertaken to more quantitatively define testing requirements that would satisfy the maximum credible accident criteria. One study examined drops while loading, impacts due to collisions, and fire and immersion conditions that could be encountered in road, rail, sea, and air transport [8]. Studies such as this led to the incorporation of specific test requirements that would simulate the effects of a severe accident into the 1964 Transport Regulations. These test requirements were chosen to include the following tests, performed so as to cause maximum damage:

— impact — 9-m drop onto an essentially unyielding target,
— puncture — 1-m drop onto a solid steel bar 15 cm in diameter,
— thermal — heat input no less than exposure to a radiation environment of 800°C for 30 min with specified engineering parameters.

An immersion test of 0.9 m was also required for a minimum of 8 h. In all cases, the package was not permitted to release a significant amount of radioactive material and its shielding could not be significantly degraded.

4. BUT THAT WAS FORTY YEARS AGO, THINGS HAVE CHANGED!

At their inception, it was recognized that the Transport Regulations would have to be regularly reviewed in order to remain consistent with currently accepted radiation-protection principles and transport-industry practices. Member States and international organizations have opportunity during the review and revision process to raise issues and propose amendments. Since Member States are represented by their transport-safety regulatory agencies, most proposals deal with improving the level of safety provided by the Transport Regulations or improving their ease of application. Proposals for change must be justified, and technical analyses are often developed and provided to support such proposals.

During the 40+ years since the Transport Regulations were first published, there have been dramatic changes in the types of radioactive material transported, materials of construction, and technologies available for packaging, as well as transport conditions. Similarly, the ways in which safety is examined and the standards for acceptable societal risk have also changed. Likewise, the Transport Regulations have evolved to provide an appropriate level of protection and an internationally accepted basis for safe transport of radioactive material. The evolution of some of the major provisions relating to Type B packages is illustrated in Table 1.

TABLE 1. MAJOR PROVISIONS RELATING TO TYPE B PACKAGE REQUIREMENTS

1961	— Type B packages must be designed for the “maximum credible accident”
1964	— Introduction of specific package performance test requirements representative of severe accident forces (see Section 3) — Special form material defined — Quantitative surface contamination limits — 15-m immersion test for Type B packages
1967	— More precise specification of ambient and test conditions for Type B packages
1973	— Distinction between Type B(U) and Type B(M) package designs (unilateral and multilateral approval, respectively) — Quantification of release limits for Type B packages — Compliance assurance requirements introduced
1985	— 200-m immersion test required for packages containing more than 37 PBq (10^6 Ci) of irradiated nuclear fuel — Dynamic crush test added for lightweight low-density Type B packages containing non-special form contents above 1000 A_2
1996	— Activity limits placed on Type B packages transported by aircraft, unless they contain a special “Low Dispersible” category of material — Type C packages introduced (replacing high-activity Type B packages for transport by aircraft) — Extension of the 200-m immersion test to all Type B packages containing activities greater than 10^5 A_2

In addition to the major provisions relating to Type B package requirements shown in Table 1, some safety areas evolved over several editions of the Transport Regulations, including:

- Quality assurance — introduced in the 1985 edition, these requirements were applied to all packages and transport operations and were extended in the 1996 edition to cover materials (such as special form material),
- Radiation protection — these requirements have evolved from simple compliance with applicable dose limits (1973 edition) to implementation of full radiation protection programs covering all facets of transport (1996 edition),
- Criticality safety — provisions based on Fissile Classes (I, II and III) to limit the number of packages transported together have evolved into a

system that relies on a Criticality Safety Index to clearly provide an indication of how many packages can be safely transported together.

As the foregoing illustrates, Member States, working closely with the IAEA and other involved international organizations, have continued to examine the levels of safety provided by the Transport Regulations and have proposed and adopted amendments as needed. This is a good example of the dynamic nature of the regulations as we enter the fifth decade of their implementation.

5. EVALUATING THE LEVEL OF SAFETY PROVIDED BY THE TRANSPORT REGULATIONS

The first performance requirements for Type B packages were based on engineering analyses of accident conditions and the probability of their occurrence. Over the years, however, the discipline of risk assessment has advanced and has become more sophisticated in explaining the interactions between probabilities and consequences. Recent examples of these types of analysis have confirmed not only the improbable nature of an accident resulting in any release from a Type B package, but also the low expected consequences of severe accidents involving Type B packages in general, and irradiated nuclear fuel packages in particular [9, 10]. Along with experience gained over the years, these types of peer-reviewed quantitative technical reports provide the scientific basis for Member States' safety regulatory agencies to determine when changes to the Transport Regulations are warranted.

6. IMPLEMENTATION

In addition to establishing an appropriate set of transport safety requirements, IAEA Member States have expressed the desire that activities be undertaken to assist in the implementation of national regulations that are consistent with the Transport Regulations. The Transport Safety Assessment Service (TranSAS) has been established to accomplish this, and these services are available from the IAEA upon request from Member States. The first few TranSAS missions have proved to be valuable in: observing where a Member State might improve its regulatory practices; pointing out good regulatory practices that other Member States might consider adopting; and providing an overall assessment of how well the requesting Member State has implemented regulations based on the Transport Regulations. More missions have been requested and the General Conference has continued to express its support for the IAEA to continue this service [11].

7. CONCLUSION

Since their inception, the Transport Regulations have been regularly reviewed and revised to be responsive to justified need for safety improvements. These revisions have continued to ensure a high level of safety throughout the world [12] and have kept the regulations suitable for application to all modes of transport. Analyses and risk assessments using the latest techniques developed in these disciplines continue to show the adequacy of the levels of protection provided. With the move to a two-year revision cycle, the IAEA, its Member States and participating international organizations are demonstrating their dedication to keeping an excellent safety record intact and moving forward in the twenty-first century.

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THE ROLE OF NATIONAL COMPETENT AUTHORITIES IN FACILITATING REGULATION OF THE TRANSPORT OF RADIOACTIVE MATERIAL

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Abstract

The role, duties and responsibilities of national competent authorities, as defined in the IAEA's safety requirements document Regulations for the Safe Transport of Radioactive Material, are described. Further elaboration of the duties and responsibilities of the competent authority in facilitating the regulation of transport of radioactive material is presented with reference to other relevant IAEA Safety Standards Series documents.

1. INTRODUCTION

The IAEA Regulations for the Safe Transport of Radioactive Material [1] (IAEA Regulations) define "competent authority" as:

"any national or international regulatory body or authority designated or otherwise recognized as such for any purpose in connection with these Regulations."

This paper describes the competent authority (CA) as an essential entity in implementing the IAEA Regulations and in assuring compliance with them. In particular, it describes the role, duties and responsibilities of national CAs, as distinct from those of international CAs, which are considered in other papers in this volume.

In many countries, the legally designated national CA is the appropriate government minister or government department (e.g. in the United Kingdom it is the Secretary of State for Transport). The executive functions, however, may be assigned to one or several bodies, which may include branches of government departments, national institutes, and officially appointed agencies.

The Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material [2] elaborates on the definition of CAs as follows (emphasis added for the national CA):

"The competent authority is the organization defined by legislative or executive authority to act *on behalf of a country,* or an international authority, in matters involving the transport of radioactive material. The legal framework of a country determines how a national competent authority is designated and is given the responsibility to ensure application of the Regulations. In some instances, authority over different aspects of the Regulations is assigned to different agencies, depending on the transport mode (air, road, rail, sea or inland waterway) or the package and radioactive material type (excepted, industrial, Type A, Type B and Type C packages; special form radioactive material, low dispersible material; fissile material or uranium hexafluoride). A national competent authority may in some cases delegate the approval of package designs and certain types of shipment to another organization having the necessary technical competence. National competent authorities also constitute the competent authorities referred to in any conventions or agreements on the transport of radioactive material to which the country adheres.

The competent authority should make the consignors, carriers, consignees and public aware of its identity and how it may be contacted. This may be accomplished by publishing the organizational identity (department, administration, office, etc.), with a description of the duties and activities of the organization in question as well as detailed mailing address, telephone and facsimile numbers, email address, etc.

The primary source of competent authority identifications is the list of National Competent Authorities Responsible for Approvals and Authorizations in Respect of the Transport of Radioactive Material, which is published annually by the IAEA [3] and is available on request. Each country should ensure that the listed information is current and accurate. The IAEA requests verification of this information annually, and prompt responses by Member States will ensure the continued value of this list."

2. ROLE AND DUTIES OF THE COMPETENT AUTHORITY

The role of the national CA may be summarized as to:

— Ensure compliance with regulations by designers, manufacturers, operators, consignors and carriers;

— Provide guidance on regulatory safety requirements;
— Establish and maintain national regulations, based on IAEA Regulations;
— Ensure that national technical and administrative infrastructure exists to facilitate compliance;
— Create compliance assurance programmes that incorporate inspection and enforcement activities to facilitate implementation of the Regulations.

The main duties and responsibilities of the CA may be described as legislative and regulatory, and may be further subdivided as follows and described in subsequent paragraphs:

— Legislative: making national regulations (taking account, where appropriate, of international regulations);
— Regulatory:
  - radiation protection,
  - assessment and approval,
  - emergency planning and preparedness,
  - quality assurance,
  - compliance assurance,
  - inspection and enforcement,
  - administration,
    — issuing certificates of approval and validation,
    — receiving notifications,
    — recording information on incidents,
    — allocation of identification marks and registering packaging serial numbers,
  - information,
    — providing advice to the IAEA, government ministers, other government departments, industry, users, and the general public,
  - training,
  - research coordination,
  - development of regulations.

3. LEGISLATIVE: MAKING NATIONAL REGULATIONS

The CA is responsible for providing the national regulations that implement the IAEA Regulations, and for updating them when necessary. The national regulations must fully and accurately reflect the requirements of the IAEA Regulations. This is necessary to ensure harmony with other countries' regulations and with the international modal transport authorities, thus facilitating international trade. In addition, the national regulations must suitably extend the IAEA Regulations to cover all national needs and all practical operational requirements relating to the modes involved. Some countries endorse the Regulations simply by incorporating the text into their national regulations. Alternatively, their citation in national regulations can enact the Regulations. The effects of these measures are multi-modal and supplementation is needed to cover modal requirements. National regulations will often be mode-specific, catering for individual conditions of transport, and may even be regulated by different CAs. For example, in the United Kingdom, the transport of dangerous goods (one class of which, Class 7, is radioactive material) in the four principal modes of transport — rail, road, air and sea — is regulated by four separate government departments/agencies. Though many of the CA's functions, including package assessment and certification, are handled in a single government department, the Department for Transport.

4. REGULATORY: RADIATION PROTECTION

The CA's responsibility for radiation protection mainly concerns ensuring compliance with the general requirements of paragraphs 301 to 303 and 305 to 309 of the IAEA Regulations, on control of exposure of the public and of transport workers. The CA is required to arrange periodic assessments of the radiation doses to persons due to the transport of radioactive material, to ensure that the system of protection and safety complies with the Basic Safety Standards [4]. The national institute responsible for radiation protection may act as the relevant CA, or be delegated by it, for the purposes of carrying out such assessments. Actions that are the direct responsibility of the CA include:

- Monitoring the optimization of radiation protection in transport,
- Establishing segregation procedures,
- Conducting periodic surveys,
- Ensuring that there are radiation protection programmes, including for the approval of programmes for special use vessels,
- Providing instructions for dealing with undeliverable packages.

The CA may also provide advice on radiation protection programmes readily available on the Internet, e.g. *http://www.shipping.dft.gov.uk/trm/index.htm*.

4.1. Assessment and approval

Assessment and approval by certification by the CA are required in the following cases:

— Special form and low dispersible radioactive material,
— Type B(U) package designs,
— Type B(M) package designs,
— Type C package designs,
— Packages containing 0.1 kg or more of uranium hexafluoride,
— Designs of packages for fissile material (above excepted levels),
— Continued use of packages manufactured to a design approved under the provisions of earlier editions of the IAEA Regulations,
— Certain shipments and all special arrangements,
— Calculation of radionuclide values that are not listed in Table I of the Regulations,
— Radiation protection programmes for special use vessels.

As part of its duty to provide relevant information, the CA may provide specific guidance to assist applicants for approval, e.g. the United Kingdom's Guide to an Application for UK Competent Authority Approval of Radioactive Material in Transport (IAEA 1996 Regulations) can be found at *http://www.shipping.dft.gov.uk/trm/index.htm.*

4.2. Emergency planning and preparedness

The CA has a responsibility to ensure that appropriate national emergency arrangements exist and are maintained for dealing with radioactive material transport accidents. The CA must also ensure that consignors and carriers have adequate contingency arrangements to respond to accidents and incidents involving their consignments. Guidance can be found in the IAEA publication Emergency Response Planning and Preparedness for Transport Accidents Involving Radioactive Material [5].

4.3. Quality assurance

The CA is responsible for ensuring that acceptable QA programmes are in place across the range of activities associated with the transport of radioactive material. Manufacturers, consignors and users must be prepared to provide facilities for CA inspection during manufacture and use and to demonstrate to any cognizant CA that the manufacturing methods and materials used are in accordance with the approved design specifications and that all packagings are periodically inspected and, as necessary, repaired and maintained in good condition so that they continue to comply with all relevant requirements and specifications, even after repeated use. When CA approval is required, such approval is contingent on the adequacy of the QA programme. Guidance on the CA's duties in respect of QA can be found in the IAEA publication Quality Assurance for the Transport of Radioactive Material, Safety Series No. 113 [6].

4.4. Compliance assurance

The responsibility for assuring compliance with the IAEA Regulations rests with the CA, as assigned by paragraph 311 and, as is explicit in paragraph 208 of the Regulations, which defines compliance assurance as:

"*A systematic programme of measures applied by a Competent Authority which is aimed at ensuring that the provisions of the Regulations are met in practice.*"

Detailed guidance on the CA's duties in terms of compliance assurance can be found in the IAEA publication Compliance Assurance for the Transport of Radioactive Material, Safety Series No. 112 [7].

4.5. Inspection and enforcement

Inspection and enforcement are essential elements of a CA's compliance assurance programme. The national legal and institutional framework will determine how they are carried out in any country. An essential element, however, is to have effective sanctions and remedies written into the national law and available to apply where an inspection reveals non-compliance with the regulatory requirements. Such sanctions may include written notices, suspension of transport activities, and prosecution.

4.6. Administration

4.6.1. Issuing certificates of approval and validation

The issuing of CA approval certificates is essentially an administrative function that follows an appropriate technical assessment. Paragraphs 827 to 833 of the IAEA Regulations include all the necessary details to ensure they are presented in a uniform, consistent manner. There should also be appropriate inputs to the IAEA's PACKTRAM database (see Chapter 18).

4.6.2. Receiving notifications

Another aspect of administration is the receipt of notifications of shipments and copies of certificates of approval issued by foreign CAs. Besides being useful in the case of possible accidents, these documents also provide information on consignments of packages that have high-activity contents, and those containing fissile material.

4.6.3. Recording information on incidents

Notification of incidents in transport should be required by national regulations, and receiving and recording these is an administrative duty of the CA. This is another important source of information on transport events in a country. The IAEA maintains a database (Events in the Transport of Radioactive Material, EVTRAM) of such information that provides useful feedback on the effectiveness of the Regulations. Competent Authorities are encouraged to provide data to the IAEA to maintain this database.

4.6.4. Allocation of identification marks and registering packaging serial numbers

An important administrative task is to allocate approval identification marks (paragraph 828(b) of the Regulations) and to maintain the register of packaging serial numbers (paragraph 819 of the Regulations). These should be assigned exactly according to the provisions of paragraphs 828 and 829 of the Regulations.

4.7. Information

4.7.1. Providing advice

Each national CA has a duty to provide information to the IAEA that may serve as a basis for establishing, justifying or changing the regulatory standards for the benefit of all Member States. The CAs will also be national sources of information on the principles of the Regulations as well as on their use and interpretation. Each CA acts for the government of its own country, and may be responsible for certain policy matters or for advising ministers and/or other government bodies on policy. The CA should be prepared to give advice on safety standards to government ministers, elected representatives, other government departments, local authorities, industry and the public.

Making presentations at international symposia and conferences is another vital function.

4.8. Training

Training facilities and courses to instruct personnel concerned with the transport of radioactive material may be provided directly by CAs or by specialized organizations with the necessary resources. When training courses are not provided directly by the CA, it is, nevertheless, valuable for all concerned to have the support and relevant participation of expert CA personnel. Such courses should be open to all. Persons who customarily take advantage of these courses are consignor's personnel (particularly those responsible for preparing and despatching consignments and who have to sign the consignor's certificates), carrier personnel (drivers and freight-forwarding staff), emergency service officers (fire, police and ambulance personnel), customs officers, and the CA's own staff. In addition to nationally organized courses, many organizations in developed countries will run internal courses on safe transport of radioactive material.

4.9. Research coordination

The CA should help national research workers to take advantage of opportunities to benefit from research activities elsewhere and to collaborate with other workers. The IAEA's coordinated research projects provide a means of encouraging international collaboration in research on the transport of radioactive material. The European Commission, through its Standing Working Group on the Transport of Radioactive Material, provides a route to support international collaborative research in the safety of transport of radioactive material.

4.10. Development of regulations

An important function of each CA is participation in the development both of the IAEA Regulations and of regulations for the international modal organizations, to which its country adheres by signing a convention or by some other formal process. In principle, the CA's duties are much the same in both cases. For the IAEA Regulations, it involves organizing national input to regulatory reviews and related studies. For the international modal regulations, the task is to organize the national input to meetings dealing with reviewing, and, as necessary, to revise and update the regulations. In general, the organization of national input to IAEA reviews or other regulatory revisions involves administrative action possibly supplemented by technical contributions. The administrative actions usually comprise the following:

— Receiving communications from the IAEA, and distributing them to interested parties nationally,
— Calling for national views on existing regulatory provisions and proposals for change,
— Arranging meetings to discuss these matters, and as a result
— Coordinating a national view on them to be fed back to the IAEA.

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INDUSTRY COMMITMENT TO TRANSPORT SAFETY

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Abstract

The paper discusses the shipper's point of view with regard to maintaining transport options in the interest of bringing the benefits that are needed the world over. Open and sustained dialogue between regulator and the regulated is necessary. The roles of the regulator and the regulated are considered, as are the essential role of transport in ensuring the safe and practical use of nuclear material, industry's context for transport and its commitment to transport safety, and the need for all parties involved to work together and communicate effectively.

1. THE REGULATOR AND THE REGULATED

Standards and regulations do not become operationally effective until they are implemented by the entities that are subject to them. Accordingly, synergy is necessary between the regulator and the regulated: those whose task it is to make and enforce the rules for safe, efficient and reliable transport, and those whose job it is to transport within the rules. Both can be more effective in achieving their objectives when they cooperate in the interest of mutual understanding.

In the case of the international transport safety regulatory regime, it is the nuclear transport industry, such as represented by the World Nuclear Transport Institute, that is the object of transport-safety standards and regulations. As such, the nuclear transport industry is a principal stakeholder.

2. THE ESSENTIAL ROLE OF TRANSPORT

Transport is not a side issue in the nuclear fuel cycle; it is intrinsic. Transport enables the cycle. Most people are familiar with the graphics typically used to display the fuel cycle; beginning with the uranium mine site, arrows carry the eye around a circle from refinement, conversion, enrichment and reconversion, from fabrication facilities to reactor site. And then, in the case of reprocessing, the cycle spins off on another round, ultimately carrying spent fuel through the reprocessing cycle back to the reactor site. There are, of course, off-ramps, carrying radioactive residues away from the cycle for treatment, storage and disposal.

The nuclear transport industry plays a vital role in supporting the International Atomic Energy Agency's objective of accelerating and enlarging the contribution of atomic energy to peace, health and prosperity throughout the world. One of the founding articles of the IAEA — Article III — authorizes the IAEA to make provision to meet the needs of research, development and practical application of atomic energy for peaceful purposes, including the production of electric power, with due consideration for the needs of developing countries. Whether or not a particular country generates a portion of its electricity from nuclear power, the benefits of nuclear power do not accrue only to those countries that so choose. All countries, developed and developing, derive benefit from technologies that contribute to reductions in CO_2 emissions. If nuclear power is to play a part in meeting the energy and clean-air needs of people everywhere, transport of its basic material is essential.

3. INDUSTRY CONTEXT FOR TRANSPORT

Practical, efficient, safe transport standards and regulations should take account of their impact on those who do the transporting. The context in which radioactive material is transported is complex, it is challenging and is rapidly changing. The transport of radioactive material is increasingly international; many countries that generate electric power from nuclear plants must rely on foreign sources for necessary services and materials to support the fuel cycle. We are witnessing consolidation among buyers and sellers, supplies opening up from non-traditional sources, and the decommissioning and clean-up of facilities. Transport, by its very nature, must rely on carriers, the availability of which drives routing decisions, and changes in material flows necessitate new approaches to packaging and transport scenarios. If society is to derive full benefits from peaceful uses of nuclear energy then the provision of that energy should be cost-effective, which means that cost-effective transport of radioactive materials is critical. It has been said that the future of nuclear power depends heavily on continued public confidence in its safe and peaceful use, and on its economic competitiveness in the energy market place. Safe, efficient and reliable transport is essential both to public confidence and to economic competitiveness. Economic competitiveness relies to an important extent on the optimal use of existing facilities, packagings and efficient transport.

4. INDUSTRY COMMITMENT TO SAFE TRANSPORT

No stakeholder in the international transport safety regulatory regime has a greater interest in safe transport than those who are doing the transporting. The truck driver, railway worker, ship's crew and airline crew, etc., are closest to the material. There is no room for complacency or hesitancy on the part of the nuclear transport industry on balanced transport regulation. The most immediate losers in the event of failure would be the industry and its workers.

Industry is fully committed to meeting its requirements within the international transport-safety regulatory regime. Transporters of radioactive material have an outstanding safety record. Indeed, the transport of radioactive material could be regarded as a model for the transport of other classes of dangerous goods. All too often we see pictures on television of catastrophic accidents involving other classes of dangerous goods. The nuclear transport industry has a track record of safe transport of several decades' standing. It is noteworthy that where there have been transport incidents involving radioactive material, and these have been very few relative to the number of such transports, they have been without major radiological consequences for human health and the environment. Incidents have largely been transport events involving radioactive material rather than radiological events involving transport. There is good evidence that packages conforming to the IAEA standards offer appropriate protection under accident conditions. The IAEA General Conference in 1998 recognized that "compliance with regulations which take account of the Agency's Transport Regulations is providing a high level of safety during the transport of radioactive materials" (Resolution GC (42)/RES/13).

There are two principal reasons for this outstanding safety record. It is due primarily to well founded regulations developed by such key intergovernmental organizations as the IAEA, with essential contributions from the Member States who participate actively in the regulation review and implementation processes, and their reflection in the international transport-safety regime of modal, regional and national regulations. It is due also to the professionalism of those in the industry who have cooperated in the full implementation of this regime.

5. INDUSTRY WORKING TOGETHER

There is a clear determination on the part of the nuclear transport industry and the key international organizations to dialogue, and through the

World Nuclear Transport Institute, industry has a dedicated vehicle for participating in this dialogue. The very fact that companies are prepared and able to collaborate in this way in itself sends a powerful message of industry's commitment to safe transport. The industry, through the World Nuclear Transport Institute, values greatly the opportunities made available to it within the IAEA, international modal organizations, and by national competent authorities, to dialogue in the common interest of safe, efficient and reliable transport.

6. ENHANCING THE IMPACT OF THE TRANSPORT SAFETY REGULATORY REGIME

The bottom line of transport safety regulation is, of course, safety. But safety is not a function exclusively of the wording of the regulatory provisions. Safety also is assured to the extent that there is stability in the international transport-safety regulatory regime. Safety is enhanced to the extent there is clarity within the regulations, to the extent that there is consistency and uniformity in their interpretation and their application around the world, and to the extent that they provide for efficient operation. Consistent interpretation and application of international regulations is important to the safe, efficient and reliable movement of radioactive materials.

Implementation is the reverse side of the regulation coin; they are intrinsically related. Consistency and predictability assist in ensuring compliance, help to avoid confusion among those involved in the transport chain, and help to avoid perception of differing applications of the regulations in different jurisdictions. When tailored to domestic circumstances, they focus appropriate resources on safety considerations and compliance.

7. COMMUNICATING TRANSPORT SAFETY

It is said on occasion that transport is a weak link in the public debate of issues surrounding the fuel cycle. It is the transport link that carries radioactive materials out from behind the factory perimeter fence and into the community — onto the highways and the railways. I would argue to the contrary, that transport should be perceived as a strong link. First, it is an absolutely essential link. Second it is a safe link with an outstanding safety record. Perhaps it would be more accurate to say that it is the debate surrounding the transport of radioactive material that is the potential weak link. This need not be the case.

The regulators and the regulated both have powerful messages to convey of necessary and safe transport.

Many have sincerely held concerns about the transport of radioactive material. Sometimes this concern derives from a lack of information or understanding of the reasons for, and the nature of, the transport and how safe it really is. The value of an idea, of course, may have little to do with the sincerity with which it is held.

It would be difficult and a mistake to underestimate the importance of public attitudes to nuclear transport. The nuclear transport industry recognizes this and takes its responsibilities for effective and appropriate communication seriously, commensurate with the necessity to ensure security of transport. An appropriate balance must be struck between openness and security requirements according to international agreements.

It is not sufficient that the nuclear transport industry is conducted safely, and that the industry and the regulators know that it is so conducted, it is necessary that the message of essential and safe transport be conveyed to far wider and diverse audiences. The public's approach to information processing is complex and diffuse. Public attitudes are made up of much more than facts. They tend to be a complicated mix of beliefs and feelings as well. And attitudes can be devilishly hard to change, even when confronted by compelling new contrary evidence.

The smallest incident involving the transport of radioactive material, even in the absence of radiological consequences, has the potential to play to people's latent fears. There is no question that accurate information plays a powerful part in allowing greater public understanding. The communicator must engender trust, the communicator must provide reliable, empirically based and rigorously proven knowledge. Facts must be presented such as to take account of the wider context, being seen to respond to the wider public's interests. No longer is it sufficient that the science, the standards and the regulations should be right; they should be intelligible. The nuclear transport industry today is committed to communicating effectively while honouring its commitments and requirements for safe and secure transport.

8. SUMMARY

There is widespread recognition that maintaining transport options — in the interest of bringing the benefits of nuclear energy to where they are needed — requires open and sustained dialogue between regulators and the regulated. It also requires close collaboration among all parties in the industry. Industry recognizes that it must continually educate itself to ensure full compliance with the international transport safety regulatory regime. Equally, industry must take the opportunities afforded it to inform the regulators and others of the context in which industry performs its essential services, and to be engaged in the regulation-review and implementation processes.

Practical, efficient and safe transport regulation takes account of its impact on those who do the transporting. Pressures on the transport sector are not without serious consequences; they can cause delays and, in some cases, cancellation of essential deliveries. Complex routings and the necessary use of expensive carrier options can adversely affect cost efficiency.

There is a powerful message here: transport of radioactive material plays a vital role in the implementation of peaceful uses of the atom for the benefit of society. The nuclear transport industry operates within a highly stringent international transport-safety regulatory regime that is subject to regular review to ensure safety. The transport of radioactive materials has an outstanding safety record over several decades. The nuclear transport industry takes its responsibilities seriously. The industry has come together, through the World Nuclear Transport Institute, to collaborate in ensuring that it continues to meet its commitments to safety. The industry is seeking every opportunity to increase mutual understanding among the major stakeholders through dialogue and collaboration.

The nuclear transport industry, and all those who rely on safe, efficient and reliable transport welcome the opportunity provided by this important conference to increase that understanding.

THE ROLE OF WORKER NGOs IN ENSURING SAFETY IN THE TRANSPORT OF RADIOACTIVE MATERIAL
A view from IFALPA

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Abstract

The paper elaborates on the role that airline pilots play in facilitating the safe transport of radioactive material and how the International Federation of Air Line Pilots Associations (IFALPA) uses a Dangerous Goods Committee to address radioactive-material transport issues. Through this committee, the interests of the pilots are carried to the regulatory bodies, and information from those bodies is carried back to the pilots. The function of IFALPA and its Dangerous Goods Committee are described, and a viewpoint of the end-users of the Regulations is provided.

1. INTRODUCTION

I am Vice-Chairman of the Dangerous Goods Committee of the International Federation of Air Line Pilots Association (IFALPA) and have been directly involved in the carriage of radioactive materials since 1987, when my committee first heard of plans to ship nuclear fuel by air.

IFALPA is a non-governmental organization (NGO) based at Interpilot House in Surrey near Runnymeade, in the United Kingdom. It has offices also in Montreal (within the International Civil Aviation Organization (ICAO) building) and Mexico City, with a combined permanent secretarial staff of about twenty.

IFALPA exists to represent the interests of member pilots at an international level. The federation is structured to provide a democratic forum, to promote a common viewpoint, and the federation tries to interact with all the major aviation bodies. It was founded in 1948 by thirteen associations and now has ninety-five member organizations representing over 120 000 pilots, about two thirds of the global commercial pilot population. It is a large organization, but it is important to remember that everyone within it has the same objective in the end: aviation safety.

Figure 1 shows a rather poignant photograph, taken in New York prior to 11 September 2001.

2. IFALPA'S MISSION

IFALPA's mission statement is "to be the global voice of airline pilots, promoting the highest level of aviation safety standards worldwide and to provide support and representation to all of its member associations."

This statement was taken from our excellent award winning web site at *www.ifalpa.org,* where news releases are available with regularly issued aviation-safety bulletins.

3. IFALPA'S FUNCTION

Among other things, IFALPA:

— Presses for the adoption of international standards and their implementation at a national level,
— Uses the ICAO, the Joint Aviation Authority (JAA), the Federal Aviation Authority (FAA), the International Air Transport Association (IATA) and the International Atomic Energy Agency (IAEA); in fact, IFALPA uses any organization that can effect a global standard or regulation,

FIG. 1. An Aer Lingus aircraft with the World Trade Center towers in the background.

— Tries to provide communicating channels among member associations and between these organizations and their government departments that apply the regulations.

Let me provide two recent examples of lack of harmonization in flight operations. Globally all aircraft fly at fixed altitudes — flight levels — that are usually measured in hundreds of feet. In China and the Russian Federation, however, they are measured in metres. Not ideal, so in these two regions we apply a conversion factor to our altimeters.

Recently I flew across the Atlantic and through Canadian airspace at 38 000 ft or flight level 380. I could not enter US airspace at this flight level, as it would not be legal until the following month.

These examples illustrate that although we've come a long way towards global standardization, we still have a long way to go.

4. ORGANIZATION OF IFALPA

IFALPA is organized into specialist committees that are made up of active pilots who give of their spare time to share their expertise. The committees' prime task is maintaining detailed policy manuals that serve as briefs for IFALPA representatives. In structure, these policy manuals usually mirror ICAO's annexes. They are basically the wish lists of the pilot community.

The decisions and policy statements from the committees are discussed and ratified at annual conferences.

5. THE SPECIALIST COMMITTEES

The eleven specialist committees, composed of line pilots nominated for their particular expertise or interest, meet once or twice per year to review their policy statements, to discuss and foster new developments in aviation, and to share details of incidents, problems and solutions.

6. THE TECHNICAL COMMITTEES

There are seven technical committees, as follows:

— Accident Analysis,
— Aircraft Design,

— Air Traffic Services,
— Airport & Ground Environment,
— Medical,
— Security,
— Dangerous Goods.

Figure 2 shows a photograph that I took from a cockpit as we were taxiing off the runway at the old airport in Hong Kong. This illustrates the fact that all seven technical committees would probably have discussed this accident.

7. FUNCTIONS OF THE IFALPA DANGEROUS GOODS COMMITTEE

I am vice-chairman of the Dangerous Goods Committee, known as HAZMAT in the United States. This committee monitors developments in the carriage of dangerous goods; reviews ICAO's Annex 18, the Technical Instructions for Carriage of Dangerous Goods and IATA's Dangerous Goods Regulations, helps to develop emergency-response procedures and training material. Through this committee, I and others have represented IFALPA at IAEA

FIG. 2. Aircraft after an accident.

meetings on the transport of radioactive material. We have also had representatives from the IAEA participate in our committee meetings. As a result, the committee regularly discusses the carriage of radioactive material.

8. AIR TRANSPORT OF RADIOACTIVE MATERIAL

Figure 3 shows the belly hold of a passenger aircraft.

The top of the hold is the floor of the passenger cabin. A passenger may sit close to a radioactive package.

Radioactive material can be shipped safely by air, but only if all proper precautions are taken. Accidents, we agree, are rare. Nobody has yet been injured by the radiation, but continued vigilance is needed because a single incident would have a disastrous effect in the present sensitive climate. It will be hard work to maintain existing standards.

FIG. 3. Belly hold of a passenger aircraft with cargo.

IFALPA will continue to offer opinions and expertise to the IAEA, which, in the past ten years, has radically changed how it does business.

9. COMPLEXITY IN THE REGULATIONS

A word of caution: many new cost-driven shippers are complaining about being overwhelmed by masses of complex dangerous-goods regulations. This is resulting in deliberate non-compliance with the regulations. These shippers often use excuses such as high training costs or staff turnover; it is happening also among shippers of radioactive material.

When caught, the guilty airline's reaction to a punitive fine is often a refusal to carry all dangerous goods. This is happening in the United States, and it is becoming a global problem.

If we are going to continue to serve the medical and industrial fields that require timely transport of radionuclides, we will have to grasp these complexity and training issues expeditiously.

10. THE END-USER'S VIEWPOINT

Pilots see themselves as goalkeepers, the last line of defence in the safety team. We have to trust the other team members and trust in the system as a whole. Confidence in that system has been shaken by recent events, which is why I now sit behind a bullet-proof door and why some US pilots are armed.

With regard to the transport of dangerous goods, if there is any ambiguity or error in the paperwork that is presented to the pilot prior to departure, he will always take the safest option, which is to offload the cargo in question.

11. CONCLUSION

We have come a long way in aviation, as indeed has the nuclear industry. Much remains to be done. The complexity issue, security, training, benefit analysis are all areas that need to be addressed and very soon.

It is unlikely that the next 100 years will see as much change as the past 100, but we must try to look forward, to imagine how the regulations will be seen in 2103.

With the dramatic advances that we have made, increasingly complex systems can actually be made simple for the end-user, the pilot. I implore the IAEA, for the sake of the pilots, to keep the regulations simple.

THE DEVELOPMENT OF RECOMMENDED REQUIREMENTS FOR SECURITY IN THE TRANSPORT OF RADIOACTIVE MATERIAL
A status report

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Abstract

The International Atomic Energy Agency has, until recently, focused on providing standards for safety, but not security, in the transport of radioactive material. It has issued guidelines on physical security for nuclear material, but is now expanding its efforts to provide guidelines for security of all radioactive material in transport. This paper summarizes the issues and recent efforts directed towards the development of the security guidelines.

1. BACKGROUND

Historically the transport of radioactive material has proved to be an extremely safe activity. It is estimated that approximately fifty million package shipments of radioactive material are undertaken each year, many of them internationally, and by all modes of transport (air, maritime, inland waterway, road, rail and post). This exemplary safety record is a result of the efforts of the:

— International Atomic Energy Agency (IAEA) in developing model regulations;

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— International organizations promulgating those regulatory requirements through binding regulatory documents;
— Member States implementing regulations at the State level based on the IAEA Transport Regulations;
— Industry effectively applying the requirements.

The focus of the IAEA's Transport Regulations has been, pursuant to the IAEA's Statute [1] (Article III.A.6), on establishing "…standards of safety for protection of health and minimization of danger to life and property." The Regulations (TS-R-1 (ST-1), Revised) [2] specifically address normal, routine and accident conditions of transport (e.g. see para. 106 of TS-R-1). The Regulations do not address intentional acts that disrupt packages or shipments of material for malevolent sabotage or terrorist purposes. Thus, the Regulations currently address safety (i.e. measures intended to minimize the likelihood of accidents involving packages of radioactive material and, should an accident occur, to minimize its consequences), but do not specifically address security (i.e. measures or precautions intended to minimize theft, loss of control, or misuse of radioactive material while in transport that may endanger life or property).

As a result of events and changing attitudes in the world, efforts were initiated by the IAEA, the United Nations Committee of Experts on the Transport of Dangerous Goods (UNCETDG) and other involved UN modal authorities to provide enhanced security requirements for the transport of all dangerous goods, consistent with the IAEA's statutory authority [1], focusing on developing guidelines for safety in the packaging and transport of radioactive material. Specifically, the IAEA General Conference took note of the need for enhanced security efforts in all areas of the application of radioactive material in its September 2001 meeting [3] and, as a result, the IAEA initiated efforts in mid-2002 to develop recommended security requirements for the transport of radioactive material. Those efforts have culminated in draft guidelines for security in the transport of radioactive material, which continue to be reviewed and developed.

2. ISSUES AND CONSIDERATIONS

A principal focus of Member States' security concerns has related both to unknowing mistreatment and mishandling, and to malevolent use of radioactive material, including nuclear material and sealed radioactive sources. Some of these concerns actually predate the events of 11 September 2001, which provided a new dimension to potential terror acts. For example:

— Loss of control of sources that has led to:
  - inadvertent exposure of people;
  - the meltdown of irradiator sources at foundries, contaminating significant quantities of metal products;

— Use or planned use, and the availability of, radioactive material for terrorist purposes.

These concerns have resulted in a number of initiatives by the IAEA and by some Member States to define appropriate levels of accountability and security for radioactive sources. A series of IAEA sponsored meetings have resulted in a Code of Conduct on the Safety and Security of Radioactive Sources [4], which is currently under revision, supporting documents such as the Categorization of Radioactive Sources [5] and the Security of Radioactive Sources [6]. In addition, an international conference was convened in March 2003 to focus attention on the scope of the problem with source security and on possible methods to improve their control.

Nuclear material is a subclass of radioactive material. It was subject to initiatives to assure their security prior to 11 September 2001. Since nuclear material is required to produce or build nuclear weapons, every aspect of its production, use, storage and transport has been subjected to intense concern and effort to institutionalize controls to prevent significant quantities from being diverted, and from falling into the hands of rogue States and terrorist groups. A primary vehicle for maintaining control of nuclear material is the Convention on the Physical Protection of Nuclear Material [7], to which eighty-eight Member States are party, and forty-five are signatories. The companion document The Physical Protection of Nuclear Material and Nuclear Facilities [8] provides guidelines on suitable means for establishing security for nuclear material including during transport.

Subsequent to 11 September 2001, added attention has been paid to security for all radioactive material, not just radioactive sources and nuclear material. This attention is a result, in part, of the realization that, in the view of those with malevolent intent, suicide in performing a terrorist act is sometimes acceptable and, perhaps, in some cases may even be desirable. Thus, the hazardous and sometimes lethal radiation field for some radioactive material, previously thought to provide self-protection for the diversion of the material, may no longer be considered a protecting factor. As a result, it is clear that the psychological and possibly immense socioeconomic cost and the potential for physical harm to exposed humans from an optimally successful terror-based use of radioactive material must be limited through the application of enhanced security measures, including for transport.

To meet this need, the IAEA, in response to a Board of Governors Resolution in 2002 [3], embarked on a programme to develop a set of recommended security requirements for radioactive material in transport as part of an overall enhanced security initiative to be funded, in part, from extra-budgetary contributions. The aforementioned draft guidelines for security in the transport of radioactive material are one of the results of that effort.

For the purposes of this paper:

— Safety relates to the protection of humankind and the environment from the potential consequences of accidents, while
— Security relates to the protection of humankind and the environment from the potential consequence of malicious, purposeful and unlawful acts of an individual or group.

It is noteworthy that the Agency's Transport Regulations, TS-R-1 [2], clearly address issues associated with safety and make clear that security requirements, if applied, should not interfere with requirements to assure safety (e.g. see para. 108 of TS-R-1). Indeed, the IAEA's founding statute [1] authorizes it to perform certain functions, including, in Article III.A.6,

"…establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property…"

Security guidelines, such as those in The Physical Protection of Nuclear Material and Nuclear Facilities, INFCIRC/225 [8], the Security of Radioactive Sources, TECDOC-1355 [6], and the anticipated guidelines for security in the transport of radioactive material, all are directed towards protecting health and minimizing danger to life and property. Thus, security may be considered a subset of safety.

Efforts relating to security in the transport of radioactive material build on the IAEA's statutory provision of "establishing standards of safety" so that activities involving radioactive material will be in compliance with the requirements of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources [9], which specifies that:

"*The transport of radioactive sources shall be subject to the requirements of the IAEA Regulations for the Safe Transport of Radioactive Material and any applicable international convention.*" (para. 2.9) and

"*Sources shall be kept secure so as to prevent theft or damage and to prevent any authorized legal person from carrying out any of the actions specified in the General Obligations for Practices of the Standards (see paras 2.7–2.9), by ensuring that: (a) control of a source not be relinquished without compliance with all relevant requirements specified in the registration of licence and without immediate communication to the Regulatory Authority, and when applicable to the relevant Sponsoring Organization, of information regarding any decontrolled, lost, stolen or missing source; (b) a source not be transferred unless the receiver possesses a valid authorization; and (c) a periodic inventory of movable sources be conducted at appropriate intervals to confirm that they are in their assigned locations and are secure.*" (para. 2.34)

The results of the efforts to provide recommended guidelines for security in the transport of radioactive material are expected to be initially published as a technical document (TECDOC) with the notation that it is provided as "*Interim guidance for comments*". The TECDOC may very well be a precursor for a future safety guide within the IAEA's corpus of Safety Standards.

3. PRECEDENT ACTIVITIES

A long-standing precedent for IAEA involvement in developing security requirements for transport is INFCIRC/225(Rev. 4) [8]. This document — which addresses a very small fraction of the family of radioactive material, and which was developed primarily to protect against diversion of this material for use in developing nuclear weapons — provides guidance for security requirements for nuclear material in both fixed facilities and in transit that may be incorporated in whole or part into national legislation to meet the intent of the Convention on Physical Protection of Nuclear Material [7]. Although application of INFCIRC/225 is not mandatory on IAEA Member States, following the tenets of the Convention is required for all of its signatory states.

Nuclear material is defined [8] as:

— plutonium (unless the isotopic concentration of ^{238}Pu is greater than 80%);
— uranium-235;
— uranium-233;
— irradiated nuclear fuel (INF).

The guidance offered by INFCIRC/225 for transport security includes general as well as specific requirements that may be omitted or graded in stringency depending on the nuclide(s) and quantity (of each) involved. The general requirements include:

— Minimizing time in transport;
— Minimizing the number and duration of transfers;
— Avoiding use of regular movement schedules;
— Requiring predetermination of trustworthiness of all individuals involved;
— Limiting advanced knowledge to a minimum number of persons.

Appropriate protection above the general level is defined by a categorization scheme based on the nuclide(s) and quantity. The highest security level, Category I, represents materials that are imminently applicable to the construction of one or more nuclear weapons. Category II requires significant security, while Category III requires only slightly more stringent security than that provided in standard transport. Some additional requirements that may be specified or are graded in stringency for these three categories of materials are:

— Advance notification to receiver;
— Advance authorization;
— Mode and routing selection;
— Provision of locks and seals;
— Search of load vehicle;
— Written instructions and measures after shipment;
— Communication during transport;
— Guards during transport;
— Emergency response force capabilities;
— Transfer of responsibility for international shipments;
— Mode-specific requirements.

In addition to the guidance for security provided by INFCIRC/225, other recent initiatives have increased the level of security in transport for dangerous goods. For example, new text was agreed to at the December 2002 meeting of the United Nations Sub-Committee of Experts on the Transport of Dangerous Goods [10]. These provisions will recommend security requirements for the transport of all dangerous goods, including radioactive material (Class 7), together with an enhanced set of security requirements for “high consequence dangerous goods”. The relevant air and maritime regulatory bodies (i.e., the International Civil Aviation Organization (ICAO) and the International

Maritime Organization (IMO)) also undertook actions beginning in late 2001 to provide enhanced security requirements. For example, in early 2003, the IMO published the International Ship and Port Facility Security Code and SOLAS Amendments 2002 [11], which focus on security in general, not specifically on security of dangerous goods.

The United States Department of Transportation has issued a Notice of Proposed Rulemaking (HM-232 [12]) intended to "…enhance the security of hazardous materials transported in commerce". The scope of the proposal is to require development and implementation of security plans by carriers and consignors and training of employees in the plan's content.

The IAEA recently issued two documents relating to security of radioactive sources [5, 6], and is proposing revisions to the existing Code of Conduct on the Safety and Security of Radioactive Sources [4]. The Security of Radioactive Sources TECDOC [6] provides some general guidelines for security in the transport of radioactive material, but also notes that sources transported "should also satisfy the recommendations that are to be issued in further IAEA publications on security in transport…"

4. ACTIVITIES TO DATE

The process of developing recommended security practices for radioactive material shipments began with the work of a single consultant in 2002 who defined many of the issues involved and derived a basis for identification of quantities of dispersible material (i.e. radioactive material in other than special form) that should be provided additional security.

A meeting of six consultants convened in October 2002 to extend the earlier work. They developed a method for identifying consignments of special-form radioactive material that should be afforded greater security where the methodology closely paralleled that developed earlier for radioactive material in other than special form. The consultant group developed draft requirements drawn, in part, from INFCIRC/225 and the United Nations Recommendations on the Transport of Dangerous Goods: Model Regulations [10], which had recently been modified to include specific security requirements for Class 7 shipments in excess of 3000 A_1 or 3000 A_2.

In March 2003, a group of consultants with expanded participation considered the work done previously, together with comments from selected outside reviewers and IAEA staff. The consultants studied the ongoing work at the IAEA relating to the security of radiation sources to determine the relevance of the classification scheme (which uses so-called D-values to categorize radioactive sources [5]) to the determination of security levels for materials in transport, and they continued the development of draft text to define recommended security measures for various classes of radioactive material consignments in transport. The consultants' draft envisaged three security levels:

— Security level 1, the most stringent,
— Security level 2, with requirements somewhat less stringent than those for security level 1,
— Normal security, which is typically provided by carriers as a matter of course.

These levels are based on the potential for harm posed by loss of control of the material.

The consultants evaluated, using D-values or A-values (i.e. A_1 or A_2 as specified in the Transport Regulations) as the basis for estimating the potential for harm, the appropriate delineator for the security levels. They decided by consensus that the A_1 and A_2 values used in transport for 30 years should be used to determine the appropriate security level to be afforded each consignment. It was proposed that:

— For consignments of radioactive material in other than special form, the security level is to be determined by the number of A_2s per conveyance,
— For special-form radioactive material consignments, the security level is to be determined by the number of A_1s or A_2s per conveyance.

The specific features required for each security level were developed from INFCIRC/225, and the newly developed security provisions for all dangerous goods, incorporated into the UN Model Regulations, were modified by the consultants based on their experience to meet the practicalities of the transport environment.

5. KEY FACTORS

Among the key aspects of the development of the proposed draft guidelines for security in the transport of radioactive material were:

— Conveyance or consignment as primary target,
— Potential uses of special-form material,
— Potential use of material not in special form,
— Amount of material needed to trigger security enhancements.

A brief discussion of these features of the problem as considered by the consultants is discussed in greater depth in the following sections.

5.1. Conveyance/consignment target scenarios

An initial step in determining the amount of radioactive material that requires security is whether a terrorist is likely to target a consignment or a conveyance carrying, potentially, several consignments. In transport, an attack is likely to focus on a conveyance and what it carries. Presumably, any terrorist group would have intelligence suggesting that one or more consignments of a nuclide of interest would be on board and would pursue a plan to capture the material for subsequent use/deployment elsewhere, and/or at the site of the attack.

For some materials, like spent fuel or high-level waste, where a consignment takes up the entire conveyance, the difference in determining a threshold for applying security on a consignment or conveyance basis is largely moot. However, in a case where multiple consignments are aboard a conveyance, it could be that one or more consignments are the target of a terror group. An example is an attack in which the goal is socioeconomic disruption in a modestly sized area that might be accomplished by use of multiple small consignments of radiopharmaceuticals for relatively simple dispersal action.

Thus a conservative approach suggests that a decision on security requirements should include the total of all nuclides on the conveyance, where there is the potential for the attacker(s) to attempt to disperse/use the entire contents of the conveyance. To further the process of determining the activity level requiring security means that evaluation of use/attack scenarios and potential for harm must be pursued.

5.2. Dose levels to be avoided by application of security measures

In the process of making estimates of shipment activities that would trigger application of security measures, the focus was on keeping the likelihood of causing a radiological dose resulting from terrorist action below 0.5 Sv. This dose level is somewhat above the stochastic limit, but certainly below the lethal limit of about 5 Sv for a short-term dose. The prospect of exceeding doses at this level was used to propose invoking the need for security measures to reduce the likelihood that a given scenario would occur.

5.3. Amount of radioactive material

A key issue addressed by the consultants related to determination of what quantity of various nuclides would trigger application of security levels 1 and 2. Since most actions required in the transport regulations are related to the activity in a consignment as measured in units of A_1 or A_2, these "customary" measures, or A-values, were judged to be a possible index. In addition, an extensive effort at the IAEA related to radioactive source security has resulted in a source classification system that depends on a "D-value" that relates to the activity that makes it "dangerous" to life or leads to permanent disability in some specific scenarios such as unknowingly carrying the source in one's clothing or accoutrements. As a result of the high profile of this work and its link to the concept of a dangerous radioactive device, D-values were also evaluated as the indices for triggering application of security levels.

Considerable discussion among the consultants related to the merits of A-values versus D-values as an appropriate figure of merit on which to decide the level of security to be afforded all radioactive material in transport. Ultimately, the consultants decided that A-values should be recommended as the determinant of security level. The bases for this decision were:

— Consignors and carriers have used A-values for decades and are familiar with them;
— A separate and independent set of criterion values inserted into the process of preparing shipping papers would increase complexity, require additional training and increase costs; and
— Concern that the basis for the D-values, especially the "pocket" exposure scenario, was believed to be untypical of the likely terrorist uses of radioactive material.

However, given the depth of discussion, the lack of unanimity among the consultants, the effort expended by the IAEA in developing and applying the D-values to radioactive source classification [5] and the commitment of Member States to the concept in their efforts on the Code of Conduct [4], it seems likely that this will be a major topic of significant discussion at the forthcoming October Technical Meeting scheduled to be convened to aid the development of guidelines for security in the transport of radioactive material.

5.4. Scenarios for radioactive material in other than special form

For conveyances containing consignments of radioactive material in other than special form (or consignments in special form in which the encapsulation has been removed by the terrorist group or breached in an attack), the issue of concern is the potential for dispersal of the radioactive material in a manner that produces a radiation dose, by inhalation, ingestion, ground shine, skin contamination or sky shine. These are the mechanisms that are considered in constructing the A_2 value (see, e.g. Appendix I of TS-G-1.1 [13]) and, as a result, the potential hazard posed by an attack or hijacking of the conveyance is taken as being described by the number of A_2s the consignment(s) contain(s).

Actions against conveyances can take many forms, ranging from intentionally caused accidents, use of high-penetration power devices to release package(s) contents, capturing the conveyance and producing a controlled release of contents, or capture of the conveyance and removal to a place where the contents can be accessed, processed and then released in a manner chosen to inflict maximum harm. For the purposes of the analysis performed, it was assumed (based on existing studies) that by moving through this sequence of actions increasingly larger fractions of the conveyance's content (as expressed in multiples of A_2) could be released. The actual fraction that might be released obviously depends on the intrinsic integrity of the package (Type A or Type B) and the sophistication of the attack. However, it was assumed that the most sophisticated approach can release virtually all the material in a form having maximum dose potential (i.e. a release fraction of 1.0) and that the least severe event (causing an accident) will release some small multiple of A_2, which might amount to as little as 10^{-7} A_2.

Figure 1 brings together the conveyance contents, potential release fractions in attacks of escalating sophistication, and potential dose consequence based on the basic radiological dose limit that defines an A_2 quantity of radioactive material. From the discussion of Q_c in TS-G-1.1 [13], at a distance of about 10 m from a package containing an A_2 quantity that releases 10^{-3} of its contents, a dose of about 0.05 mSv would be expected. For this application, an equivalent dose scenario is one that produces a dose of about 10^{-3} Sv when a package containing one A_2 releases 10^{-3} of its contents as respirable material. This is the base point for Fig. 1. Lines are included in Fig. 1 showing doses of 0.05, 0.5 and 5 Sv for reference. These lines, slanting upwards to the right, indicate the potential dose to be received from the release of the indicated fraction of the conveyance's contents as respirable material.

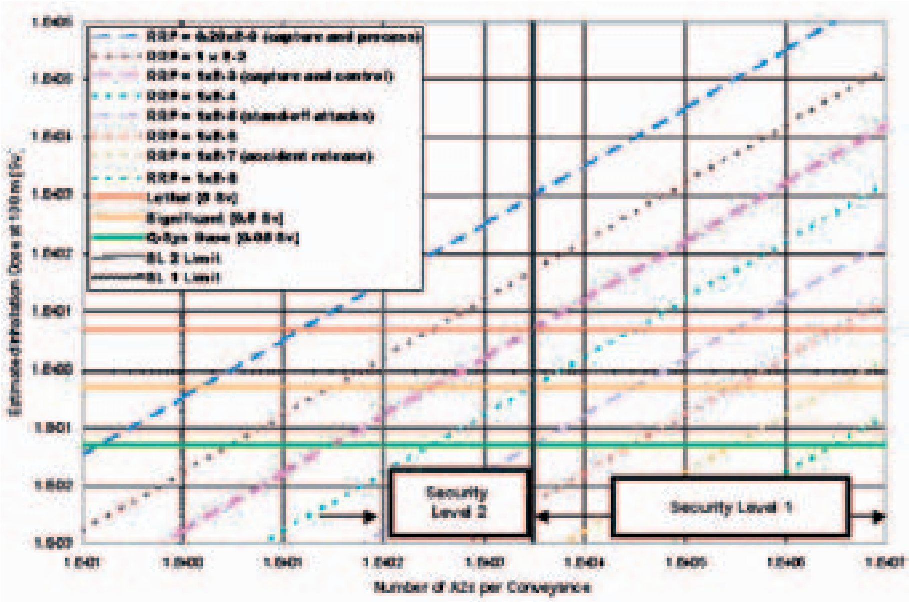

FIG. 1. Determination of security levels for radioactive materials not in special form (level 1 >3000 A_2/conveyance and level 2 between 10 and 3000 A_2/conveyance).

As can be seen in Fig. 1, the line for a 10^{-4} release fraction, which is just above what might be expected in a terrorist action using a standoff type weapon for which most feasible defenses are unlikely to be successful, intersects the 0.5 Sv line at about 3000 A_2. It was concluded that, at about this level of conveyance content, there should be effective security to reduce the likelihood that a terrorist group could effect attack modes involving capture and control that would have greater release fractions. This is taken as the threshold for security level 1 measures to be taken. Similarly, at an activity per conveyance of about 100 A_2, application of a somewhat lower security level would be justified to guard against conveyance attack scenarios that have relatively lower dose consequences than those further to the right. Thus, the security level 2 limiting conveyance content is suggested to be about 100 A_2.

It is clear from the above arguments that the selection of the activity limits for security level 1 and 2 thresholds is a process that is largely judgemental. However, the limits selected do respond to the need for a graded approach, providing security to reduce the probability that a conveyance containing a large amount of material could be used to produce very high doses in a large population in a capture, process and release scenario that approximates a radiation dispersal device (RDD) (sometimes called a “dirty bomb”).

5.5. Scenarios for special-form radioactive material

In evaluating the potential doses that might be realized from malevolent use of special-form material, several exposure scenarios were examined that were derived from the basic definition of an A_1 quantity of radioactive material [13]. That definition, 0.1 Sv/h at 1 m from the unshielded material, was extended to potential exposure situations characterized by different combinations of distance and time. In Fig. 2, lines showing the dose received in these time/distance scenarios are plotted on a field showing dose and number of A_1s per conveyance.

Implicit in the cases developed is the idea that loss of a large source would be detected within a few hours and a search developed to locate it that would limit potential exposure time for the public to no more than 5 or 6 h. Also shown is an estimate of the dose that might be received if a source were secreted in a letterbox or vehicle parked at a sidewalk. From these scenarios it is clear that an unshielded special-form radioactive material source amounting to 100 A_1 (especially those much larger than 100 A_1) can produce exposures in a few hours to a few minutes that equal or exceed 0.5 Sv. These sources should be subject to the highest level of security to ensure that an attack on the conveyance, loss, or failure of accounting for them is quickly obvious on a time scale consistent with the time it takes to set up an exposure situation. Smaller

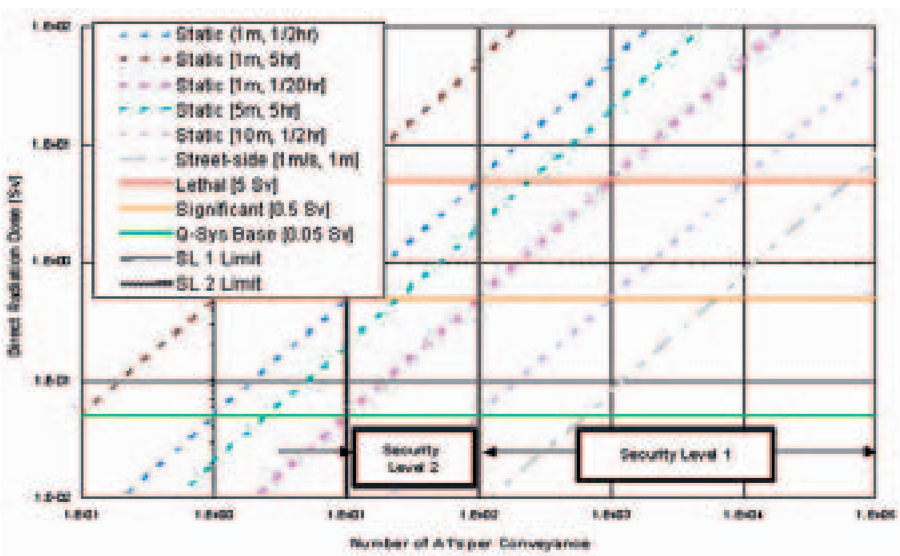

FIG. 2. Determination of security levels for special-form radioactive materials (level 1 >100 A_1/conveyance and level 2 between 10 and 100 A_1/conveyance).

sources, those between 10 A_1 and 100 A_1, which accumulate dose more slowly, could be subjected to lower security requirements, but it is clear that, even in those cases, search and recovery needs to be accomplished fairly quickly.

6. PRINCIPAL FEATURES OF THE RECOMMENDED REQUIREMENTS

The recommended draft guidelines for security in the transport of radioactive material include an Introduction, Application and Security Levels, General Requirements for Consignments in Security Levels 1 and 2, Additional Requirements for Consignments in Security Level 1, Additional Requirements for Consignments in Security Level 2, and Appendices.

The radioactive material quantity levels that have been proposed to delineate the three security levels are expressed in terms of multiples of A_1 and A_2 quantities of nuclides.

— The highest security is afforded by security level 1, which includes special-form radioactive material consignment(s) in excess of 100 A_1 per conveyance and consignments(s) of radioactive material in other than special form in excess of 3000 A_2 per conveyance.

— A lower level of security, but still above that normally afforded radioactive materials in transport, is provided by security level 2, which includes special-form radioactive material consignment(s) in excess of 10 A_1 per conveyance and consignments(s) of radioactive material in other than special form in excess of 100 A_2 per conveyance.

7. ISSUES REMAINING FOR DISCUSSION AND RESOLUTION

A number of issues related to the draft guidelines for security in the transport of radioactive material are likely to engender further discussion and will require resolution. These include:

— Cost and complexity related to adding security relative to potential benefits of increased security (or avoidance of serious incidents involving illicit use of materials obtained from consignments in transport);

— Number of security levels and activity thresholds for their determination;

— Consistency with the recent changes to the UN Model Regulations for security for all dangerous goods;

— Whether exclusion of certain classes of consignments is justified, e.g.

- nuclear material covered by INFCIRC/225,
- material with unlimited A_2s,
- packaged LSA and LCO material,
- bulk LSA/LCO material,
- excepted packages;

— Use of A-values or D-values for security discrimination and, if D-values are used, what the discrimination levels should be;
— Irrespective of the discrimination levels and their bases, how a consignor or a carrier is to handle multiple or mixed consignment where there may be both special-form radioactive material and radioactive material in other than special form on a given conveyance;
— Relationship to the transport recommendations in IAEA-TECDOC-1355 [6] on Security of Radioactive Sources.

8. CONCLUSION

A methodology has been developed to define the level of security that should be afforded radioactive materials in transport. The methodology as well as the actual recommended requirements will be subject to intense scrutiny and will likely be modified to some considerable degree. However, the events of 11 September 2001, which defined a new scale of attack and self-sacrifice in its execution, taken with some preliminary indications that terror events based on use of radioactive material are possible, make completion of this work an important aspect of the IAEA's Radiation and Waste Safety Programme.

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STATEMENT BY THE RESIDENT REPRESENTATIVE OF NEW ZEALAND TO THE IAEA

B. BRIDGE
Ambassador,
Permanent Mission of New Zealand to the IAEA,
Vienna

We have heard today an informative and detailed account of the history of transport of radioactive material and of the regulatory arrangements that are currently in place.

To round out the picture, Mr. President, I wish to mention some concerns that I know are shared by a number of States past whose shores these shipments regularly sail.

Mr. President, a number of us are very concerned that shipments of radioactive material are regularly sent past our countries. We are worried about the potential for an accident or incident that could result in a release of radioactive material or might one way or another have a very adverse effect on our countries. And given the international environment of the last two years, a terrorist attack is one type of incident that we are concerned about, along with other international criminal activities.

Some of today's speakers have argued that the risk of an accident is low. But the potential damage and loss from an accident involving nuclear materials is enormous. This means, in our view, the strictest and most comprehensive regulatory regime possible. We need to ensure that our populations, economies and marine environments are protected, as our size and capacity to respond to incidents involving the transport of radioactive materials make some States especially vulnerable to such incidents.

Mr. President: We States are here at this conference to discuss how we can jointly work to ensure that risks are minimized, and how we can establish a comprehensive set of arrangements which takes into account the concerns that so many of us have. We are hopeful that the conference can produce a positive and constructive outcome.

We see a continuum of concerns that need to be addressed. The starting point must be that every effort is made to prevent any incident or accident occurring — obviously risk-management principles and practices are important in this respect.

Then there needs to be in place a plan for a quick and effective collective response to any incident that might occur.

And finally — really the ambulance at the bottom of the cliff which we all hope would not need to be utilized but which must be available in case of need — we must have in place a comprehensive liability regime covering all situations where harm or damage is linked to the incident in question.

EXPLANATORY TOPICAL SESSION: LIABILITY

Chairperson

R. ELK
South Africa

Co-Chairperson

S. McINTOSH
Australia

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Invited Paper

THE IAEA'S ROLE IN AND STATUS OF THE INTERNATIONAL LIABILITY REGIME

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Abstract

Over recent years, the international regime of liability for nuclear damage has undergone significant evolution. There is now in place a body of legal instruments dealing with nuclear liability. The International Atomic Energy Agency (IAEA) has played an active role in the development of the international nuclear liability regime. Several instruments of universal character were adopted under its auspices, including the Vienna Convention that forms, together with the Paris Convention (a regional treaty concluded within the framework of the Organization for Economic Co-operation and Development), the basis of the existing international liability regime. The two conventions enunciated identical principles of nuclear liability that apply both to incidents occurring at nuclear installations and during transport of nuclear material. There are also rules designed specifically to govern liability in the course of transport. In the aftermath of the Chernobyl accident, the IAEA initiated work with a view to strengthening the system of remedies available under the Vienna Convention. It resulted in the adoption of three new instruments under the auspices of the IAEA: the Joint Protocol (1988), which linked the Vienna and Paris Conventions without affecting their substantive provisions; the Protocol to Amend the Vienna Convention (1997), which substantially improved the protection of victims of nuclear accidents; and the Convention on Supplementary Compensation (1997), which established a mechanism of additional compensation from public funds to be contributed predominantly by nuclear power generating States and created conditions for establishing a single worldwide liability regime open for adherence by States party to the Vienna and Paris Conventions as well as by other States. While the objective of further improvement remains, it is advisable that effort now be focused on enlisting broad participation in the existing instruments, in the first place the Protocol to Amend the Vienna Convention and the Convention on Supplementary Compensation, so that they are enforced soon. Liability remains a topical issue. Given its mandate as well as its role in the development and functioning of the international nuclear liability regime, the IAEA is well placed to ontinue to serve as a focal point of international interest in the field of nuclear liability.

1. INTRODUCTION

A firm normative framework is vital for peaceful, secure and safe conduct of nuclear activities. Liability — a special mechanism for redress in the event of a nuclear accident — forms a requisite component of the legal infrastructure governing nuclear safety. It plays a significant socio-economic role in mitigating consequences of nuclear accidents by providing prompt and adequate compensation should nuclear damage occur. Liability reinforces the importance of maintaining a high level of safety, and stimulates measures to prevent or minimize nuclear damage.

Awareness of potential hazards resulting from a nuclear accident (e.g. large-scale domestic and transboundary damage; the latter may occur distant from the place of the accident with delayed health effects) led to early recognition of the need for liability rules specifically designed to address radiation risks that cannot be adequately dealt with through ordinary civil law remedies. While the first national legislation on nuclear liability was enacted in the late 1950s, it became evident that domestic measures were insufficient and that the problems arising from a nuclear accident, especially if transboundary damage occurs (e.g., transport cases), could not be effectively resolved without an arrangement at the international level. The objective was to establish a harmonized international legal regime that would provide victims of nuclear incidents with a simplified and assured access to compensation and would ensure, at the same time, certainty of liability conditions under which the nuclear industry would operate. Since the adoption in the 1960s of the first legal instruments, the international liability regime has evolved significantly. There is now in place a substantial body of such instruments. In pursuance of its statutory objectives and functions, the International Atomic Energy Agency (IAEA) has been actively engaged, cooperating as appropriate with other relevant organizations, in nuclear liability. Four legal instruments have been negotiated under IAEA's auspices.

2. STATUS OF LIABILITY INSTRUMENTS

2.1. The Vienna and Paris Conventions

In 1960, the Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention) was concluded within the framework of the Organization for Economic Co-operation and Development (OECD). It is a regional treaty, with, at present, fifteen parties; it was subsequently supplemented by the Brussels Convention, which established, also at the regional level, a system of State compensation where the damage exceeds operator liability. In 1963, the

Vienna Convention on Civil Liability for Nuclear Damage (Vienna Convention) was adopted under the auspices of the IAEA. Unlike the Paris Convention, it is a treaty of universal character, i.e. adherence is open to any State. The Vienna Convention entered into force in 1977 and currently has thirty-two parties. The Vienna and Paris Conventions, despite certain differences in detail, set out identical principles that have formed the basis of the present international regime of liability for nuclear damage.

They apply to incidents occurring *in certain installations* in the nuclear fuel cycle as defined in the conventions, e.g. land-based reactors, as well as to incidents involving nuclear material *in the course of transport.* Liability is *channelled* exclusively to the operator of a nuclear installation and, as a general rule, no other person that may be related to the nuclear incident, e.g. suppliers, carriers manufacturers, may be held liable for nuclear damage. The liability of the operator is *absolute/strict;* a person suffering nuclear injury is not required to prove fault on the part of the operator (or any other person), which would, in the circumstances of a nuclear incident, place a heavy burden on the claimant, especially in transport cases (victims are relieved of a complicated, time-consuming and expensive litigation in several jurisdictions against several defendants).

Liability is *limited in amount.* Under the Vienna Convention, its upper ceiling is not set, the installation State is authorized to limit the liability of its operators to an amount of not less than US$5 million in terms of gold on 29 April 1963. The Paris Convention sets the level of maximum liability at 15 million special drawing rights (SDRs). The State of the liable operator (installation State) may, however, establish a greater or lesser amount, but not below 5 million SDRs, taking into account the availability of the insurance coverage or the nature of the installation or nuclear material and the consequent risk involved. The operator is required to maintain requisite *insurance or other financial security.* It is incumbent on the installation State to ensure that adequate and effective financial security is in place in such amount, of such type, and in such terms as it specifies.

Liability is *limited in time.* As a general rule, rights of compensation are forfeited if an action is not brought within ten years of the nuclear incident. The law of the competent court may establish a shorter time limit of not less than three years (the Vienna Convention) or two years (the Paris Convention) from the date on which the claimant knew or ought to have known of the damage and the operator liable ("discovery rule"). The Conventions provide for the concentration of *jurisdictional competence* with the courts of a single contracting party and, as a general rule, it is the courts of a State party within the territory of which a nuclear incident occurred. Thus, in transport cases, it may be a State other than the installation State. The Convention applies to victims *without discrimination* on the grounds of nationality, domicile or residence.

Under the Vienna and Paris Conventions, the basic liability principles mentioned above are equally applicable to incidents occurring at nuclear installations and in the course of *carriage of nuclear material.* Also, they contain special provisions setting out detailed rules governing liability during transport. In conformity with the principle of "channelling", the operator, rather than the carrier, is, under normal circumstances, liable for nuclear damage in a transport incident. The transfer of liability between the sending operator and receiving operator is determined in accordance with the express terms of the written contract or, in the absence of such terms, by the point in time when each takes charge of the nuclear material. In the case of transport to a person in a non-contracting State, the sending operator in a State party remains liable until the nuclear material has been unloaded from the means of transport by which it has arrived in the non-contracting State. Conversely, in the case of shipment from a person in a non-contracting State, liability is imposed on the receiving operator in a State party, who consented in writing to the shipment, but only from the time the material has been loaded on the means of transport by which it is to be carried from the non-contracting State.

The carrier may be liable in two specific situations: (i) a carrier of nuclear material may, at his request and with the consent of the operator concerned, be designated or recognized, pursuant to the legislation of the installation State, as the operator in respect of such material. The carrier will then be considered as an operator for all purposes of the Convention; (ii) the two liability Conventions do not affect the application of international agreements in the field of transport (in force or open for signature or adherence at the time) dealing with third-party liability. Thus, in the case of an incident, both the carrier and operator could be liable pursuant to simultaneous application of a transport and a nuclear liability convention, respectively. With a view to avoiding the possibility of two-fold liability, the Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material was concluded in 1971 as a result of an effort sponsored by the IAEA, OECD, the OECD Nuclear Energy Agency (NEA) and the International Maritime Organization (IMO).

2.2. Convention of 31 January 1963, supplementary to the Paris Convention

The Brussels Supplementary Convention (BSC), which was concluded in 1963 within the framework of the OECD, is a regional treaty, an accessory to the Paris Convention. It has been in force since 1974 and currently has eleven parties. The BSC provides additional compensation to supplement the funds available from the operator under the Paris Convention up to the total of 300 million SDRs. The compensation is structured into three tiers: (i) the first corresponds to the operator's liability limit established pursuant to the Paris Convention, not less than 5 million SDRs; (ii) the second tier is the difference between the operator's limit and 175 million SDRs provided by the government of the Contracting Party in whose territory the installation of the liable operator is situated; (iii) the third tier of 125 million SDRs is provided jointly by all parties to the BSC from public funds. Contributions to this tier are made in accordance with a special formula on the basis of GNP and the thermal power capacity of the reactors situated in States parties.

2.3. Convention relating to civil liability in the field of maritime carriage of nuclear material

This Convention was concluded in 1971 as a result of an effort sponsored by the IAEA, OECD, OECD/NEA and IMO. It came into force in 1975 and now has fourteen parties. As mentioned above, it is designed to avoid twofold liability pursuant to a nuclear liability convention and an agreement in the field of maritime transport. Under the Convention, principles of nuclear liability law have been given precedence. In particular, any person who might be liable for nuclear damage by virtue of an international convention or national law applicable in the field of maritime transport, will be exonerated from such liability if the operator of a nuclear installation is liable under the Paris or Vienna Convention, or by virtue of a national law governing the liability for such damage, provided that such law is in all respects as favourable to persons suffering damage as the Paris or Vienna Convention.

3. STRENGTHENING THE INTERNATIONAL LIABILITY REGIME

In the aftermath of the Chernobyl accident, which prompted renewed interest in the strengthening of the international regime of nuclear liability, the IAEA initiated as a priority matter a comprehensive review of all aspects of nuclear liability. The negotiations pursued two main goals: to improve the existing liability regime, including revision of the Vienna Convention, and to develop a comprehensive liability regime open to worldwide participation. In this context, consideration was given to establishing a mechanism of additional funding through some form of State involvement.

3.1. Joint Protocol

Although based on the same principles, the Vienna and Paris Conventions existed for years in isolation from each other. In 1988, a combined effort of the IAEA and the OECD/NEA resulted in the adoption by a diplomatic conference convened by the IAEA of the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (Joint Protocol). It linked the two Conventions into one expanded regime. Between parties to the Joint Protocol, specified operative articles of both Conventions, i.e. Articles I–XV of the Vienna Convention and Articles 1–14 of the Paris Convention, are applied "in the same manner" as between parties to each convention. In order to avoid conflict of jurisdiction, the Joint Protocol has established a choice of law rule to determine which of the Conventions should apply to the exclusion of the other in respect of the same incident. In the case of a nuclear incident occurring in a nuclear installation, the applicable Convention is that to which the State is party in whose territory that installation is situated. In transport cases, determination of the applicable convention will be made pursuant to the provisions of the two Conventions (identical in substance) governing liability in the course of transport (Article II.1(b) and (c) of the Vienna Convention or Article 4(a) and (b) of the Paris Convention). The Joint Protocol does not change the material provisions of the two Conventions and applies to their current texts and future amendments. It came into force in 1992 and now has twenty-four parties.

Following the adoption of the Joint Protocol, effort was focused on the revision of the Vienna Convention and elaboration of an instrument on supplementary compensation. In 1977, intensive negotiations of several years resulted in the adoption of two new instruments by the Diplomatic Conference convened by the IAEA. Eighty-one States participated, four international organizations, and three non-governmental organizations attended as observers. The Conference adopted by an overwhelming majority the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (by a vote of sixty-four in favour to one against with two abstentions) and the Convention on Supplementary Compensation for Nuclear Damage (by a vote of sixty-six in favour to one against with two abstentions).

3.2. Protocol to Amend the Vienna Convention

The Protocol explicitly provides that the revised Vienna Convention does not apply to nuclear installations used for non-peaceful purposes. It *extends the coverage* to nuclear damage wherever suffered. Only a limited exception is allowed in respect of nuclear damage suffered in a non-contracting State that has a nuclear installation on its territory and does not afford reciprocal benefits. Thus, damage suffered in a non-contracting State having no nuclear installation is unconditionally covered. Substantial changes have been made to *the definition of nuclear damage:* the Protocol expressly lists certain kinds of damage, including costs of measures of reinstatement of impaired environment, and costs of preventive measures. The *definition of a nuclear incident* has been expanded to include, in respect of preventive measures, any occurrence that creates “a grave and imminent threat” of causing nuclear damage. The limit of operator liability is increased to not less than 300 million SDRs, which may be *phased in* over a fixed period of time. In particular, for a maximum of fifteen years from the date of entry into force of the Protocol, the operator’s liability may be limited to a transitional amount of not less than 100 million SDRs. Given latent injuries that may manifest long after the incident, a thirty-year period is set for claims for loss of life and personal injury. The ten-year period remains for all other types of nuclear damage. The Protocol enhances the jurisdiction provisions of the Vienna Convention by providing that, in the event of transport incidents within the exclusive economic zone or a similar area, jurisdiction over actions concerning nuclear damage lies with the courts of the coastal State having “most connection” with the incident. This does not, however, permit the exercise of jurisdiction contrary to the international law of the sea, including the United Nations Convention on the Law of the Sea. The Protocol may be *signed and adhered to* by all States, not just parties to the 1963 Vienna Convention. Five adherences are required to bring it into force. Currently, it has four contracting States and fifteen signatories.

3.3. Convention on Supplementary Compensation

The objective of the Convention on Supplementary Compensation (CSC) is to generate *additional funds* to supplement the compensation of nuclear damage available under the national legislation of States parties implementing the Vienna or Paris Convention or which is consistent with similar liability rules set out in the Annex. As a *free-standing instrument,* the CSC is also aimed at establishing a worldwide liability regime for nuclear damage that may be adhered to by all States irrespective of whether they are party to two basic conventions or not. The importance of the free-standing character of the CSC is underscored by the fact that at present many States, both nuclear-power generating and non-nuclear, for various reasons do not participate in the Vienna Convention or Paris Convention and, therefore, adherence to the CSC provides them with an alternative channel to establish treaty relations and join the worldwide nuclear liability regime. The Annex, which is an integral part of the Convention, provides the mechanism through which States not party to the Vienna and the

Paris Conventions may adhere. They will be required to bring their national legislation on compensation for nuclear damage into line with the liability provisions laid down in the Annex, which are in general equivalent to those of the two Conventions and the Protocol to Amend the Vienna Convention. However, contracting parties without nuclear installations may have only the legislation necessary to enable them to give effect to their obligations under the CSC. Also, the Annex contains special provisions (a *"grandfather" clause*) that allow a State having well developed legislation with "economic channelling" to participate in the CSC without changing its legislation. The "grandfather" clause was designed to satisfy the specific situation of the United States of America.

Supplementary compensation is provided by States parties in addition to the national compensation amount of at least 300 million SDRs, the availability of which is ensured by the installation State. This threshold for triggering the system of supplementary compensation correlates with the minimum level of the operator liability under the revised Vienna Convention. The Convention provides a phasing-in mechanism similar to that in the Protocol to Amend the Vienna Convention. The *contribution* of a contracting party is calculated according to a special formula on the basis of its installed nuclear capacity of nuclear reactors (one unit for each MW of thermal power) and its United Nations rate of assessment. The formula heavily relies on nuclear capacity; the latter part of the supplementary funds constitutes 10% of the part calculated on the basis of installed nuclear capacity. Contracting parties on the minimum United Nations rate of assessment with no nuclear reactors are not required to contribute.

The provision on *the allocation of supplementary funds* is designed to achieve a balance between non-differential treatment among victims in and outside the territory of the installation State of a liable operator and the need for certain proportionality between the national compensation amount and compensation of domestic and transboundary damage. In particular, 50% of the funds are devoted to compensate for nuclear damage in or outside the installation State; 50% are reserved for compensation of transboundary damage. In the event and to the extent that the national compensation amount of the installation State is less than 300 million SDRs, the amount for compensation of both domestic and transboundary nuclear damage is reduced proportionally and the other part of the supplementary funds is increased accordingly. On the other hand, if the national compensation amount is not less than 600 million SDRs, then all supplementary funds will be used to compensate nuclear damage in and outside the installation State.

The CSC contains a *jurisdiction clause* similar to that included in the revised Vienna Convention regarding jurisdiction of the coastal State party over actions in connection with nuclear incidents occurring in the exclusive economic zone.

The CSC *enters into force* when five States with a minimum total of 400 000 units of installed nuclear capacity adhere to it. Since this amounts to approximately 40% of the world total, the enforcement of the CSC depends on participation of States of large nuclear capacity. Currently, there are three contracting States and thirteen signatories.

3.4. Revision of the Paris and Brussels supplementary conventions

In 2002, the contracting parties to the Paris Convention and BSC completed negotiations on their revision by elaboration of two draft instruments: the Paris Amending Protocol and the BSC Amending Protocol. They are not yet open for signature. The most significant changes suggested in the former are the increase of the minimum amount of operator liability to 700 million euros, introduction of a detailed definition of nuclear damage and extended geographical scope. The BSC Amending Protocol raises the total compensation under the three-tier system to 1.5 billion euros. Also, the Protocol contains a provision that, where all the BSC contracting parties join any other international agreement in the field of supplementary compensation for nuclear damage, e.g. the CSC, a contracting party to the BSC may use the funds from the third tier of the BSC to meet its obligations under the CSC. This, in principle, creates a possibility for States parties to the revised BSC to join the CSC.

4. FUNCTIONS OF THE IAEA UNDER LIABILITY INSTRUMENTS

The IAEA has been assigned some specific roles under the liability instruments that are essential for their effective operation. The Director General performs functions of depositary of four instruments concluded under IAEA auspices, i.e. the Vienna Convention, Joint Protocol, Protocol to Amend the Vienna Convention, and Convention on Supplementary Compensation. Apart from regular depositary responsibilities, (s)he is entrusted several special tasks, e.g. receipt and dissemination of national laws and regulations (Vienna Convention, CSC), receipt of information on and maintenance of a list of nuclear installations for the purpose of calculation of contributions (CSC), and receipt of notifications on maritime areas for the purpose of establishing jurisdiction in the event of an incident (Protocol to Amend the Vienna Convention, CSC). The IAEA Board of Governors is assigned the function of establishing and reviewing criteria for the exclusion of nuclear installations and the maximum limits for the exclusion of small quantities of nuclear material (Vienna Convention, Protocol to Amend the Vienna Convention).

5. CONCLUDING REMARKS

The IAEA has made a significant contribution to the establishment of the international regime of liability for nuclear damage. At its initiative, the liability regime was strengthened by the adoption in 1997 of two new instruments: the Protocol to Amend the Vienna Convention and the Convention on Supplementary Compensation. These instruments have consolidated recent developments in the legal, technical and economic aspects of nuclear liability, while the internationally recognized principles of nuclear liability set forth in the two basic conventions have been reinforced. They represent substantial improvement in the protection of victims of nuclear accidents and a significant step towards a worldwide liability regime. The importance of the Protocol to Amend the Vienna Convention and the CSC is underscored by the fact that they were adopted through a carefully negotiated consensus on a broad international basis, a product of many years of discussion taking into account various legal, economic and political considerations of States from various geographical regions. While the objective of further improvement remains, it appears that effort will now be focused on enlisting broad participation both by nuclear and non-nuclear countries in the existing instruments, most importantly the Protocol to Amend the Vienna Convention and the CSC, so that they enter into force as soon as possible. It is pertinent to refer in this connection to resolution GC(46)/RES/9 adopted last year by the IAEA General Conference which, inter alia, "stresses the importance of wide adherence to the international nuclear liability regime established by the Vienna Convention on Civil Liability for Nuclear Damage, as amended in 1997, and the related treaties adopted under IAEA auspices."

Liability remains a topical issue. Given the IAEA's mandate, an important role it has played in the development of the nuclear liability regime and responsibilities assigned to it under the relevant instruments, it is well placed to continue to serve as a focal point for international interest in the field of nuclear liability.

Explanatory Topical Session: Liability

DISCUSSION[1]

S. MCINTOSH (Australia): The agreed changes to the Paris Convention are clearly to be welcomed. However, the revised Convention is still not open for signature. I should like to ask Mr. Reyners when he thinks it will be opened for signature.

P. REYNERS (OECD/NEA): Work on revising the Paris Brussels Conventions was completed in the spring of 2002, but final adoption of the revised instruments had to be postponed owing to a conflict of law between the provisions on jurisdiction of the Paris Convention and a new EC regulation dealing with the same subject. A solution to the problem, which did not affect the substance of the revision exercise, has now been found. As soon as the EC Council of Ministers confirms this, the amending protocols should be signed — in the autumn, I hope.

R. GONZÁLEZ ANINAT (Chile): As my country's representative to the IAEA, I should like to say that I fully support what Ms. Azurín Araujo of Peru said about the IAEA's liability regime. Moreover, the fact that the International Conference on the Safety of Transport of Radioactive Material includes a session on liability — a legal concept — shows clearly that the subject of the conference is not only technical but also political.

I. KOCA (Turkey): I believe that there is a need to strengthen the international liability regime. I should like to see a regime with a definition of "harm" that includes environmental damage and all forms of economic loss, and with adequate account taken of the concerns of transit States regarding such things as prior notification and emergency response. I hope that the findings of the conference will refer appropriately to the gaps in the existing international liability regime and to possible improvements.

T. KOMATSU (Japan): Expressions like "a floating Chernobyl" have been used in discussions regarding the transport of radioactive material. I hope that this technical gathering will lead to a better appreciation of the facts of radioactive material transport. The coastal States that are expressing great concern about some aspects of radioactive material transport do not have nuclear power programmes, and it is difficult for a nuclear expert to find a job in such a "non-nuclear" State. In the early stages of a radiological emergency,

[1] All contributed papers were published and made available at the conference, and were generally summarized either by one of their authors, an expert designated by the author(s), or by an invited expert. All of the contributed papers for this conference are included on a CD-ROM at the back of this publication.

however, the assistance of nuclear experts would be important. There exists a gap here that the IAEA, acting within the frameworks of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, can help to fill. Action taken pursuant to the Early Notification Convention and the Assistance Convention can help to minimize damage, including “rumour damage”. I would like to see more countries acceding to these two conventions. With regard to “rumour damage”, I would mention that, from the legal point of view, it is very important that there be a reasonable causative link between the damage and the radiological incident.

I would also mention that, after the 1999 Tokai-Mura accident, the responsible private company compensated for all the damage incurred. In paper IAEA-CN-101/2 by Maughan and Carroll of Ireland’s Department of the Environment and Local Government, it is stated that “compensation provided by the Japanese government for economic loss arising from perceived damage in respect of the 1999 Tokai-Mura incident received mixed reactions among commentators.” This suggests that there is not a widespread acceptance that such losses ought to be compensated and a belief that they are not covered by convention definitions.

A. HART (Peru): I should like to endorse what Mr. Carroll from Ireland and Mr. Mansfield from New Zealand said in their presentations, and also to express support of the idea of establishing a working group on liability within the IAEA. In addition, I should like to ask why the liability limits under the revised Vienna Convention are so different from those under the revised Paris Convention.

P. REYNERS (OECD/NEA): The fact that the future liability limits under the Paris Convention are higher than those under the revised Vienna Convention is due primarily to the difference between, on the one hand, the economic conditions prevailing generally in the Paris Convention region and, on the other, the economic conditions in many Vienna Convention countries. The capacity of the nuclear insurance pools in Western Europe was one of the main factors considered when deciding on the new Paris Convention limits, which also reflect the political will of the Paris Convention parties to place a great share of the financial burden of compensating for nuclear damage on operators as opposed to States. The share of the financial burden that will be borne by the nuclear industry has been vastly increased.

V. BULANENKOV (Russian Federation): In reply to Mr. Hart, I would say that the liability limits — and the other provisions — adopted in the protocol amending the Vienna Convention and [in] the Convention on Supplementary Compensation (CSC) represent a consensus carefully negotiated on a broad international basis. The revision of the Paris Convention and the

Brussels Supplementary Convention was undertaken by a very limited number of participants belonging to Western Europe, whereas the revision of the Vienna Convention and the elaboration of the CSC involved participants from countries from various regions with varied interests and economic situations. Representatives of more than fifty States attended the meetings of the IAEA Standing Committee, and the diplomatic conference that adopted the revised Vienna Convention and the CSC — by an overwhelming majority — was attended by representatives of eighty-one States.

S. MCINTOSH (Australia): Mr. Reyners referred to the capacity of the nuclear insurance pools in Western Europe. In that connection, I would recall that the parties to the Vienna Convention decided on a liability limit of 300 million special drawing rights (SDRs) as that was the maximum cover that the insurance industry representatives said insurers would provide.

P. BUBAR (United States of America): What is the substantive difference between, on the one hand, the Paris Convention and, on the other, the Vienna Convention and the CSC?

J.B. MCRAE (United States of America): For the most part, there is no substantive difference. The Paris Convention, the Vienna Convention and the Annex to the CSC all require countries to adopt national laws that incorporate the basic international norms of nuclear liability law, including the channelling of all legal liability exclusively to the operator, the imposing of absolute liability on the operator, the granting of exclusive jurisdiction to the courts of the country where the accident occurred, and the limiting of liability in amount and time. The CSC is the international instrument that provides the linking mechanism that permits countries with national laws based on the Paris Convention, the Vienna Convention or the CSC Annex to achieve treaty relations with one another and thereby advance global adherence to a comprehensive nuclear liability regime. The CSC provides essentially a top-level global comprehensive nuclear liability regime, i.e., it provides an opportunity for umbrella coverage.

The Paris Convention and the Vienna Convention, and also the Joint Protocol that links them, have not been successful in achieving a global regime. Currently, of the ten countries with the largest nuclear power generating capacities, five (Canada, Japan, the Republic of Korea, the Russian Federation and the United States of America) are not parties to either the Paris or the Vienna Convention. Many other important countries with nuclear power plants, such as China, and most countries without nuclear power plants are not parties to them either — the CSC was developed to attract broad adherence by these countries and also the countries that are already parties to the Paris or the Vienna Convention. In particular, the CSC ensures the availability of a substantial amount of compensation (at least 300 million SDRs under national law and a comparable amount from an international fund of which approximately 98% would be provided by countries with nuclear power plants). The CSC also ensures the exclusive jurisdiction of a country's courts in the event of a nuclear incident within that country's territory or its exclusive economic zone (EEZ). In addition, the CSC addresses the unique situation of the United States of America, where national law predates both the Paris Convention and the Vienna Convention and includes certain features that make adherence to either the Paris or the Vienna Convention impossible. The CSC will permit the USA to become part of the international liability regime without making fundamental changes to its national law. The CSC will also permit countries that adhere to the Paris Convention or the revised Vienna Convention to adhere to the CSC with few, if any, changes to their national laws.

R. ELK (South Africa): I recommend to Ms. Bubar that she read the full text of the paper presented by Ms. Touitou (IAEA-CN-101/1 by Mr. Mignot et al.), which contains a good comparison of the Paris Convention and the Vienna Convention.

J. LUDBROOK (New Zealand): I believe that the shortcomings of the present liability regimes could be alleviated by a protocol providing a single regime tailored to the circumstances of maritime transport and embracing prevention and response as well as liability and compensation. One problem for small States relates to the difficulty of pursuing claims in foreign courts. Many such States, for example the Pacific islands, have only very limited financial resources and relevant expertise. Perhaps provision could be made for the pursuit of claims through a diplomatic process, with the establishment of a claims commission whose costs and procedures would take account of the situation of many small States.

C.N. YOUNG (United Kingdom): In the "Conclusion" of paper IAEA-CN-101/2, Mr. Maughan and Mr. Carroll write, "Such weaknesses may be ameliorated through, inter alia, introducing unlimited liability for the installation State and ensuring the necessary funding is in place." How might these apparently inconsistent objectives be achieved?

E.P. CARROLL (Ireland): I should like to answer that question by emphasizing my view that the basic aim of the third-party liability conventions is to provide the nuclear industry with some form of insulation from normal third-party liability rules and that, until the nuclear industry is prepared to accept unlimited liability, it is going to have a credibility problem. Surely the "nuclear" States should together be able to establish a pool of funds sufficient to compensate for the consequences of serious — even catastrophic — accidents, especially if, as the nuclear industry keeps assuring us, the probability of such accidents is extremely low.

J.E. COOK (United Kingdom): From the presentation of Mr. Carroll, I understand him to believe that the conventions do not apply to States that are not parties to them. What is the situation?

S. MCINTOSH (Australia): I think that, in his presentation, Mr. Carroll said that the conventions do apply to States that are not contracting parties, but the insurance policies might not. From my understanding of the conventions, this means that the State would have to pay all.

J.E. COOK (United Kingdom): I understood Mr. Carroll to say that the conventions would not apply in the event of damage due to a terrorist act. That idea alarms me and I should like to hear the views of Mr. Reyners.

P. REYNERS (OECD/NEA): The Paris Convention and the Vienna Convention would definitely apply in the event of damage due to a terrorist act, although their provisions relating to the exoneration of the operator from liability in cases of armed conflict do not refer explicitly to terrorist acts, and it is agreed that they must be interpreted restrictively. The events of 11 September 2001 raised questions regarding the ability of nuclear insurers to continue providing coverage for damage resulting from armed conflict. These questions are being addressed in the various countries concerned and also in the NEA Nuclear Law Committee. Clearly, however, if the operator or the insurer were unable to compensate for such damage, governments would, under the conventions, have to take steps to indemnify the victims.

S.W.P. DE WAAL (South Africa): My understanding is that the nuclear liability regime was established in order to cater for catastrophic nuclear accidents at nuclear power plants that could not be catered for by normal civil law and normal insurance arrangements. Why should the nuclear liability regime be extended to cover the transport of radioactive material?

S. MCINTOSH (Australia): The regime already does cover radioactive material transport. Ever since their adoption some forty years ago, the conventions have covered such transport. We are not talking here about a proposal that they should cover it. A major factor here is that the operators of nuclear installations are assumed to have a greater financial capacity for meeting claims than carriers, who would normally be responsible under general liability principles.

P. REYNERS (OECD/NEA): It is sometimes forgotten that the conventions were adopted some 40 years ago because of concern about the possible international ramifications of accidents during transport of radioactive material. That concern existed long before concerns arose about the possible international ramifications of accidents at land-based nuclear installations, except in the case of such installations located near national borders.

D.J. KOP (Netherlands): In the case of the Amoco Cadiz oil spill, there was significant contamination. In the case of an accident during the transport of radioactive material, there may be no contamination, but, nevertheless, economic damage, due, for example, to a slump in tourism because of the perceived threat of contamination. Who is liable, or — to put it more bluntly — who should pay for the consequences of hysteria? Is there a legal precedent here, or are we in the realm of people being awarded damages because the producer of their microwave oven failed to inform them that it could not be used for drying pets?

N.L.J.T. HORBACH (Netherlands): As far as I know, there has been no court case where compensation was awarded on the basis of a perceived threat of nuclear damage. The Amoco Cadiz case suggests that the exhaustiveness and exclusiveness of the nuclear liability regimes are less strict than is generally claimed. There is a risk that claims for damages not covered by the nuclear liability regimes will be brought under other applicable (tort) law, especially in respect of victims from, or damage suffered in, States that are not contracting parties. One should bear this risk in mind when considering the network created by, and the interrelationship between, the IAEA-sponsored and the OECD-sponsored legal instruments.

B. MANSFIELD (New Zealand): There are examples of compensation being paid at the domestic level in cases where there has been no actual radioactive contamination, but loss has been suffered as a result of a perception of contamination. In my view, if coastal States suffer loss owing to a perception of contamination, it is unjust and inequitable that they should have to bear that loss unsupported. The transporting States should devise ways in which coastal States can be supported in such circumstances — a not impossible task for their lawyers.

J.B. MCRAE (United States of America): With regard to the Amoco Cadiz case, in the oil pollution area there is an international treaty to which France is party but not the United States of America. Only French fishermen suffered from the oil pollution caused by the Amoco Cadiz. Although no United States citizens suffered from it, this did not prevent a New York court from exercising jurisdiction and awarding $200 million in damages. Thus, unless all countries involved in such a case have treaty relations among themselves through a single international instrument, there may well be multiple lawsuits without any uniformity as to the rules that apply and who can be sued.

M. LAOSE (Nigeria): I should like to associate myself with the statement made by Ms. Bridge of New Zealand at the end of the Background Session on behalf of coastal States and with the suggestions made by Ms. Azurín Araujo of Peru in her presentation. I hope that the statement and the suggestions will be adequately reflected in the conference findings, and that the conference findings will contribute to efforts to work out a more comprehensive and globally applied nuclear liability.

Explanatory Topical Session: Liability

SUMMARY BY THE CHAIRPERSON

The liability regime is important for:

- Operators as consignors and consignees, carriers and shippers, and States to know where the liability lies;
- Insurers to be aware of the risk;
- Claimants to understand territorial jurisdiction and limits relating to time and amount.

The papers that were presented in the liability session addressed these issues as contained and provided for in the International Liability Regimes of both the Paris and Vienna Conventions and the Protocols dealing with amendments to these Conventions as well as the Convention on Supplementary Compensation. From both these papers and the discussion from the floor it is apparent that diverse views exist on the adequacy of these instruments.

The provision for informal discussion sessions during the conference is commended; it provided further opportunity to discuss mechanisms for establishing a way forward.

In the papers submitted for this session, the presenters:

- Addressed the two basic international liability instruments, the Vienna Convention on Civil Liability for Nuclear Damage and the Paris Convention on Third Party Liability in the Field of Nuclear Energy, concluded in the 1960s;
- Highlighted the amendments introduced to these two conventions through the amending protocols;
- Suggested the Convention on Supplementary Compensation for Nuclear Damage as a potential comprehensive global liability instrument for nuclear damage;
- Identified possible deficiencies and/or inadequacies in the current liability regimes.

During the open discussion from the floor it was apparent that:

- Diverse views exist on many of the provisions contained in the liability instruments, including the amount of compensation available and jurisdictional issues;

— A lack of understanding exists, both as regards the complexity of the instruments covering liability for damage and the relationship between the various international instruments; and
— More States need to join the existing liability conventions in order to have an effective global liability regime.

This explanatory topical session identified a need for a way forward, which will:

— Increase understanding of the liability regime and the international instruments,
— Enhance adherence to the current international instruments.

Round Table

COMMUNICATION WITH THE PUBLIC AND BETWEEN GOVERNMENTS

DISCUSSION

Chairperson

A. MACLACHLAN
Nucleonics Week

Co-Chairperson

A. HART
Peru

BLANK

Round Table

DISCUSSION

J.A. DOOLEY (United States of America): From the subject matter covered in this Round Table, I conclude that the essential issue is one of voluntary notification versus mandatory notification. The USA has no objection to voluntary notification if it is handled in a manner that does not compromise operational security, but a mandatory requirement of prior notification is inconsistent with the right of freedom of navigation under customary international law as reflected in the United Nations Convention on the Law of the Sea (UNCLOS).

There is absolutely no authority in international law whereby a State may make transit through its exclusive economic zone (EEZ) or territorial sea dependent on its receiving prior notification. I recommend Mr. Tani's paper IAEA-CN-101/10 in this connection.

Regarding paper IAEA-CN-101/11 by Ms. Azurín-Araujo, in my opinion she seriously misinterprets UNCLOS in a number of respects. For example, it is simply not true that, for the transport of radioactive material through territorial seas, the consignor must notify the competent authorities of the States in question or prepare an environmental impact statement. Further, it is simply not true that States have a duty to give prior notification of movements of radioactive material through the EEZs and territorial seas of other States, and the other States do not have a right to receive such prior notification. In her paper, Ms. Azurín-Araujo addresses the "precautionary principle". which she says is universally recognized. However, this principle is not universally recognized. There is no single, agreed "precautionary principle" that can be, or has been, invoked in all contexts. The position of the USA is that the "precautionary principle" has not been established as a principle of customary international law. Ms. Azurín-Araujo cites Principle 15 of the 1992 Rio Declaration on Environment and Development. However, the Rio Declaration is not a set of principles of customary international law. As the chapeau of the Rio Declaration makes clear, the principles enunciated in the Rio Declaration are not legally binding; they are what those who attended the 1992 United Nations Conference on Environment and Development in Rio de Janeiro believed countries should aspire to. The USA, which signed the Rio Declaration with reservations, does not consider it to be legally binding. Moreover, Principle 15

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

does not refer to the “precautionary principle” but to the “precautionary approach”. which is something rather different.

In paper IAEA-CN-101/16, Mr. Maughan and Mr. Brazel — after considering a range of international conventions, declarations, codes and resolutions (including recent resolutions of the IAEA’s General Conference) — conclude, perhaps reluctantly but I think correctly, that they do not meet the needs of all States potentially affected by the maritime transport of radioactive material, and they insist that those States “must be afforded a right of consultation and notification”. However, the USA, with the solid backing of the International Law of the Sea, emphatically declines to consider the establishment of any such right. Also, they raise, once more, the issue of the perceived need to establish a comprehensive and effective liability mechanism. The position of the USA is clear: the CSC and the revised Vienna Convention adequately address all civil nuclear liability issues, including those that relate to radioactive material transport, and the USA is strongly opposed to the idea of creating a further instrument in the nuclear liability area, especially an instrument dealing exclusively with radioactive material transport. In the opinion of the USA, the IAEA should promote broad adherence to the CSC and the revised Vienna Convention. The USA considers a special protocol on liability to be unnecessary and wasteful, since it would simply lead to further years of meetings and discussions and would delay the coming into force of a global regime.

In paper IAEA-CN-101/17, Mr. Stewart amply documents the fact that plenty of communication is taking place and plenty of information is being provided. In my view, the real problem is that those receiving the information are — if they take the trouble to examine it — simply unhappy about its substance, and there is little one can do about that.

J.A. READ (Canada): I would simply comment that, if you ask “Is there or is there not a mandatory requirement for…?”, then there is nothing to discuss. However, if you ask “Should there or should there not be a mandatory requirement for…?”, then there is something to discuss.

C. AZURÍN-ARAUJO (Peru): Since UNCLOS places on coastal States the obligation — and gives them the right — to monitor and protect the marine environment, I believe that coastal States are entitled to require environmental impact assessments of planned radioactive material transport operations. I do not consider the right of freedom of navigation to be absolute, and I would like to see the exercise of that right subjected to regulation. I would not like to see the maritime transport of radioactive material stopped, but I would like there to be regulations governing the way in which it is conducted. I believe that the authority established within the UNCLOS framework could be empowered to monitor what is done on the high seas, the common heritage of humankind.

A. HART (Peru): I would add that UNCLOS — to which 148 States are parties and which has therefore become "customary law" even for States that are not party, like Peru — clearly requires information exchange for the purpose of protecting the marine environment, including the environment of the high seas. Consequently, coastal States have, within the UNCLOS framework, some degree of jurisdiction in respect of the high seas. In that connection, I would note that some developed countries are trying — through measures such as the establishment of marine research areas — to gain greater control over the high seas for themselves. There are United Nations instruments regarding various activities carried out on the high seas, for example, fishing. So why should the marine transport of radioactive material not be covered by such an instrument?

F. MAUGHAN (Ireland): We seem to have moved into a discussion of whether UNCLOS confers rights on coastal or shipping States. I do not think that we shall get very far in interpreting UNCLOS during this week. However, I would like to make a general point about UNCLOS; it could be characterized as a framework convention that leaves it open to States, acting bilaterally or regionally, to develop arrangements for addressing their own concerns.

In his intervention, Mr. Dooley said that in paper IAEA-CN-101/16 Mr. Brazel and I, having considered a range of international conventions, declarations, codes and resolutions, concluded that they did not meet the needs of all States potentially affected by the maritime transport of radioactive material. We referred to those instruments primarily in order to show that many international instruments call for transparency and prior notification. We were not trying to prove that there is a right of prior notification. We were simply trying to show how international legal practice seems to be evolving. Regarding Mr. Dooley's final comments, I agree that there is unhappiness about the substance of the information being provided, but not that there is little one can do about it. The States that are providing information and the States that are unhappy must continue to engage, with a view to bringing about improvements in the current practice.

J.T. STEWART (United Kingdom): In my view, the issue of the prior notification of radioactive material shipments by sea is best addressed within the framework of the International Maritime Organization rather than that of the IAEA.

M.S.T. PRICE (United Kingdom): With regard to paper IAEA-CN-101/9 by Mr. Aguilar, it is ironic that until recently the International Nuclear Event Scale (INES) was not applied in the case of transport events, which are — because of the vast number of radioactive material package movements constantly taking place worldwide — the most likely to have an impact on the general public. However, the European Commission, France, Belgium, the

United Kingdom and the USA have come out in support of the application of INES in the case of transport events, and the French journal Contrôle uses the INES classification when reporting on transport events in France.

The idea of building INES into the IAEA's Transport Regulations was discussed at the Packaging and Transportation of Radioactive Materials (PATRAM) Conference in Chicago. An argument against that idea, however, is that INES has nothing to do with safety. There is a strong case for including in the Transport Regulations a requirement that there be an INES-based assessment of each event, so as to have a rapid snapshot that will facilitate communication with the general public, the media and governments.

A. MACLACHLAN (Nucleonics Week): I was involved in the development of INES Transport in France. I think it can be a very useful tool for communication immediately after an event. For example, it can help to alleviate the concerns that sometimes surround minor events. However, it is not ideal for indicating the severity of complex ones.

A.J. GONZÁLEZ (IAEA): I am opposed to the idea of building INES into the IAEA's Transport Regulations or into any other regulations since, as Ms. MacLachlan just said, INES Transport is not ideal for indicating the severity of complex events. INES is not based on thorough technical assessments, although some people have used it for assessing the safety of certain nuclear power plants in the light of the INES ratings given to events at those nuclear power plants. That is a misuse of INES.

J.A. READ (Canada): We have found that the first report that we receive after a radioactive material transport accident is invariably incorrect, so we always try to wait with our emergency response actions until we have received a report sent by one of our own inspectors from the accident site. Against that background, I am in favour of using INES for transport events despite its limitations. However, I do not think that its use should be a regulatory requirement. In my view, if INES were used consistently from country to country for transport events, it would be very useful.

J.T. STEWART (United Kingdom): I believe that INES could be a useful tool for rating transport events, but I also agree with Mr. González that it should not be built into regulations.

H. TANI (Japan): It is important that appropriate safety-related information be provided to relevant coastal States, in order to improve mutual understanding and increase confidence regarding shipment of radioactive material. However, sensitive information about physical protection must remain confidential. Moreover, on the basis of UNCLOS, ships have a right of free navigation and prior notification is not obligatory, although prior notification is normally given in special situations, for example, when there are traffic separation schemes in internal waters or territorial seas. That having been said, I do not think that issues such as prior notification and consultation should be considered within the framework of the IAEA. I believe that INES could be useful for rating transport events, and I would like the Secretariat to post INES ratings on an IAEA website. I would also like the Secretariat to post information about the incorporation of the IAEA's Transport Regulations into national regulations. In addition, I would like the Secretariat to make available to all Member States (including those not represented here), and also to the general public, the documents submitted to, and the substance of the arguments put forward at, this Conference either in a publication or on an IAEA website.

J. LUDBROOK (New Zealand): With regard to my paper, IAEA-CN-101/4, we see action to deal with the possibility of harm from an accident or incident as part of a continuum: prevention, emergency preparedness and response, and liability and compensation. Communication between governments is very important for building trust in the general safety of radioactive material transport, but we think that it must be a two-way process, for it is also an essential element of prevention and response. Communication between governments is an essential element of prevention because information exchange helps governments to ensure that all necessary preventive measures have been taken. Indeed, in the interests of best-practice risk management — which we would advocate — shipping States should consider how coastal States might be of assistance. After all, coastal States know their own regions and could help in assessing whether risk-management strategies and procedures have taken account of all relevant factors.

Communication between governments is an essential element of response because prior notification and dialogue help to ensure that coastal States, which have a legitimate interest in the protection of their territorial seas and their EEZs, are as prepared as possible for an incident and for related calls on their resources and infrastructure. If an incident occurs, governments must be able to respond immediately both to any radiological consequences and also to public concerns about the incident. As indicated by the IAEA's Director General in the opening session, clear advance notification of shipments of radioactive material is desirable, but the desirability of transparency must be reconciled with security considerations. In light of what I have just said, I should like to make the following points:

— There is need for dialogue and information exchange in the interests both of prevention and of response;
— There is need for agreement on the basic information that shipping States should, as a matter of course, provide to affected coastal States (papers

IAEA-CN-101/11 by Ms. Azurín Araujo and IAEA-CN-101/16 by Mr. Maughan and Mr. Brazel contain useful ideas in that connection);

— There is need for understanding of which parts of the information provided by shipping States should, for security reasons, be protected; and
— There might be value in interested countries working together on the development of ideas for "maintaining dialogue and consultation aimed at improving mutual understanding, confidence building, and enhanced communication in relation to the safe maritime transport of radioactive materials", an objective that the IAEA's General Conference last year highlighted in paragraph 12 of resolution GC(46)/RES/9.B.

H.-J. NEAU (France): In response to Mr. Ludbrook's intervention, I would like to say — in amplification of what is stated in paper IAEA-CN-101/15 — that, since 1995, four nuclear material shipments organized by COGEMA LOGISTICS have transited the Tasman Sea, but a long way from the New Zealand coast. Each time, before the arrival of the vessel in the Tasman Sea, COGEMA LOGISTICS deployed an expert team in New Zealand, where the expert team remained as long as the vessel was in the Tasman Sea. While in New Zealand, the expert teams were in constant contact with local authorities and local media.

A. HART (Peru): It seems to me that the attitude towards the sharing of information about radioactive material shipments and also towards the planning of such shipments differs markedly in the case of transport within a State from the attitude in the case of international maritime transport. For example, in the former case there are — as indicated in paper IAEA-CN-101/8 by Mr. Read and Mr. Clark — things such as fire department briefings and town council meetings at which the nuclear industry seems to have no difficulty in passing on detailed information. In the latter case, one cannot help feeling that the nuclear industry does not have much confidence in the discretion of the governments of coastal States. This is an issue that I would like to see addressed within the IAEA or in some other forum.

A. MACLACHLAN (Nucleonics Week): That is a point that has also occurred to me.

M. CLAPPER (United States of America): Regarding the comment just made by Mr. Hart, I would — as the manager of my country's Foreign Research Reactor Spent Nuclear Fuel Program — emphasize that, before every spent-fuel shipment, we notify the involved competent authorities in the country of departure, the countries of transit and the country of destination. By the term "country of transit" I mean one through which the shipment may pass by road or rail or where a vessel with the shipment may simply call in at a port.

Within the USA, we notify — and provide training in — only those States that will be transited. We do not notify States that will not to be transited, even if they are located close to the final destination point. Such States are in agreement with this approach as it means that their response and law-enforcement arrangements do not have to be activated.

We have been safely transporting radioactive material by road, rail and sea for forty years, thanks, in my view, to a process that works. It is not simply a 40-year streak of good luck. Nevertheless, many operations like those that we carry out are bedevilled by misinformation, false rumours, and unfounded fears that can be countered only through education of the general public. In that connection, I believe that members of the public in non-shipping coastal States would benefit from opportunities to inspect, for example, mock spent fuel, an empty spent fuel transport cask and an INF-class vessel.

H.-J. NEAU (France): We have given members of the general public the opportunity to examine vessels with transport casks on board during three port visits, two in South Africa and one in Panama.

N.C. BRUNO (Brazil): A big problem in educating the general public is that we technicians speak a technical language that the general public does not understand, whereas professional communicators, who speak a language that the general public understands, do not have a good grasp of the technical aspects of radioactive material transport. What should be done about this? Do you train technicians to be communicators or do you organize basic technical courses on radioactive material transport for professional communicators?

J.T. STEWART (United Kingdom): We have had a similar problem between technicians, on one hand, and lawyers, on the other. Do you teach the technicians some law or send the lawyers on technical courses? You need technical specialists who are able to communicate effectively with the general public and communications experts who are technically aware.

A. MACLACHLAN (Nucleonics Week): As a receiver of a great deal of technical information, I agree. It is important not to overwhelm people. Someone must take the technical information and produce a clear, concise message that will not confuse people.

H.-J. NEAU (France): We try to teach our technical experts how to communicate effectively and, in parallel, we try to ensure that our communications experts acquire a grasp of the technical issues. In that connection, we produce a variety of informational material, ranging from concise brochures through fact sheets covering the main points to “info files” containing all the information available.

C. AZURÍN ARAUJO (Peru): Returning to the question of the use of INES, although it is a useful post-event tool for general information purposes, I do not think that INES will help coastal State governments to take — pursuant to various conventions — emergency action for the purpose of assisting ships and their crews in protecting the environment. What such governments want is not so much post-event information as pre-shipment information in sufficient detail and well in advance as to enable them to prepare for any necessary emergency actions.

Further to what Mr. Hart said about the provision of information by the nuclear industry to the governments of coastal States, that the governments of such States have not — as far as I know — handled such confidential information as has been provided to them in an incorrect manner. Moreover, in my view, terrorism-related risks are greater when radioactive material is transported overland than when it is transported by sea; however, for overland transport, provisions are in place already for prior notification of shipments.

Reference has been made to “freedom of navigation”. I would recall in that connection that, in the European Commission, some Member States have been requesting measures to hold ships that have polluted the high seas when they enter ports within the European Union and to prosecute the owners. Some coastal State governments are wondering why such stringency is requested in one part of the world but not in others.

Lastly, regarding Mr. Ludbrook’s final point, I think that there would be value in interested countries working together on the development of ideas for “maintaining dialogue and consultation aimed at improving mutual understanding, confidence building and enhanced communication…”, and that those countries should work together on the development of such ideas within the framework of the IAEA.

A. MACLACHLAN (Nucleonics Week): Perhaps the principal question we should address is how to involve coastal States systematically in information exchange without compromising security.

J.A. READ (Canada): UNCLOS allows development of agreements that add to it and under which the parties are not bound by the UNCLOS text. Thus, a group of States party to UNCLOS could, without infringing UNCLOS, agree to exchange certain information in a certain manner under certain circumstances. Reaching the agreement would be the difficult aspect rather than implementation.

A.E. BOYLE (United Kingdom): I teach law of the sea and international environmental law at the University of Edinburgh. Also, perhaps more importantly, I sometimes act professionally for governments in connection with law-of-the-sea issues, and in doing so I try to prevent them from becoming involved in legal disputes, which can be very expensive. In my view, governments not wishing to become involved in expensive legal disputes should bear in mind that UNCLOS does not have any articles on prior notification of the passage of ships or on prior consent. And I doubt whether the article on environmental impact assessments (EIAs) applies to shipments of hazardous cargoes.

In my view, some of the papers contributed for this conference contain advice which, if accepted and acted upon by governments, would generate expensive legal disputes. In this context, I would mention that, in a recent UNCLOS-related legal dispute concerning the MOX fuel fabrication plant at Sellafield, United Kingdom, the arbitrators declined to hear the case, stating that there was no evidence of a risk of serious pollution of the marine environment due to shipments of MOX fuel. To me as a lawyer this suggests, no, demands that citing UNCLOS for EIAs in connection with radioactive material shipments by sea generally would fail because the threshold set in UNCLOS Article 206[1] would not be met. Also, the precautionary principle or precautionary approach would not be applicable. On the question of EIAs, I wonder whether anyone here would argue that, each time one of its tankers heads out onto the high seas, every oil company must conduct an EIA. The risk of pollution from oil tankers is very obvious, but I do not think that anyone is ever going to demand an EIA before every oil shipment by sea.

E.M. SUPKO (WNTI): On the question of communicating with the public, as I note in paper IAEA-CN-101/14, public opinion research in the USA and Canada indicates that the public considers scientists and engineers to be good sources of information on nuclear-energy-related issues. So, perhaps the emphasis should be mainly on training technicians to communicate in simple language without technical jargon.

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[1] The full text of this UNCLOS article is: “When States have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment, they shall, as far as practicable, assess the potential effects of such activities on the marine environment and shall communicate reports of the results of such assessments in the manner provided in article 205.”

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Round Table

SUMMARY BY THE CHAIRPERSON[1]

In this session, it could be seen that "communication" covers a very broad set of issues. These include the following:

— It is possible, as described by Canada and the United States of America, to communicate effectively with local and regional governments, especially through exchange of information with local safety and security authorities, so they will be prepared to deal with any emergency and, in turn, establish confidence with the public. This has been done on a small to medium scale; it will be interesting to see its implementation on the much larger scale needed to move spent fuel to the planned Yucca Mountain repository. The summary by Mr. Read also identified the importance for public acceptance of a perception of benefit — in this case using mixed-oxide fuel for nuclear weapons disarmament — to counterbalance the perception of risk.

— The situation becomes more complex, it seems, in the international arena. It does seem that it is easier to communicate about nuclear fuel movements within a country than between countries. To be sure, there are tools that can be used to communicate safety, as described by WNTI and COGEMA Logistics, or to communicate the degree of non-safety, as for example may be communicated with the International Nuclear Event Scale (INES) for transport events.

— It is also clear that States that feel affected, even threatened, by international sea shipments of spent fuel, plutonium or high-level waste are not satisfied with videos and information seminars. Citing international legal instruments, they claim a right to know *beforehand* of such a ship's passage, and, in some cases, the right to verify its safety through independent Environmental Impact Assessments. Only then, they say, can safety be adequately ensured.

— The shippers and the States that support them say, in essence, that they are doing all they can and need to do on the information front. More detailed, prior notification, not to mention consultation or consent, is not required by law and is precluded for security reasons. As put by Mr. Stewart, "The requirement for safety is more important than the desire for transparency."

[1] Presented by the Co-Chairperson, A. Hart (Peru), on behalf of the Chairperson.

— It was apparent that a difference of opinion exists on the interpretation of legal texts that apply in this field, and on the question of whether new measures are needed to promote what Mr. Maughan, Ireland, called a *systematic* right to notification and consultation. Also unresolved is whether there is, in fact, a way to respond to the desire of coastal States for prior notification without compromising security.

— At the least, what appears clearly to be needed are more efforts and new ideas to build confidence between States. The IAEA's safety-related services were mentioned as one way to build such confidence. Others could be sought — perhaps along the lines suggested by Mr. Ludbrook, New Zealand, of agreed international standards for information to coastal States — implemented in parallel with the ongoing dialogue on communication.

EFFECTIVENESS OF RADIATION PROTECTION IN TRANSPORT

(Technical Session 1)

Chairperson

J. JOLY
France

Rapporteur

S.M. MAGNUSSON
Iceland

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Technical Session 1

DISCUSSION

V.N. ERSHOV (Russian Federation): In paper IAEA-CN-101/24, Mr. Trivelloni and his colleagues stated that in Italy "the radiation protection regulations establish that the authorized carriers of radioactive materials have to provide to the competent authority, on a quarterly basis, detailed data regarding each shipment." Do similar requirements relate to the transport of other dangerous goods in Italy?

S. TRIVELLONI (Italy): I believe that such requirements relate to the transport of explosives.

V.N. ERSHOV (Russian Federation): Do such requirements exist in the other European Union countries?

S. TRIVELLONI (Italy): To the best of my knowledge, no. We enquired about what was done in some other European Union countries and found that, where the competent authority collected detailed data about radioactive material shipments, the shippers provided the data on a voluntary basis.

D.W. PSTRAK (United States of America): Should shippers of radioactive material to developing countries have some responsibility for ensuring that the receiving countries have the radiation protection infrastructure necessary for handling the material safely?

C. FASTEN (Germany): In my view, one cannot expect shippers to assume such responsibility. Incidentally, whatever the responsibilities of shippers may be, I do not think that one should differentiate between developing and developed countries in this matter.

A.D. WRIXON (IAEA): There is a great deal of discussion taking place about the responsibilities of exporting States vis-à-vis importing States, some of it in the context of the current work on revising the Code of Conduct on the Safety and Security of Radioactive Sources. The IAEA's Secretariat has been asked whether it could act as a judge of whether a State importing radioactive material has the necessary radiation-protection infrastructure. Rather than acting as a judge in such matters and making pronouncements that might be passed on to other countries, the IAEA's Secretariat is helping countries strengthen radiation protection infrastructure through a so-called Model Project in which over eighty IAEA Member States are participating on a voluntary basis.

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

K.A. SCHNEIDER (Germany): Radiation protection during the transport of nuclear fuel cycle material is well understood, and the people involved in the transport of such material frequently participate in and present reports at gatherings like this one. The people involved in the transport of radiopharmaceuticals, on the other hand, hardly ever participate in such gatherings, and I cannot help wondering why. For its part, the public believes that the safety levels in the transport of radiopharmaceuticals are higher than those in the transport of nuclear fuel cycle material, which is completely contrary to the facts.

J.T. STEWART (United Kingdom): When summarizing the papers contributed for this session, Ms. Fasten said that higher maximum exposures were reported in some of them than in others. I would welcome more information regarding this point.

C. FASTEN (Germany): From the survey described in paper IAEA-CN-101/22, it would seem that in Germany the highest doses are received in connection with the transport of radiopharmaceuticals, during the loading and unloading of road vehicles.

S. TRIVELLONI (Italy): The situation in Italy is similar. The highest doses to workers are associated with the handling of small packages, some of which have quite high surface-radiation levels.

J. JOLY (France): When there are many packages, vehicle drivers, who are in any case exposed to radiation from their loads while on the road, sometimes help with loading and unloading, thereby incurring higher doses.

S. FAILLE (Canada): With regard to the study described in paper IAEA-CN-101/19, no radiation protection programme was in place at the time of the study within the company at which high exposures occurred. The Canadian Nuclear Safety Commission is in the process of developing guidelines for the implementation of a radiation-protection programme within that company, which we expect will be in place by June 2004.

R.B. POPE (IAEA): From the data shown by Mr. Trivelloni in his presentation, it seems that in Italy the higher doses during transport are still due to molybdenum-99. I should like to know whether Mr. Trivelloni considers that additional dose minimization measures for molybdenum-99 are necessary.

S. TRIVELLONI (Italy): In my view, the only additional measure for minimizing the doses from packages with molybdenum-99 is to place the packages with the highest TI in the rear of the vehicle, so as to maximize the distance to the driver's cabin.

A.D. WRIXON (IAEA): At the end of her presentation, Ms. Fasten asked whether, as the doses to transport workers are so low, the individual monitoring of transport workers is necessary. I should be interested in hearing responses to that question.

C. FASTEN (Germany): I had in mind workers involved in the transport of nuclear fuel cycle material. The World Nuclear Transport Institute (WNTI) has suggested that individual dose monitoring of such workers is unnecessary, and my question was really about what we should do in that connection when we review the 1996 Edition of the IAEA's Transport Regulations (TS-R-1). The situation regarding doses to workers in other areas of radioactive material transport is not so good, and it has not improved during the past 15 to 20 years. As I indicated, the main problems are associated with loading and unloading of road vehicles.

W.L. WILKINSON (WNTI): Regarding the transport of nuclear fuel cycle material, operating experience over many years has shown that the doses to workers are unlikely to exceed 1 mSv/a, and that the doses to members of the public are only a few μSv/a. That is the reason for WNTI's suggestion just mentioned by Ms. Fasten, which is fully in line with the relevant IAEA guidance.

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Technical Session 1

SUMMARY BY THE CHAIRPERSON

The conference found that, for the transport of radioactive material:

- Individual doses *to the public* are low (well below 0.1 mSv/a),
- Individual doses *to workers* are generally low (less than 1 mSv/a), particularly from the transport of radioactive material in the nuclear fuel cycle,
- Individual doses *to workers* from the road transport of radioactive material for medical or industrial use can be significant (up to 10 mSv/a),
- Radiation protection programmes (RPPs) are a positive element in the control of doses *to workers*. The conference encourages broad application of the requirement for RPPs based on prior risk assessment and dose data,
- RPPs should lead to improvement through:
  - provision of information;
  - provision of training for all concerned;
  - establishment of procedures for routine transport and emergencies.

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COMPLIANCE AND QUALITY ASSURANCE

(Technical Session 2)

Chairperson

C. PECOVER
United Kingdom

Rapporteur

M. KUBO
Japan

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Invited Paper

APPRAISING STATES' REGULATION OF THE TRANSPORT OF RADIOACTIVE MATERIAL
A report on the IAEA's TranSAS

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Abstract

The International Atomic Energy Agency has established, at the request of its Member States, an appraisal service for transport safety. This service is undertaken upon request from a Member State. An overview of the Transport Safety Appraisal Service (TranSAS) is provided, including its objectives, the scope of an appraisal, the TranSAS questionnaire, the role of a preliminary agreement with a requesting State, and the appraisal process. Results of appraisals, to date, are reviewed.

1. INTRODUCTION

The Member States of the IAEA meet once a year in September to discuss questions or matters within the scope of the IAEA Statute and to make recommendations concerning issues they consider important. In September 1998, the General Conference adopted Resolution GC(42)/RES/13 on the Safety of Transport of Radioactive Materials. In adopting that resolution, the General Conference recognized that compliance with regulations that take account of the IAEA Regulations for the Safe Transport of Radioactive Material (the IAEA Transport Regulations) is providing a high level of safety during the transport of radioactive material. Good compliance requires that the regulations be implemented effectively. The General Conference, therefore, also requested the IAEA Secretariat to provide a service for carrying out, at the request of any State, an appraisal of the implementation of the Transport Regulations by that State.

In response to this request, the Director General of the IAEA offered a Transport Safety Appraisal Service (TranSAS) to all States in letter J1.01.Circ, dated 10 December 1998. The first TranSAS mission was undertaken and completed at the request of Slovenia in 1999. A report on the results of that appraisal was published and released for general distribution in the autumn of 1999.

In each of the General Conferences since 1998, resolutions focused on transport safety have commended the Secretariat for establishing the TranSAS, commended States that have requested that service and encouraged other States to avail themselves of it (see GC(43)/RES/11, GC(44)/RES/17, GC(45)/RES/10) and GC(46)/RES/9). Requests for TranSAS have now been received by the IAEA from Brazil, Turkey, the United Kingdom (UK), Panama and France. Five appraisals and a preparatory mission visit to France have now been completed. Two appraisal reports have been published and the other three are in various stages of completion.

This report provides an overview of TranSAS and summarizes the major findings from each of the appraisals completed to date.

2. OVERVIEW OF THE TRANSPORT SAFETY APPRAISAL SERVICE

This overview will address the following:

- The objective of TranSAS;
- The scope of the appraisal;
- The TranSAS questionnaire;
- The preliminary agreement;
- The appraisal process;
- The appraisal report.

2.1. Objective

The objective of TranSAS is to assist any requesting State in ensuring a high level of safety during the transport of radioactive material by reviewing its implementation of the IAEA Transport Regulations and by making recommendations for improvement where appropriate.

2.2. Scope of the appraisal

The general scope for any TranSAS includes:

- An appraisal of the State's regulatory practices for transport safety with respect to the requirements of the IAEA Transport Regulations and

related international standards and guidelines, covering all modes of transport (i.e. road, rail, maritime and air);
— Particular emphasis on any aspect of the appraisal as requested by the State.

2.3. Questionnaire

A TranSAS questionnaire was developed to provide a common basis for the appraisals, to assist the State in preparing for an appraisal and to assist the TranSAS team in carrying out the appraisal. The questionnaire contains detailed questions on the following eight key topics:

— Legislative and governmental responsibilities;
— The authority, responsibilities and function of the regulatory body;
— The organization of the regulatory body;
— The authorization process;
— Review and assessment;
— Inspection and enforcement;
— The development of regulations and guides;
— Emergency preparedness for transport.

Other questions may be included when specific emphasis on a particular area has been requested by the State.

2.4. Preliminary agreement

Following the request for TranSAS, and initial discussions between the appointed liaison officers from the State and the IAEA, a preparatory mission visit is arranged to organize and agree the details of the appraisal. These details are summarized in a preliminary agreement, which is prepared during the visit.

The preliminary agreement addresses the following:

— Objective of the appraisal;
— Scope of the appraisal;
— Tentative dates for the appraisal;
— Funding for the appraisal where appropriate;
— A listing of the activities to be completed by the IAEA and by the State during the period leading up to the appraisal;
— A preliminary schedule of activities during the appraisal;
— Facilities required during the appraisal.

The main activities to be completed by the State prior to the appraisal include the following:

- The completion and transmittal to the IAEA of the detailed TranSAS questionnaire;
- Ensuring the availability of key personnel from the authorities during the appraisal;
- Arranging the logistics for the appraisal, including accommodation and local transportation for the team members.

The main activities to be completed by the IAEA prior to the appraisal include the following:

- Recruiting the TranSAS team (this includes obtaining the necessary approvals for the recommended team members);
- Providing the TranSAS team with the completed questionnaire and guidelines for the appraisal;
- Arranging for travel of the team members to and from the State.

2.5. Appraisal process

The appraisal process includes the following:

- A preparatory session for the TranSAS team;
- An entrance meeting involving presentations by key representatives from the authorities concerning their responsibilities for the safe transport of radioactive material;
- Discussions to obtain clarifications and additional or more detailed information;
- Preparation of the draft report of findings;
- Ongoing feedback on the draft report of findings;
- Visits to facilities as appropriate;
- The exit meeting to present and discuss the findings.

2.6. Appraisal report

The appraisal report includes the findings for each area considered in the appraisal, together with a background discussion and a basis for any finding (tied to an international regulatory requirement or recommendation). The findings are presented as recommendations, suggestions, and good practices, which, for TranSAS, have been defined as follows:

— A *recommendation* is advice on improvement in the reviewed area. It can, but need not be, an indication of shortcomings either in the national statutory legislative and regulatory regime or in the methods of fulfilling requirements.
— A *suggestion* is either an additional proposal in conjunction with a recommendation or it may stand on its own. A suggestion should stimulate the regulatory body's management and staff to consider ways and means of enhancing performance.
— A *good practice* is recognition of a current practice that goes well above the norm and is worth bringing to the attention of other nuclear regulatory bodies as a model in the general drive for excellence.

3. OVERVIEW OF FINDINGS FROM COMPLETED APPRAISALS

3.1. Slovenia

The TranSAS team made recommendations and suggestions with regard to the legislative framework, competent-authority approvals, and inspections. One of the recommendations, with regard to approvals for "special arrangement" shipments, was acted on immediately in order to incorporate some specific requirements in the draft legislation on the transport of dangerous goods. It was recognized that action with regard to the other recommendations and suggestions would take some time.

The team identified some good practices and was impressed in particular by the fact that the latest edition of the IAEA Transport Regulations, the Basic Safety Standards, and other IAEA documents had already been published in Slovenian. These publications are provided, free of charge to university libraries and public libraries. The Internet is also used to make Slovenian regulations readily accessible.

3.2. Brazil

In general the appraisal concluded that, although some improvements were recommended, all areas of transport safety were well addressed and some good practices contributed to the safe transport of radioactive material.

There was some potential for harmonizing revision of the national transport regulations with revisions to the regulations from the international modal organizations. It would also be useful to develop formal agreements between ministries in areas of overlapping responsibility. The responsibilities for regulating, licensing, and inspection should be more clearly separated from the operational and promotional functions. More formality in procedures would enhance compliance-assurance aspects in regulating the transport of radioactive material.

Good practices were noted in particular in the area of emergency response. Capabilities for responding to an emergency and very practical guidelines would be worthy of consideration by other competent authorities. Another good practice involved emphasis on preparing and evaluating transport plans and the practical application of these plans for assuring compliance.

3.3. United Kingdom

Appraisal of the safety of the transport of radioactive material in the UK considered multiple aspects of transport, including all modes (i.e. road, rail, sea and air); the intermodal exchange of packages (i.e. road–rail, road–air, and rail–sea); the design approval, manufacture, operation and maintenance of packages; inspection and enforcement activities; and planning and responding to emergencies.

The appraisal showed that:

> "the regulatory framework in the UK for the transport of radioactive material is well developed; that the UK is committed to a sound safety culture in its transport regulations; that, in general, the regulation of this transport is handled well; and that the competent authority and the other involved regulatory bodies should be commended for their efforts. In all of these areas, and in other associated areas, the appraisal found much to praise. Specifically, the appraisal did not find any issues that were safety critical."

However, several areas were identified in which improvements could be made. The appraisal resulted in three recommendations and twenty-one suggestions, and identified fifteen areas of good practice that may serve as a model for other transport-competent authorities to emulate. Good practices identified in the maritime and air-transport operational areas were deemed to be especially noteworthy.

3.4. Turkey

The transport of a relatively small number of packages of radioactive material is well controlled in Turkey. Customs regulations specify permission from the Turkish Atomic Energy Commission (TAEK) for import of radioactive material. Only companies licensed by TAEK can import, export, transit, and transport radioactive material. Each shipment of radioactive material is subject to a permit from TAEK. A comprehensive database with information on the use, storage, and movement of radioactive material is updated on a continuous basis. This high level of control and monitoring enhances the safety of the transport of radioactive material in Turkey.

A draft revision of the national transport regulations, based on the 1996 edition of the IAEA Transport Regulations, has been used in Turkey since the requirements of these IAEA regulations became effective for international transport in 2001. It was recommended that these draft regulations be approved formally as soon as possible.

3.5. Panama

The responsibilities for implementation of the regulations for the transport of radioactive material in Panama and through the Panama Canal are clearly defined in laws and regulations and are well understood by the authorities involved. Highly qualified personnel are available to carry out the activities required for the small number of radioactive material shipments in Panama. Highly qualified personnel and significant resources are used to ensure safe transport of radioactive material through the Panama Canal.

With regard to radioactive material shipments in Panama, procedures and resources need to be developed to accommodate the increasing regulatory requirements resulting from revisions to the IAEA Transport Regulations and an expected increase in the number of shipments of radioactive material in Panama.

A considerable number of good practices were identified with regard to shipments through the canal, which are under the jurisdiction of the Panama Canal Authority. A very high level of safety is achieved by rigorous requirements concerning compliance with all applicable regulations, by control of the shipments through the canal and by highly developed emergency preparedness capabilities.

4. CONCLUSION

The safety record for the transport of radioactive material on a worldwide basis has been excellent, helped by good regulations and good implementation of the regulations. Just as it is necessary to continue updating the regulations, taking into account new requirements for transport as well as developments in technology and radiation protection, it is also necessary to continue reviewing the implementation of the regulations.

Review of the implementation of the regulations has just started and to date has been carried out only in five States that requested the appraisal service. These five TranSAS missions have confirmed regulatory practices that support the safe transport of radioactive material. Some of the identified good practices could be beneficial for other States. At the same time, all missions identified areas for improvement. Considering these needs for improvement in the small number of States reviewed to date, it is clear that TranSAS can assist many States with improving the implementation of the transport regulations and thereby enhance the safety of the transport of radioactive material. The General Conference has recognized the benefits of TranSAS missions and continues to encourage other States to make use of this service.

Invited Paper

EXPERIENCE WITH TranSAS
A key to compliance assurance

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Abstract

The paper provides a report on the experience of one expert in two Transport Safety Appraisal Service (TranSAS) missions for the International Atomic Energy Agency. It provides insight into how these missions are undertaken, the objectives, scope and findings. It also summarizes common findings, and makes suggestions on how future TranSAS missions might be enhanced.

1. INTRODUCTION

According to paragraph 311 of the Transport Regulations, the competent authority is responsible for assuring compliance with the regulations. The means of discharging this responsibility include the establishment and execution of a programme for monitoring the design, manufacture, testing, inspection and maintenance of packaging, special-form radioactive material and low-dispersible radioactive material, and the preparation, documentation, handling and stowage of packages by consignors and carriers, to provide evidence that the provisions of the Regulations are met in practice. Transport-safety appraisal services have been set up to assist Member States in evaluating compliance assurance.

2. OBJECTIVE OF TranSAS MISSIONS

The objective of a TranSAS mission is to assist a requesting State in ensuring a high level of safety during transport of radioactive material by reviewing its implementation of the IAEA's Transport Regulations and by making recommendations for improvement where appropriate. The appraisal focuses on the implementation of the Transport Regulations, but also addresses some other IAEA standards:

— Safety Series No. 120, the Safety Fundamentals for Radiation Protection and the Safety of Radiation Sources;
— Safety Series No. 115, the International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources;
— Safety Standards Series No. TS-R-1, the Regulations for the Safe Transport of Radioactive Materials;
— Safety Standards Series No. GS-R-1, Requirements for the Legal and Governmental Infrastructure for Nuclear, Radiation Radioactive Waste and Transport Safety;
— Safety Standards Series No. TS-G-1.1, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Materials;
— Safety Standards Series No. TS-G-1.2, Guidance on Planning and Preparing for Emergency Response to Tansport Accidents Involving Radioactive Material;
— Safety Series No. 112, Safety Report on Compliance Assurance for the Safe Transport of Radioactive Materials;
— Safety Series No. 113, Safety Report on Quality Assurance for the Safe Transport of Radioactive Materials.

The appraisal of the implementation of the IAEA Transport Regulations results in a report comprising recommendations, suggestions and good practices.

A recommendation is to be understood as advice on how improvements can be made in the national regulatory arrangements in the areas that have been reviewed and discussed. Such advice is based on proven international practices and should deal with root causes rather than the symptoms of the concerns raised. It can, but need not necessarily, be an indication of shortcomings either in the national statutory legislative and regulatory regime or in the methods of fulfilling their requirements. Recommendations should be specific, realistic and designed to result in tangible improvements.

A suggestion is to be understood as either an additional proposal in conjunction with the recommendation or may stand on its own following a discussion of the associated background. It may indirectly contribute to improvements in national regulatory arrangements, but it is primarily intended to make the regulatory body's performance more effective, to indicate useful expansions of existing programmes, and to point out possibly superior alternatives to current work. In general, it should stimulate the regulatory body's management and staff to consider ways and means of enhancing performance.

A good practice is to be understood as an indication of an outstanding organization, arrangement, programme or performance, superior to those

TABLE 1. STATISTICS ON FINDINGS FROM COMPLETED TranSAS MISSIONS

Country	Recommendations	Suggestions	Good practices
Slovenia	7		2
Brazil	22	7	3
United Kingdom	3	21	15
Turkey	6	14	3

observed elsewhere, and more than just the fulfilment of current requirements or expectations. It has to be superior enough to be worth bringing to the attention of other nuclear regulatory bodies as a model in the general drive for excellence.

The distinction between a recommendation and a suggestion is sometimes subject to discussion, due to divergent interpretations and sensitivities. Table 1 gives some statistics on numbers of recommendations, suggestions and good practices for the first four TranSAS missions.

Table 1 indicates the difficulty in reaching a uniform interpretation of recommendations and suggestions. It also illustrates the evolution in the interpretation of those terms.

3. SCOPE OF TranSAS MISSIONS

The general scope of TranSAS missions includes:

— An appraisal of the State's regulatory practices for transport safety with respect to the requirements of the IAEA Regulations for the safe transport of radioactive material and related international standards and guidelines;
— Recommendations, as appropriate, in areas where the State's regulatory programme for transport safety might be improved.

Since the appraisal is performed at the request of a Member State, the scope of each mission is slightly different.

The more specific (additional) scope for Brazil, as requested, included:

— To evaluate national transport legislation and regulation, taking into account applicable international practices, and give special attention to the need to take into account the implementation of the requirements of

the 1996 edition of the IAEA Transport Regulations that were to become effective in 2001 for international air and sea transport through the applicable International Civil Aviation Organization (ICAO) Technical Instructions and the International Maritime Dangerous Goods (IMDG) Code;
- To review and evaluate the efficiency of the inspection and enforcement programme related to the transport of radioactive material; and
- To evaluate the cooperation arrangements with key government organizations with specific attention to areas of overlapping responsibilities, for example in the area of environmental protection.

The more specific (additional) scope for Turkey, as requested, included:

- To evaluate national transport legislation and regulation, taking into account applicable international practices, and to review the implementation of the requirements of the 1996 edition of the IAEA Transport Regulations within the Turkish regulations for national and international transport for all modes of transport;
- To review the authorities, responsibilities and functions of the regulatory body with regard to the transport of radioactive material;
- To review and evaluate the efficiency of the inspection and enforcement programme related to the transport of radioactive material;
- To evaluate the cooperation arrangements with key government organizations with specific attention to areas of overlapping responsibilities; and
- To review compliance practices, for example of a major importer.

4. QUESTIONNAIRE

In addition to making practical arrangements, part of the preparation for a TranSAS mission involves prior completion of a questionnaire. It is the basis for the mission, necessary for understanding the situation in the country: the legal infrastructure, the authorities involved, the interfaces between them, and the terminology used by those authorities.

This questionnaire is subdivided into eight topics:

- Legislative and governmental responsibilities,
- Authority, responsibilities and functions of the regulatory body,
- Organization of the regulatory body,
- Authorization process,
- Review and assessment,

— Inspection and enforcement,
— Development of regulations and guides, and
— Emergency preparedness for transport.

These topics are also the headings of the main sections in the report.
My experience with the questionnaire is that:

— Not all the questions are directly relevant to transport safety;
— The questions are sometimes subject to divergent interpretation because of the language; one should not forget that the questionnaire is drafted in English, which is not the official language in all countries; and
— There is some overlap between the different sections.

5. COMMON FINDINGS

A number of common difficulties and problem areas exist that probably are applicable to countries that have not requested a TranSAS mission.

Completing the questionnaire is instructive for the competent authority because it provides the opportunity to obtain a complete view of the regulatory system that is applicable to the transport of radioactive material and also of the interfaces with other authorities that have overlapping or complementary responsibilities.

The management of the interfaces with other authorities is, in some cases, a question of good personal relationships. Formal memoranda of understanding or cooperation agreements do not always exist, although useful to have, for instance, between the competent authority for transport of radioactive materials and the authorities responsible for the transport of other dangerous goods and for environmental protection. In such memoranda of understanding, responsibilities should be clearly defined, in particular with respect to the regulatory process, the licensing procedures and the inspections.

The competent authority for transport of radioactive material may be part of a larger organization, e.g. the Nuclear Energy Commission in Brazil and the Atomic Energy Authority in Turkey, that has responsibilities for nuclear safety and radiological protection and also operates research institutes. The separation of regulatory from operational and promotional functions is not always clear from the organizational chart, neither is it always clear what part of the large organization is responsible for transport of radioactive material. Transparency could be improved.

The competent authority for the transport of radioactive material may not be the competent authority for transport of other dangerous goods, and different competent authorities may be responsible for different transport modes (road, rail, air and sea). Coordination with other modes and domestic transport is far from easy and is complicated by the fact that regulatory processes differ. The ICAO Technical Instructions and the International Maritime Organization (IMO) Dangerous Goods Code are revised regularly and enter into force almost automatically. The situation is very different for the other modes of transport, where the IAEA Regulations have to be implemented separately into domestic regulations. The translation and the regulatory process take some time. Revisions of the IAEA Transport Regulations that occur every two years are not very helpful in this respect. The conclusion of regional agreements (like ADR and RID for rail and road, respectively, in Europe) might help to address this situation. Coordination between the different authorities involved is of utmost importance to harmonize implementation of the regulations for domestic and international transport and for the various modes. In this context, it can be noted that, sometimes, for practical reasons and to avoid safety problems, the international regulations are complied with also for domestic transport, although the domestic transport regulations exist only in draft form and have not been promulgated.

The IAEA Regulations require that some types of shipments be licensed. In many countries, fully encompassing systems of licensing are set up, for instance, for each shipment or for a series of similar shipments. The administrative burden is not negligible and one should question the added value of such an administrative burden with respect to nuclear safety and radiological protection.

The assessment of safety files requires various disciplines that are not always available within the competent authority. Arrangements have to be made with other institutes and universities. In such cases, attention must be given to the independence of the competent authority. In particular, for packages designed in other countries, the limited period of validity sometimes leads to difficulties: no new certificates are available in due time, and no new certificates are issued by the competent authority of the country of origin, because the package is no longer used in that country.

6. CONCLUDING REMARKS AND SUGGESTIONS

TranSAS is an excellent tool to assess compliance assurance. The implementation of the transport regulations is addressed quite well, but improvements are always possible. TranSAS encourages the requesting Member State to improve the implementation of the Transport Regulations.

A clear distinction should be made between recommendations and suggestions. Perhaps recommendations should make reference to Safety Requirements; suggestions could then refer to Safety Guides.

The questionnaire should be reviewed and amended where appropriate, to make it more user-friendly, to avoid overlapping, and to avoid divergent interpretations. Yes/no answers should be made impossible. It may be useful to adapt the questionnaire to specific requests from each Member State.

The two year revision cycle for the IAEA Transport Regulations should be reconsidered, because it is difficult for a number of countries to follow through at such a high frequency.

The requirement of an expiry date in the approval certificates may be helpful in the country of origin as a tool for ensuring compliance. On the other hand, it may lead to difficulties in other countries. Consideration should be given to making it optional. It should be noted that the competent authority, in issuing an approval certificate, certifies that the model has been designed in accordance with a specific edition of the regulations, e.g. the 1996 edition; if this is so in 2000, why should it not be true anymore in 2006? As a consequence, the drafting of the transitional arrangements could be simplified.

Means to follow up the appraisal should be envisaged to determine what the requesting State does with recommendations and suggestions, and whether good practices continue to be good practices.

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Technical Session 2

DISCUSSION

M.S.T. PRICE (United Kingdom): Compliance assurance was hived off from quality assurance (QA) in the 1985 edition of the IAEA's Transport Regulations, and we now have Safety Series No. 112 on compliance assurance and Safety Series No. 113 on QA. That may have been the right thing to do at that time, but I do not understand why compliance assurance is still being treated separately from QA. Compliance assurance is an audit function (performed by the competent authority or by an agent of the competent authority), but, as can be seen from paper IAEA-CN-101/31, "audits" constitute only one of numerous items that have to be covered in a QA programme — one out of eighteen in the case of the QA programme requirements set by the US Nuclear Regulatory Commission. I think consideration should be given to bringing compliance assurance back together with QA, particularly in light of the fact that, at conferences like this one, rarely are papers devoted entirely to compliance assurance, which is normally treated just as a part of QA.

C. PECOVER (United Kingdom): Perhaps the question should be, "Is there a need for an IAEA document on compliance assurance in addition to one on QA?"

S.C. O'CONNOR (United States of America): I cannot answer that question as I am not familiar enough with the meanings attached to "compliance assurance" in the IAEA context. In the context of the US Nuclear Regulatory Commission, "compliance assurance" is the combination of the internal audits performed by the licensees and the inspections carried out periodically by regulators to assess compliance with the Commission-approved QA programme.

C. PECOVER (United Kingdom): In the 1980s I was involved in the development of a separate IAEA document on compliance assurance, the purpose of which was to provide regulatory authorities with the advice that they were calling for at that time. From my experience during recent TranSAS missions, I think that, for the time being, the two IAEA documents in question should continue to be kept separate.

N.C. BRUNO (Brazil): Coming from a country that has hosted a TranSAS mission, I should like to emphasize the benefits of such missions to the host countries. The international experts making up the TranSAS teams

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Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

look at the host countries' transport-safety arrangements from a different — outside — perspective, are available to answer questions put by the host countries' transport authorities and operators, and come up with useful recommendations and suggestions. I was impressed by the fact that the five TranSAS missions carried out so far resulted in thirty-eight recommendations and forty-two suggestions. I was also impressed by the fact that twenty-three good practices were identified. In that connection, it should be noted that some of the good practices are being followed in developing countries, an indication that the important thing is the commitment to safety, not whether a country is developing or developed.

G.J. DICKE (IAEA): Mr. Bruno just mentioned the numbers of recommendations and suggestions resulting from the five TranSAS missions carried out so far. In that connection, I would mention that the definitions of "recommendation" and "suggestion" have been evolving and need to be further refined. The definitions used for the TranSAS mission to the United Kingdom are given in section 5 of Mr. Young's paper, IAEA-CN-101/30.

I would not attach too much importance to the numbers of recommendations and suggestions made following TranSAS missions. The important thing is whether practical advice was given and, if so, whether it was acted upon by the host countries. I agree with what Mr. Bruno said about good practices; it is not a question of developing versus developed countries. Moreover, no good practice is appropriate for all countries; what is good for a country in which only a hundred shipments of radioactive material take place each year may well not be good for one where hundreds of thousands of shipments take place annually, and vice versa.

So far, we have published only two reports on the TranSAS missions (for Slovenia and the United Kingdom). We hope to publish the reports on the other three that have been completed (to Brazil, Turkey, and Panama) within the next six months.

C.N. YOUNG (United Kingdom): Mr. Dicke and others have mentioned the TranSAS mission to the United Kingdom, on which I reported in paper IAEA-CN-101/30. The mission was carried out over a 2-week period in June 2002 by a team of fourteen experts (including three observers) from Argentina, Brazil, Japan, New Zealand, Peru, Spain, Turkey, the United States of America (two persons), the IAEA (two persons), the International Civil Aviation Organization and the International Maritime Organization (two persons). I recommend that conference participants interested in learning more about the TranSAS mission to the United Kingdom read, at least, the "Conclusions and follow-up" section of paper IAEA-CN-101/30.

E.W. BRACH (United States of America): Not many papers were contributed for this session, but I think we all recognize the importance of QA in the design, manufacture and use of transport packages. The importance of QA is made clear in a number of papers contributed for other sessions, for example, paper IAEA-CN-101/45 ("Licensing of a Type B(U) package design for the transport of industrial Co-60 sealed sources and the use as irradiator facility in Argentina") and paper IAEA-CN-101/47 ("Transport of industrial radiography sources — Indian scenario") contributed for Technical Session 3. At the end of the mission to the United Kingdom, the TranSAS team suggested, inter alia, that "the Radioactive Material Transport Division should prepare and implement a technical instruction document, i.e. an "assessment manual" that provides guidance for the review and approval of applications for package design, special form and low dispersible radioactive materials, special arrangements, shipments, and radiation protection programmes." In my view, such an "assessment manual" could be helpful to countries besides the United Kingdom, and I was wondering whether the IAEA's Secretariat has considered preparing one.

G.J. DICKE (IAEA): As emphasized at Transport Safety Standards Committee (TRANSSC) meetings, there is a need for quite a few manuals in the radioactive material transport area. Unfortunately, the resources made available for work in this area through the IAEA budget are limited. At recent meetings, TRANSSC has discussed the possibility of IAEA Member States doing more to help the Secretariat with the preparation of manuals. From the good practices identified during TranSAS missions, it is clear that much relevant expertise exists in Member States.

R.B. POPE (IAEA): The suggestion regarding the preparation and implementation of an "assessment manual" resulted from the fact that the TranSAS team had established that the Radioactive Materials Transport Division had been working on such a document for some time. Like Mr. Brach, I believe that the "assessment manual", when finalized, could benefit competent authorities throughout the world. As indicated by Mr. Dicke, because the IAEA's Secretariat is operating under severe resource constraints, it would like to make available what some competent authorities already have available in this area to the competent authorities of the other IAEA Member States so as to assist them in their work.

C. PECOVER (United Kingdom): That is clearly a matter that TRANSSC should focus on.

M.-A. CHARETTE (Canada): MDS Nordion has found that some of the countries where TranSAS missions have taken place require additional endorsements of Type B(U) transport packages that have already been unilaterally approved. How does TranSAS deal with this situation?

G.J. DICKE (IAEA): Clearly, something must be done about the issue of additional endorsements, since the IAEA's Transport Regulations offer the option of accepting the certificates relating to such packages. Perhaps there is a need for a better understanding of what those certificates mean. It is an issue that should be examined both within the Secretariat and in Member States of the IAEA.

C. PECOVER (United Kingdom): From what has been said during this session and earlier in this conference, I feel that the IAEA's senior management is thinking a great deal about TranSAS, and I have been wondering whether they would consider reviewing the objectives of TranSAS in light of what Ms. Rooney said in the opening session about the universal safety oversight audit programme of ICAO, from which there are lessons to be learned. I believe that many parties, including the general public, are right to be concerned that the IAEA's Transport Regulations and related regulations should be applied effectively and consistently. I also believe that QA programmes covering all aspects of radioactive material transport and appropriate companion compliance-assurance programmes implemented by competent authorities are essential for the building of trust in the safety of radioactive material transport. As regards the IAEA documents on QA and compliance assurance (IAEA Safety Series No. 113 and 112), I hope that the IAEA Secretariat will find the resources necessary for updating them.

Technical Session 2

SUMMARY BY THE CHAIRPERSON

1. INTRODUCTION

Following introductions, the Chairperson commented on the relatively few papers in the session, but suggested that this does not indicate a lack of interest in the subject. Reference was made to the Director General's (IAEA) comments during his opening of the conference, with particular regard to the need to have standards/regulations uniformly interpreted and applied to ensure (worldwide) safety in the transport of radioactive material. The Director General mentioned the IAEA's Transport Safety Appraisal Service (TranSAS), and stressed the importance that all Member States avail themselves of it.

2. PAPERS PRESENTED

Four papers were presented, two of which were focused on in the Transport Safety Appraisal Service, and two were related to quality assurance.

— "Appraising States' regulation of the transport of radioactive material — a report on IAEA's Transport Safety Appraisal Service (TranSAS)", presented by G.J. Dicke and R.B. Pope (IAEA). This paper introduced the initial development and introduction of the TranSAS process, and reported on the five TranSAS mission carried out so far.

— "Experience with the Transport Safety Appraisal Service (TranSAS), a key to compliance assurance", presented by L. Baekelandt (Belgium). This paper reviewed in detail the TranSAS process, and made some suggestions for improvement, drawing on the experience of the author.

— "U.S. Nuclear Regulatory Commission quality assurance roles and responsibilities for radioactive materials transport", presented by S. O'Connor. This paper introduced the current USNRC's requirements for quality assurance programmes, which must be approved by the NRC, and outlined the arrangements for NRC review and approval of such QA programmes.

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

— “Framework of the BNFL international transport management system”, presented by G. Fisher. This paper covered the development of the current management system of BNFL international transport, and related the management system to the various quality assurance standards (and other standards) in force.

3. DISCUSSION

There were five interventions/comments from conference participants. The following noteworthy points emerged from the discussions.

— Positive comments were made about the value of TranSAS missions to Member States even before the actual missions took place. Planning for the mission requires that the Member State completes a questionnaire, which, in itself, obliges review and clarification of the existing arrangements of that country. It was said that a TranSAS mission “was a good experience” for the host country.
— The future strategy, direction and process of TranSAS missions were mentioned and some improvements identified. The possibility of learning from the ICAO experience of the “Universal Safety Oversight Audit Programme” was mentioned in the ICAO representative’s presentation.
— Positive comments were made about benefits and significant contributions to safety from quality assurance programmes that are properly applied. Such QA programmes were said to be essential tools for safe transport.
— Similarly, compliance assurance programmes, properly developed and implemented, were considered to be essential foundation stones in the building of regulatory compliance. Such programmes should enable public confidence in the Regulations and their implementation to be established and improved.
— Comments on the revision and re-issue of Safety Series No. 112 (compliance assurance) and No. 113 (quality assurance) were made on the need for their urgent updating and publication, as the current editions of these documents are out of date.
— A suggestion made during the UK TranSAS mission prompted a request for the IAEA Secretariat to consider developing an “assessors manual” for competent authorities, to assist in harmonizing the interpretation of regulatory requirements.

— Comment was made about problems associated with different countries imposing different or additional conditions when dealing with Type B(U) packages.

4. FINDINGS

The following were judged to be the findings from this session:

— IAEA TranSAS missions are valuable compliance assurance tools and are recommended to all Member States.
— The TranSAS process could benefit from review, taking into account the example of the ICAO Universal Safety Oversight Audit Programme, and the experience of the TranSAS missions carried out thus far. The IAEA could also consider ways of improving the TranSAS process, so as to be able to carry out more missions on a yearly basis.
— The current IAEA documents Safety Series No. 112 and No. 113 are valuable to the radioactive materials transport industries and authorities. Their review, updating and publication should be completed as soon as possible.
— The request for a guidance document for Competent Authority assessors should be considered by the IAEA Secretariat and suitable material developed, if the need is confirmed.

5. CONCLUSION

Involved parties, including the general public, are, quite rightly, concerned to know whether the stringent applicable Regulations — IAEA's and others' — are being effectively and consistently applied. The conference found that robust compliance assurance and quality assurance programmes are essential foundation stones in building trust and confidence in the safety and effective regulation of radioactive material transport. The IAEA Transport Regulations recognize that safe and effective international commerce in radioactive material depends on a level of trust between nations, especially regarding the adequacy of packaging, event response and compliance with import/export laws.

The IAEA Transport Safety Appraisal Service is an important tool for assessing and assuring compliance at the State level. It can provide Member States, upon request, with a review of their activities in comparison to the IAEA (and other) Transport Regulations, thus evaluating their compliance assurance programmes. In the area of quality assurance, the conference recognized the essential contribution of such programmes to the continuing safe and controlled transport of radioactive material.

PACKAGING AND TRANSPORT OF RADIOACTIVE MATERIAL (FUEL CYCLE AND NON-FUEL CYCLE)

(Technical Session 3)

Chairperson

T. SAEGUSA
Japan

Rapporteur

B.G. DEKKER
Netherlands

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Invited Paper

THE PACKAGING AND TRANSPORT OF NUCLEAR FUEL CYCLE MATERIAL

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Abstract

Nuclear power is important if the world is to satisfy its growing demand for electricity and at the same time meet its environmental obligations, particularly the need to curb carbon dioxide emissions. In order to sustain nuclear power, it is essential that nuclear fuel cycle material continues to be transported internationally both safely and efficiently. The paper describes the major nuclear fuel cycle material and the means by which it is packaged and transported. These transport operations have been carried out safely for over 40 years, during which there has never been an incident that has given rise to significant radiological damage to humans or the environment.

1. THE NUCLEAR FUEL CYCLE

Nuclear power currently supplies some 16% of the world's demand for electricity from over 400 reactors in 32 countries. The majority of these are either pressurized water reactors or boiling water reactors and, in both cases, the primary fuel is enriched uranium oxide. The fuel core for these light water reactors contains typically many fuel assemblies consisting of sealed fuel rods each filled with sintered uranium dioxide (UO_2) pellets with a concentration of the fissile component of uranium, ^{235}U, of 3 to 5%.

The nuclear fuel cycle consists initially of the processes for the preparation of the new fuel for loading into the reactor starting from mined uranium ore, the so-called *front-end processes.* When the spent fuel is discharged from the reactor there are two *back-end options.* The spent fuel can either be reprocessed to recover the unused uranium and the plutonium generated in the reactor, both of which can be recycled, or it can be stored for eventual direct disposal, which is the once-through concept. The various operations are briefly described below.

1.1. Mining and milling of uranium

Uranium ore is widely distributed. The main sources are North America, Australia, South Africa and Eastern Europe. After mining, the processes are similar to those for the beneficiation of other metals, typically chemical leaching and concentration followed by precipitation to yield a dry powder of natural uranium oxide known as uranium ore concentrate (UOC).

1.2. Conversion of uranium ore concentrate to uranium hexafluoride

Uranium ore concentrate is transported worldwide from mines to conversion plants. It is first chemically purified and then converted by a series of chemical processes into natural uranium hexafluoride (hex), the form required for the subsequent enrichment stage.

1.3. Enrichment of uranium hexafluoride

The concentration of the fissile isotope in natural hex is 0.71%. This is increased to the level required, 3 to 5% for light water reactors, either by a gaseous diffusion process or in gas centrifuges. Commercial enrichment plants are in operation in the United States of America, Western Europe and the Russian Federation, and this gives rise to extensive international transport operations involving hex between conversion and enrichment plants.

1.4. Fuel fabrication

The enriched hex is first converted into uranium dioxide powder, which is then processed into pellets by pressing and sintering. The pellets are stacked into zirconium alloy tubes that are then made up into fuel assemblies for transport from the fabrication plant to the reactor site.

1.5. Spent fuel storage

Fuel is discharged periodically from nuclear reactors, typically after 3 to 5 years, and this highly radioactive spent fuel is first stored, usually under water to provide both cooling and shielding, at the reactor site. After the period of temporary storage, the spent fuel can either be sent to a reprocessing plant or be prepared for long-term storage prior to permanent disposal.

1.6. Spent fuel reprocessing

Spent fuel consists typically of 96% unused uranium, 1% plutonium formed in the reactor and 3% highly radioactive fission-product waste. These can be separated in a reprocessing plant by a series of chemical processes. The uranium can then be recycled in enrichment plants and the plutonium converted into new mixed uranium/plutonium oxide (MOX) fuel. The fission product wastes are processed into stable forms for disposal, the highly active stream being converted into glass by a vitrification process. Following commercial reprocessing, all of the products have to be returned to the country of origin.

1.7. Waste disposal

The radioactive wastes from reactor and fuel-processing operations have to be disposed of safely by isolating them from the biosphere. Current plans are to achieve this by geological disposal. When spent fuel is reprocessed, the wastes are immobilized for disposal. In the once-through cycle, the spent fuel has to be disposed of directly as waste.

2. THE SAFE TRANSPORT OF NUCLEAR FUEL CYCLE MATERIALS

Nuclear power is expected to be called upon to continue to play an important role in meeting the world's increasing demand for affordable and sustainable electricity, and to sustain the nuclear power industry fuel cycle, materials have to be transported safely and efficiently. The nature of the industry is such that most countries with important nuclear power industries cannot provide all the necessary fuel cycle services themselves, consequently nuclear fuel cycle transport activities are international.

The IAEA Regulations for the Safe Transport of Radioactive Material set the basis for the transport of nuclear fuel cycle material. The basic concept is that safety is vested in the package, which has to provide shielding to protect workers, the public and the environment against the effects of radiation, to prevent criticality excursions and also to provide protection against dispersion of the contents. All this has to be achieved both under normal and under accident conditions of transport. In addition, it is important to reduce radiation doses to workers and the public as far as is reasonably achievable by adopting best practices at the operating level.

The Regulations stipulate five different primary packages; Excepted, Industrial, Type A, Type B and Type C, and set the criteria for design based on the nature of the radioactive materials they are to contain. The Regulations also prescribe appropriate test procedures. With the graded approach to packaging, package integrity is related to the potential hazard: the more hazardous the material the tougher the package, which is important for efficient commercial transport operations. This is the case with nuclear fuel cycle materials.

Road, rail and sea transport are all commonly used for nuclear fuel cycle material. Air transport is used to a limited extent.

2.1. Uranium ore concentrate

Uranium ore concentrate is a low specific activity material. It is normally transported in sealed 200-L drums (an Industrial package) in standard containers. These can be transported by road, rail or sea. Loading is by crane or forklift truck with limited access for workers. The total world annual requirements for UOC is about 70 000 tonnes, all of which has to be transported to conversion plants mainly for manufacture into hex.

2.2. Uranium hexafluoride

Natural hex produced from conversion of UOC is a very important intermediate in the manufacture of new reactor fuel. There is a large commercial trade, involving extensive international transport. In the production process, hex is condensed as a solid directly into universal 48Y cylinders, which are steel transport units some 1.25 m (48 inches) in diameter, each holding about 12.5 tonnes of UF_6. It can be stored in these cylinders prior to being transported, normally bolted down in standard containers, to an enrichment plant either by road, rail or sea, or most likely by a combination of modes of transport. Although hex is a low specific activity material, there are significant hazards due to its chemical nature. There are toxic by-products on reaction with water or water vapour, and there also is a danger of cylinder rupture if subjected to high temperatures. For these reasons and because of the radioactive inventory, hex packages are subjected to extra requirements and have to be approved.

For enriched hex for water reactors, the concentration of the fissile isotope, ^{235}U, is increased to 3 to 5%, at which it is necessary to transport it in smaller universal 30B cylinders. These are some 30 inches in diameter and are transported in overpacks in order to guard against criticality excursions. The cylinders in overpacks can be bolted into containers for transport to fuel fabrication plants.

2.3. Uranium dioxide powder and fabricated fuel

Uranium dioxide powder derived from hex of less than 5% enrichment is also classified as low specific activity material. The fuel assemblies manufactured from it are some 4 m long. They are transported in specially designed packages normally designed to Type A standards (but with the additional requirements for packages containing fissile material). The configuration of packages during transport precludes criticality excursions.

2.4. Spent fuel

Spent nuclear fuel is intensely radioactive. It is transferred first from the reactor to on-site storage ponds for shielding and to allow radioactivity to decay. For subsequent transport off the reactor site, either to off-site storage or to reprocessing facilities at home or abroad, it is transported in high integrity Type B flasks. These flasks are massively constructed from steel, and typically weigh around 100 tonnes. The thick steel is needed to attenuate very high levels of gamma radiation, and additional shielding is also needed to reduce the neutron flux. The flasks may incorporate cooling fins to allow residual heat to dissipate and keep surface temperatures to acceptable levels. They may also provide protection against impact.

Spent fuel is transported extensively by rail across Western Europe and also by sea from Sweden and from the Far East to reprocessing plants in France and the United Kingdom. Sea transport is by dedicated ships designed and operated according to the Irradiated Nuclear Fuel (INF) Code of the International Maritime Organization (IMO).

2.5. High level wastes

High level vitrified waste from the reprocessing of spent fuel is stored temporarily at the reprocessing plant to allow fission product heating to decay before it is returned to the country of origin. The transport flasks are similar in design and construction to those for spent fuel and the transport operations, whether by rail or sea, also are similar. Several sea and rail shipments of vitrified waste have been successfully carried out.

2.6. Mixed oxide fuel

The plutonium derived from the commercial reprocessing of spent fuel is normally returned to the country of origin in the form of new mixed plutonium/uranium oxide (MOX) fuel elements in which the enriched uranium isotope is replaced by plutonium. They are transported under special conditions by road or rail and in dedicated vessels for sea transport. Extensive experience in MOX transport has been gained in Western Europe over many years and recently also by sea from Europe to the Far East.

3. EXPERIENCE IN NUCLEAR MATERIAL TRANSPORT

The IAEA Regulations for the Safe Transport of Radioactive Material have provided a sound basis for the design of equipment and procedures for the safe and efficient transport of nuclear fuel materials. On this foundation the nuclear transport industry, both those organizations solely dedicated to nuclear transport as well as the many transport companies for which nuclear transport is only a part of their business, have operated safely and successfully for over 40 years. No incident has occurred that has resulted in significant radiological damage to humans or the environment. It is important that all those involved in nuclear fuel cycle transport — industry, IAEA, modal organizations and regulators — should continue to cooperate closely to ensure that these high standards are maintained. Industry worldwide, through the World Nuclear Transport Institute (WNTI), is cooperating to ensure that it fully meets the requirements of the international transport safety regulatory regime.

Invited Paper

TRANSPORT OF GAMMA STERILIZATION SOURCES
Regulatory impact

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Abstract

Gamma processing is vital to global health care. The challenge is to preserve the willingness of shipping lines to carry Class 7 goods. Fortunately, there are actions we can take to help ensure we continue to benefit from this application.

1. INTRODUCTION

Gamma processing provides 40% of the world's sterile medical disposables and devices (from swabs and syringes to hip joints and heart valves). It also provides sterile ingredients for pharmaceuticals (organic ingredients are often heavily contaminated with bacteria and other organisms) and for the food industry (e.g. sterile packaging, sterile food for the immune deficient, eliminating *E. coli*, which can be fatal for the young and old). And it can replace hazardous fumigants such as methyl bromide. In short, it provides nearly half the world's sterile medical goods and in other applications it is used to preserve health.

With its unique combination of dependability and versatility, it sterilizes all surfaces, external and internal, sealed or otherwise inaccessible. It is totally clean, leaving no residue. Goods can be hermetically pre-packed, thus ensuring no means of subsequent contamination. Gamma sterilization also provides 40% of the world's needs at an affordable cost. This is an important factor in that all health care budgets are limited, but most especially so when considering how many nations have health care budgets of less than US$1 per person per year.

2. TRANSPORT

Transport is vital to this industry. There are over 200 gamma plants in forty countries (the number of plants is increasing at an average of two per year due to increasing demand), but the sources are manufactured in only two countries. The manufacturers make on average five to fifteen international shipments per month by sea. Sea has been the only means of transport between continents for these sources since the IAEA Type C regulations were introduced a few years ago; there is no other transport option. Without sea transport, i.e. shipping lines willing to take Class 7 goods, this industry would not survive.

However, achieving reliable worldwide sea transport of Class 7 goods is a complex and challenging undertaking. This is because of the limited availability of shipping lines willing to carry the goods and the number and variety of national regulations over and above the international regulations. Only one in ten shipping lines will carry these goods. Of the twenty or so deep-sea lines plying the route between Western Europe and the Far East and Australasia, only two will take Class 7 goods because of the associated red tape that can result in port authorities' refusal to accept them. When this is a major hub port, the shipping line may lose other business if it cannot dock. An example of such a port is Hong Kong, a key port for all shipping on the Far East route. This can mean that the number of sailings available for a shipment using this route may be reduced to one in twenty or thirty.

The number of national regulations requiring transit licences for such cargo is another problem for shipping lines. Many countries have diverse regulations covering goods in transit, but typically the carrier has to provide all necessary details 6 to 12 weeks in advance in order to obtain the necessary licences. An extreme example of this is a key Mediterranean transit port that admits to a processing time of 2 to 3 years. In other words, transit with Class 7 goods is effectively impossible. The Mediterranean is on the Far East route and this port is a key transit point for dropping off and taking on cargo. This means that finding a sailing that will not call in at either of these ports is very difficult, possibly only one in every 100 to 200 sailings. Just two problems thus reduce available sailings on a major route to one every 3 to 6 months!

The problems are worse on quieter routes, one example of which is Greece. All shipping lines working in the Mediterranean need to call in at this key Greek transit port. It took us nearly 2 years to find a sailing not calling in there. Hospitals in Greece started to run dangerously low in sterile supplies before we could ship, due to activity in the plants gradually decaying and reducing output. Land transport was not an option due to security concerns. Another example of a problem route is South Africa. No shipping lines operate between Europe and South Africa that will take Class 7 goods. We simply cannot supply this country. It is common knowledge that, as the full effects of the current AIDS epidemic there unfold over the coming years, the health care budget will be stretched to breaking point. The last thing this nation needs is to have to import expensive sterile medical goods from abroad.

Shipping lines do not like carrying Class 7 goods. They exist in a highly competitive and rapidly changing physical and commercial environment where, in order to survive, they must be able to respond quickly to any situation. This means they need to be able to change ships, routes and schedules right up to departure — sometimes even during a shipment — because of mechanical problems, adverse weather or commercial opportunities. A key obstacle preventing shipping lines operating effectively is the time it takes to obtain transit licences and the flexibility lost as a result. The licence specifies the ship, cargo, port and date. Class 7 goods and flexibility do not go well together.

Security also suffers from national licensing. Forthcoming United Nations security regulations will stress the need for security of key information. The longer in advance key and detailed information must be distributed, the less secure it is.

To summarize the transport challenge: few shipping lines willingly accept Class 7 goods; not all routes are available and consequently not all countries are accessible; lastly, transit licences take too long to process and consequently represent a security risk. The first and last points are not unconnected.

3. ACTIONS

The situation would be greatly improved if licensing nations were to process license applications in 2 to 4 weeks and accept subsequent changes of detail by notification. Should that be impractical, they should issue duration licenses instead. These could be for, say, a year and would specify the carrier, the port, and the broad details of the cargo (sources, shipping containers, maximum contents, etc.), and, if necessary, the maximum number of transits. Precise details of each shipment should then be provided by notification 1 to 2 weeks in advance. This interval is an important point; ideally, it should not be more than 2 weeks in advance. Either of these actions would allow shipping lines the flexibility they need and would improve the security of key information.

4. CONCLUSIONS

Gamma sterilization, vital to health care provision worldwide, depends entirely on the willingness of shipping lines to carry Class 7 goods. This willingness is significantly related to the lack of flexibility imposed by national licensing regulations for goods in transit. We can take action to reduce the impact of these regulations by applying them in a more responsive manner. This will have an important additional benefit in ensuring the security of sensitive information.

Technical Session 3

DISCUSSION

M.S. KRZANIAK (Canada): The problems identified by Mr. Rogers in his presentation are not unique to the United Kingdom. In Canada we have experienced the same problems, and we are very concerned about the decline in the number of carriers prepared to accept radioactive material shipments and about the growing administrative burdens. In the face of such problems, there is a need for closer cooperation among industry, regulators and local authorities.

R.B. POPE (IAEA): As the IAEA's Director General pointed out in the opening session, the IAEA Secretariat also is experiencing problems due to the denial of services by carriers, and those problems are in some cases hampering the fulfilment by the IAEA of its technical cooperation commitments vis-à-vis developing Member States. It would be interesting to hear of cases where such problems have been solved.

A.H.K. LAW (China): In response to certain remarks made by Mr. Rogers in his presentation, I would emphasize that Class 7 radioactive material can be shipped to Hong Kong by air, by sea and by land. The Hong Kong Department of Health provides inspection services and issues licences for the import, handling, sale and export of radioactive material, and I personally have monitored the unloading and loading of radioactive materials in the port and at the airport. Normally we can issue import licences within four weeks if we have received all the necessary documents, and in urgent cases we can issue them within about two weeks. We accept licence applications submitted by fax. For the transport of radioactive material within Hong Kong, so-called "removal permits" are needed. These can be issued within two working days.

D. ROGERS (United Kingdom): What Mr. Law has just said does not tally with what we have been told by many shippers. Perhaps the situation in Hong Kong needs to be looked into more closely.

E.W. BRACH (United States of America): In the opening session, the IAEA's Director General said that the safety of transport of radioactive material was a subject that, "despite its long history of excellent performance...and wide application of well developed safety standards", was continuing to generate concern. This session would be a good opportunity for

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

those who are concerned about the safety standards applied in the transport of radioactive material to put forward their views.

T. SAEGUSA (Japan): Further to what Mr. Brach just said, I would recall that the Director General asked several questions that are highly relevant to this session:

— Are the existing regulatory requirements comprehensive, consistent and clear? If not, what improvements are needed?
— Are the safety standards applied uniformly by all carriers and all States — both shipping and receiving States?
— How can the adequacy of the regulations and the manner in which they are applied be demonstrated with transparency?
— Why has so much concern been expressed over the transport of plutonium, irradiated nuclear fuel and high-level waste? How can that concern be addressed?

C.N. YOUNG (United Kingdom): In his presentation, Mr. Wilkinson compared the stresses arising in a regulatory 9-metre drop test performed by the United Kingdom's Central Electricity Generating Board in 1984 with those arising during a 100 miles per hour train crash. I think he inadvertently expressed the result the wrong way around. The stresses arising in the drop test were considerably higher than those arising in the train crash.

W.L. WILKINSON (WNTI): I am grateful to Mr. Young for pointing out my mistake. The stresses on the package in a 9-metre drop onto an unyielding surface are very much higher, because all the energy has to be absorbed by the package, whereas, in an accident involving a target that yields, some of the energy is absorbed by the target. A 9-metre drop test is therefore equivalent to a crash at very high speed onto a concrete road or against a bridge abutment. The same applies to fire tests. The IAEA thermal test (800°C for 30 minutes) is more severe than a realistically envisaged fire. Moreover, IAEA studies on the consequences of accidents at sea indicate that the sinking of a cask with spent fuel as a result of such an accident would have only a slight radiological impact — small compared with the natural background.

I. KOCA (Turkey): What practical measures can be taken to increase security during the transport of radioactive material without compromising safety?

D. ROGERS (United Kingdom): Security may be compromised if detailed information regarding a shipment is distributed to many countries and organizations long in advance of the shipment. The only solution to that problem is to obtain broad agreement (in principle) about the shipment as long in advance as necessary and to provide the precise details by notification just before the shipping.

R.B. POPE (IAEA): I would mention in this connection that the IAEA Secretariat plans to convene a technical meeting to advance the development of guidance on security in transport.

K.A. SCHNEIDER (Germany): In 1984, I participated in an IAEA working group on problems of the supply of radioactive sources, and the concerns expressed then about supply interruptions were very much like those expressed here by Mr. Rogers, but matters seem to be getting worse.

D. ROGERS (United Kingdom): They are! The number of carriers willing to take Class 7 goods has been declining steadily for a number of years. This is due almost entirely to the increasing number and complexity of the regulations and resulting administrative burdens. Some countries now require licences even in the case of empty containers, therefore, one of our customers recently had to return empty containers to us by air, instead of by sea, at enormous cost.

M.S.T. PRICE (United Kingdom): Transparency and honesty are important when one is dealing with the public, but how does one avoid causing alarm through a transparent and honest approach?

R.L. SWEENEY (United States of America): In the USA, the environmental impact statement (EIS) process is used to bound any potential environmental impacts, layers of conservatism being built in so as to ensure that the analysis has been bounded. The resulting information is then presented to the decision-maker. In the case of the EIS for the Yucca Mountain waste repository project, an important part of the process is sharing the information with the public. We held twenty-one public hearings across the United States of America and received over 15 000 comments from over 3000 people. The comments, about one third of which related to transport, were responded to in writing. We believe that the information that we provided, in a transparent manner, helped to allay the fears of the public.

R.R. RAWL (United States of America): Although it is widely recognized that the IAEA's Transport Regulations provide a high degree of safety during transport, and risk assessments, transport experience, analyses and extra-severe testing have all demonstrated the effectiveness of Type B packages, transport providers clearly still have difficulty in obtaining approvals for shipments, especially international shipments. What can be done to facilitate international transport?

R.A. STEANE (Canada): One could do more to harmonize the implementation of the international regulations in various countries, so that the "rules of the road" are consistent throughout the world.

A. BEKKER (South Africa): In that connection, I would mention that we were told by one airline that it would no longer carry Class 7 goods unless the personnel responsible for preparing the dangerous goods regulations completed an International Air Transport Association (IATA)-approved dangerous goods course. This was arranged, and it proved to be very useful in building confidence among the shipper, the cargo handler and the airline. We are all in the same business, and we need to speak the same language.

D. ROGERS (United Kingdom): Regarding Mr. Rawl's question, I would note that deviations in national regulations from the requirements in the IAEA's Transport Regulations are very often due to political expediency, whereas shipping lines are commercial organizations accountable to their owners. I would like to see the conflict resolved, to the benefit of all, by regulators ensuring that the regulations are drafted in such a way as to meet both political and commercial needs and that they are implemented in a sympathetic manner. Unreasonable regulations, especially those calling for the use of domestic carriers only, have the potential for enormous harm to the international transport of Class 7 (radioactive) dangerous goods. Perhaps the International Maritime Organization could follow ICAO's example and make available lists of national exceptions to the IMO's International Maritime Dangerous Goods Code.

W.L. WILKINSON (WNTI): I agree with what Mr. Steane just said about harmonizing the implementation of the international regulations in various countries. In that connection, I commend to conference participants the United Kingdom Department for Transport's Guide to an Application for UK Competent Authority Approval of Radioactive Material in Transport, the sixth reference in Mr. Stewart's paper, IAEA-CN-101/17.

L. GREEN (WNTI): With regard to the transport of nuclear fuel cycle material, it has been our experience that carriers are discouraged from handling Class 7 (radioactive) dangerous goods by regulations that are not well communicated, not explained in straightforward language, and not supported by easily understood guidance. WNTI would welcome an opportunity to co-operate with key stakeholders — particularly the IAEA, the modal organizations and national competent authorities — in explaining the safety significance of regulations more clearly.

R. BOYLE (United States of America): As indicated just now by Mr. Schneider, denial of carriage is not a new issue. In my opinion, the best way to facilitate the international transport of radioactive material — perhaps along the lines envisaged by Mr. Steane — is to harmonize the implementation of the regulations and the actions of different countries' competent authorities. But how is this to be done? For example, the United Kingdom guidance publication referred to by Mr. Wilkinson is no doubt an excellent document, but the United States Department of Transportation could probably produce an equally good guidance publication, and the two documents would be fairly different.

R.A. STEANE (Canada): Perhaps the best way ahead would be for representatives of different countries' competent authorities to meet more often, both formally and informally, in an effort to resolve some of the issues.

W.L. WILKINSON (WNTI): Perhaps we are anticipating a discussion that should take place in Panel 2 (Identifying Areas for Potential Improvement of the Regulatory Regime), for which L. Farrington of WNTI has contributed paper IAEA-CN-101/104.

D. ROGERS (United Kingdom): Further to what I just said about regulations that call for the use of domestic carriers only, we could live with regulations that simply specify the standards that must be met by carriers — domestic or others. If every country's regulations called for the use of domestic carriers only, there would be no international transport of Class 7 (radioactive) dangerous goods.

J. TURNBULL (New Zealand): Our National Radiation Laboratory, for which I work, is, inter alia, New Zealand's national response centre for radiological emergencies and deals with a wide range of "highly confidential" issues, including those connected with possible radiological terrorism. That being so, I have difficulties with the suggestion — which I think is being put forward at this conference — that communication between the governmental agencies of different countries can compromise security, such as the United States Nuclear Regulatory Commission. The governmental agency for which I work is well versed in handling highly sensitive information. Communication with the public is a different matter. Our biggest problem in New Zealand with radioactive material passing through our ports has in recent years been stoppages because the workforce in the ports has walked off the job because of concern about potential safety issues. Here, to alleviate such stoppages, communication at the management level is important, since neither the port authorities nor the transport companies want vessels to be held up in the ports unnecessarily.

C.U. SCHWELA (United Kingdom): Mr. Rogers described the difficulties encountered in the transport of high-activity sources. We deal with normally occurring radioactive material (NORM) and other low-activity sources, but we encounter the same difficulties and we doubt whether, in our case, the safety benefits of some countries' very strict regulations make up for the "hassle factor". Like many others, we would like to see the IAEA's Transport Regulations applied in a more consistent manner from one country to another.

D. ROGERS (United Kingdom): I doubt whether extra regulation at the State level adds much that is valuable in terms of safety.

M.C. MANN (United States of America): The organization for which I work, Transport Logistics International, routinely encounters difficulties of the kind described by Mr. Rogers. In the face of such difficulties, we have become a licensed ocean carrier, in order to have more control over carrier capacity availability. However, for the handling of our cargoes we still have to rely on port authorities, labour unions and equipment suppliers. Accordingly, I think there is a need to communicate effectively with these, demonstrating the robustness of the packages that we use and the rigour exercised by us in the implementation of the regulations and reporting on the high level of regulatory compliance that we observe among the users of the radioactive material that we transport.

E.J.E. MARTIN (Germany): As someone working for a company that processes raw materials, I should like to draw attention to the fact that some natural ores and concentrates are being classified as "radioactive material", and more may be so classified as a result of the work being done in the IAEA context on long-lived radionuclides in commodities.

D.G. WARDEN (United Kingdom): In my experience, the public reaction to radioisotopes used in medicine and industry differs greatly from the public reaction to nuclear fuel cycle material. Our company has been very successful in allaying the fears of carriers regarding such radioisotopes by clearly explaining their medical and industrial uses.

However, the dialogue between, on the one hand, single companies like ours and, on the other hand, carriers seems to be leading to a situation where there will be just a few specialist carriers for medical and industrial radioisotopes, the more general carriers having turned away from the business because of its complexities. I would like to see the IAEA broadening the dialogue to one between, on the one hand, groups or associations of companies like ours and, on the other hand, groups or associations of carriers. Our company would certainly support the IAEA in such an undertaking.

D. ROGERS (United Kingdom): I think that a broader dialogue would be useful. It must always be borne in mind, however, that shipping lines and other carriers are responsible primarily to their shareholders, and if they cannot make a profit out of transporting medical and industrial radioisotopes they will not do it.

S.P. AGARWAL (India): Broad dialogue of the kind envisaged by Mr. Warden could be very useful, but I would like to see competent authorities involved in the dialogue as well, since I think that their involvement would help to build confidence among the carriers.

Technical Session 3

SUMMARY BY THE CHAIRPERSON

In the view of the Chairperson, the conference found that the IAEA Transport Regulations form a sound basis for design requirements of packages and safe transportation; no concern with regard to that was raised. Packages for both fuel cycle and non-fuel cycle materials have been safely operated for many years throughout the world.

For fuel cycle material, most contributed papers described packages to transport material ranging from fresh fuel to spent fuel including related raw material and waste. Those packages are designed in different types using different materials for containment and shielding purposes. All packages are designed and built to comply with the requirements set by the IAEA Regulations. The same applies for packages designed and used for non-nuclear fuel cycle material such as radioactive sources. One contributed paper on future transportation of spent fuel reported on an environmental impact assessment, predicting little radiological impact. The outcome has been shared with the public to mitigate concern.

An invited paper on the transport of gamma sterilization sources reported difficulties in finding carriers and port facilities for handling these packages. The paper called for action in the field of licensing.

In the papers presented, it was noted that transport of radioactive material is essential for the generation of electricity and for industrial and health-care applications. Nevertheless, public concern is observed and the nuclear industry is facing reduced availability of transport modes and carriers. The conference found that extended explanation on the use of the Regulations to a wide public, including carriers, ports and handling facilities, may contribute to the understanding of the safety level the Regulations provide for.

During this session, the conference shared and supported the following overall views:

— A good safety record has been accumulated.
— Safe transport is facilitated by good cooperation and coordination among the regulators, local authorities, industry, etc.
— All parties involved should continue to cooperate closely to ensure that high standards are maintained.
— Transport requires a global understanding on the part of the general public.
— Further harmonization of the international and modal applications of regulations should be explored to simplify multiple licensing processes.

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PACKAGING AND TRANSPORT OF NON-STANDARD RADIOACTIVE MATERIAL

(Technical Session 4)

Chairperson

R. BOYLE
United States of America

Rapporteur

S.P. AGARWAL
India

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Technical Session 4

DISCUSSION

R. BOYLE (United States of America): In connection with the presentation just given by Mr. Nabakhtiani, dealing with the packaging and transport of orphan sources (IAEA-CN-101/51), I invite Mr. Dodd of the IAEA to briefly describe the IAEA's work on safety and security of radioactive sources.

B. DODD (IAEA): Work on the safety and security of sources covers the development of standards and guidance, the avoiding of problems, and the solving of problems. A key activity has been the work on revising the Code of Conduct on the Safety and Security of Radioactive Sources. The open-ended group of technical and legal experts that has been revising the Code of Conduct will, we hope, complete the job next week, so that a revised Code of Conduct can be submitted to the IAEA's Board of Governors and General Conference in September. If the revised Code of Conduct is adopted at that time and Member States then commit themselves to implementing it, a lot of problems relating to the safety and security of radioactive sources will be avoided. Important for implementation of the revised Code of Conduct will be the Categorization of Radioactive Sources which the IAEA has just issued as IAEA-TECDOC-1344 (a revision of IAEA-TECDOC-1191, Categorization of Radiation Sources). The recently issued IAEA-TECDOC-1355, entitled Security of Radioactive Sources, is relevant to the solving of problems associated with radiation source security. It is described as an "interim guidance for comment" since it reflects only the initial thinking of the IAEA Secretariat about what guidance should be given to Member States regarding the security of radiation sources. Also relevant are Secretariat activities pursuant to a tripartite initiative launched by the Governments of the Russian Federation and the United States of America and by the IAEA for the purpose of securing radioactive sources in countries of the former Soviet Union.

In addition, the Secretariat is working on the development of national strategies for improving control over radioactive sources, the aim being to assist Member States in carrying out comprehensive, in-depth evaluations of everything relating to the radioactive sources within their territories, in identifying weaknesses and in drawing up plans for eliminating those weaknesses through actions funded by the United States of America.

V.N. ERSHOV (Russian Federation): Regarding paper IAEA-CN-101/50 presented by Mr. Reculeau, on "The in-site regulations in France for the safe

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Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

transport of radioactive material". I think many other countries, including the Russian Federation, would benefit from having such regulations. Perhaps guidance for the safe on-site transport of radioactive material could be developed within the framework of the IAEA or WNTI.

J.-Y. RECULEAU (France): We would be happy to provide interested countries with copies of the directive with details of the requirements for the on-site transport of radioactive material in France.

E.J.E. MARTIN (Germany): Regarding paper IAEA-CN-101/55 presented by Mr. Selby, on "The transport of bulk quantities of naturally occurring radioactive materials — with the focus on zircon sand", the transport of material such as zircon sand in bulk is manageable because the material is transported in great quantities in single shiploads. Even if the activity concentration level of the ores or concentrates is close to the TS-R-1 activity concentration values for exempting the material from the Regulations (i.e. 10 Bq/g for ^{238}U and ^{232}Th), there is virtually no risk during transport, as shown in Mr. Selby's presentation. However, there are other ore concentrates, with radioactivity levels similar to that of zircon sand concentrates, that have to be transported — in much smaller quantities (for example, in sea containers of approximately 20 tonnes capacity) — from one part of the world to another for further processing. Some of them have activity concentration levels below the exemption values, but some have higher activity concentration levels and are not exempted. The problem with the transport of non-exempted material is that — as was clear from the presentation made by Mr. Rogers in Technical Session 3 — normally no shipping company is willing to transport such material owing to the time-consuming procedures resulting from the requirements of individual States. In this connection, I would recommend the perusal of paper IAEA-CN-101/72, which deals with, inter alia, the rules for transport through the Suez Canal.

Currently, the idea (in the IAEA draft safety guide DS-161) of significantly lowering the activity concentration limits for the transport of commodities — for example a reduction from 10 Bq/g to as low as 0.5 Bq/g in the case of uranium and thorium — is being discussed. Such a change would greatly inhibit the transport of raw materials from one part of the world to another, and, from Mr. Selby's presentation, it is clear that the change is unnecessary. I would not like the principle of ALARA (i.e. as low as reasonably achievable) to become a principle of ALAA (i.e. as low as achievable).

J.H. SELBY (South Africa): I agree with Mr. Martin. The provisions in IAEA draft safety guide DS-161 are confusing when it comes to transport. I suggest to Mr. Martin that he convey his views to the IAEA Secretariat via Germany's Permanent Mission to the IAEA.

L. BAEKELANDT (Belgium): The Secretariat of the IAEA has circulated IAEA draft safety guide DS-161 to Member States for comment by mid-August 2003. If agreement is reached on the draft safety guide, it will probably have consequences for the IAEA's Transport Regulations. Their scope, and probably also the definition of "low-specific-activity material", will have to be revised.

If the scope of the Transport Regulations has to be revised, an important question will be, "What is the benefit, from the radiation protection standpoint, of regulating the transport of certain categories of material?" That question will be important regardless of whether one is talking in terms of "exemption levels", "clearance levels" or some other levels. If it is decided that the transport of those categories of material must be regulated for radiation-protection reasons, the next important question will be, "How does one ensure that the severity of the requirements stands in a reasonable relationship with the expected radiation doses and the risks?" I think those two questions should be addressed once agreement has been reached on IAEA draft safety guide DS-161.

J.H. SELBY (South Africa): The scope of the IAEA's Transport Regulations will certainly have to be revised if draft safety guide DS-161 with its 0.5 Bq/g limit is agreed upon, but I do not think that the DS-161 exclusion levels will have to be applied to the transport process; for all the transport scenarios — real, not hypothetical — covered in paper IAEA-CN-101/55, the worker and public exposures are very low. The DS-161 exclusion levels should be applied only after completion of the transport process.

Our study on the transport of zircon sand confirms that the DS-161 exclusion levels are totally inappropriate for bulk quantities of naturally occurring radioactive material (NORM) during transport.

R.J. LEWIS (United States of America): I should like to specially compliment the authors of papers IAEA-CN-101/49, 51 and 52, elaborating on problems of disused sources in Bangladesh, Georgia and Lithuania, respectively, and the authors of paper IAEA-CN-101/55, elaborating on problems connected with NORM. The problems are not provided for in the IAEA's Transport Regulations and call for additional work by international experts under the auspices of the IAEA.

In the USA, radioactive sources discovered at places like scrap-metal processing facilities are sent to an authorized processor for proper disposal. The transport operations are often carried out on the basis of a generic, broad special arrangement (as defined in the IAEA Transport Regulations) or on the basis of a unique, case-by-case special arrangement. A firmer regulatory basis for such transport operations would be a worldwide, common set of standards, but that does not exist at the moment. This transport safety issue is one that might be covered by the IAEA within the framework of the activities that Mr. Dodd has just described.

Regarding Mr. Selby's presentation of paper IAEA-CN-101/55, the transport of NORM is also an area where we would like to see additional work. In the United States of America, we have been struggling with the technical basis that would allow us to justify the factor-of-ten relief for the transport of NORM that is not going to be processed for the extraction of radionuclides. From a risk standpoint, what is going to happen to the NORM after transport should not matter. We hope that studies like the one described by Mr. Selby will be drawn on in a serious investigation of whether it is an effective use of resources, and in the best interests of public health, to regulate the transport of NORM as if it were Class 7 material.

We welcome the work done on regulating on-site transport that is described in paper IAEA-CN-101/50, presented by Mr. Reculeau, and I appreciated the comment made on that paper by Mr. Ershov. In that connection, however, I would note that, during the on-site transport of radioactive material, the necessary level of safety can often be ensured through appropriate procedures — instead of the packaging — and that, in our view, on-site transport issues should be dealt with at the domestic regulatory level. To the extent that the IAEA's Transport Regulations are useful, as they have been in the French case, they should be treated as just one of a number of useful documents.

J.T. STEWART (United Kingdom): I should like to endorse what Mr. Lewis said about the transport of NORM. If we regulate where there is no need to do so from a safety standpoint, we devalue the regulatory process, which is a problem for us all.

R. BOYLE (United States of America): From the discussion it would seem that there will be quite a few interesting issues to consider during the next review of the IAEA's Transport Regulations.

B. DROSTE (Germany): With regard to Mr. Reculeau's presentation, inside nuclear facilities the impact limiters that enable a package to meet the 9-metre test drop requirements are sometimes removed, so that the remaining package containment system would possibly not meet the requirements of the Transport Regulations. How is such a situation dealt with in France?

J.-Y. RECULEAU (France): The safety case to be taken into account for authorizing on-site transport at a "centre" covers the case of handling and the on-site movement outside of individual facilities (i.e. buildings), but does not cover the case of handling or movement inside individual facilities. The latter is covered by the safety analysis report for the facility itself.

Technical Session 4

SUMMARY BY THE CHAIRPERSON

The technical session opened with Mr. J.Y. Reculeau's summary of seven papers on the packaging and transport of non-standard radioactive materials (see the attached CD-ROM). These papers dealt with transport of large quantities of low-activity material, the collection, processing and transport of disused sources, and implementation and enforcement of the transport regulations. Following this presentation, Mr. John Selby gave a presentation on specific challenges associated with the transport of bulk quantities of naturally occurring radioactive materials, specifically the transport of zircon sand. The session continued with a presentation by Mr. George Nabakhtiani on the discovery, collection, packaging and ultimate transport of orphan sources in the Republic of Georgia. A plenary discussion followed these presentations.

The session reports the following findings:

— Although the transport regulations do not cover all possible transport situations, the application of the regulatory principles to these non-specification situations provides safe transport.

— Discovery, collection and storage or disposal of orphan sources pose several unique transport challenges. These include: inability to completely identify the material to be transported; use of non-specification packages; difficult operating environments; need for technical assistance; and need for economic assistance.

— Bulk quantities of naturally occurring radioactive material can be shipped safely and in accordance with the IAEA Transport Regulations. However, due to the regulatory complexity surrounding the transport of this material, the IAEA should undertake additional research and regulatory action on this subject.

— To assist in uniform implementation of the Transport Regulations in Member States developing a regulatory programme, the IAEA is encouraged to continue, and possibly expand, its current training and assessment programmes.

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ASSESSMENT OF REGULATORY CRITERIA

(Panel 1)

Chairperson

R. CLARK
Canada

Co-Chairperson

H. BASAEZ PIZARRO
Chile

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Invited Paper

SAFE TRANSIT OF RADIOACTIVE CARGOES THROUGH THE PANAMA CANAL

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Abstract

Almost 12 000 ocean-going vessels transit the Panama Canal annually. About 30% carry dangerous goods, including radioactive material. A high level of safety has been achieved. There is a demonstrated effort to maintain and improve this by requiring compliance with the relevant regulations, exercising strict control of transit operations, inspecting transiting vessels, and by continuously making improvements to the Canal.

1. INTRODUCTION

The Panama Canal is a humanmade waterway, located in the Central American Isthmus joining North and South America. The 80-km long waterway runs from northwest to southeast with the Atlantic entrance in the north and the Pacific entrance in the south of the Canal. The Canal's principal physical features are its locks: the Gatun Locks raise and lower vessels on the Atlantic side and the Pedro Miguel and Miraflores Locks raise and lower vessels on the Pacific side. Vessels are raised, or lowered, by 25.9 m (85 feet) into or from Gatun Lake in order to cross the continental divide.

2. THE PANAMA CANAL AUTHORITY

The Republic of Panama assumed full responsibility for the administration, operation and maintenance of the Panama Canal at noon, 13 December 1999.

Panama honours the responsibility through a legal entity, the Panama Canal Authority (ACP), which was established under the Political Constitution of the Republic of Panama, and organized by Law 19 of 11 June 1997.

The ACP is an autonomous legal agency of the Government of Panama in charge of the administration, operation, maintenance, improvement and modernization of the Canal as well as its activities and related services pursuant to legal and constitutional regulations in force, so that it may be operated in a safe, uninterrupted, efficient and profitable manner. The ACP regulations, approved by its Board of Directors, present the legal framework that regulates its operation. The ACP has financial autonomy, its own patrimony, and the right to manage the Canal.

3. TRANSIT OPERATIONS AND SAFETY RECORD

Vessel transit operations are carried out continuously and simultaneously (on both the Atlantic and Pacific sides of the Canal), 24 hours a day, 365 days per year. There are two shipping lanes at each set of locks. The locks are 304.8 m (1 000 feet) long and 34.5 meters (110 feet) wide. Over 208 000 m^3 of fresh water is spent during each vessel transit.

Since its inauguration in 1914, over 850 000 vessels have transited the Panama Canal, and during the last fiscal year, there was a total of 11 853 ocean-going transits. The percentage of vessels with beams over 30.5 meters (100 feet) has been increasing: now 40% of all ocean-going vessels for FY2003, an 8% increase over FY1999.

The transit is completed in eight to ten hours under normal conditions and under the full operational control of the Panama Canal Authority. The total Canal waters time[1] is about 25 hours.

Currently, the number of vessel accidents investigated by the Board of Local Inspectors is at its lowest level in fifty years. The safety record of seventeen accidents investigated in FY2001[2] was repeated in FY2002. There was no loss of life, dangerous cargo release, or vessel loss in any of these accidents. For FY2003, eight accidents have been investigated so far.

Safety is of paramount importance at the Panama Canal and this is accomplished by means of:

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[1] Canal waters time is the time elapsed from the time the vessel is declared ready for transit until it departs the Canal after transit.

[2] The FY runs from 1 October to 30 September.

— Requiring compliance with the IMDG Code and other international regulations as well as Panama Canal regulations;
— Controlling the transit operations;
— Continuous improvements to the waterway and its structures.

4. VESSEL TRANSIT REQUIREMENTS AND DETAILS

Transiting vessels with radioactive cargo aboard are required to comply with the:

— Safety of Life At Sea (SOLAS) Convention [1];
— International Maritime Dangerous Goods (IMDG) Code [2], which incorporates the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Materials [3];
— International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Wastes on Board Ships (INF Code) [4];
— Panama Canal Regulations[3] [5].

Vessels that do not comply with the previously mentioned codes and regulations do not transit the Panama Canal. Thirty-six (0.3%) of the ocean-going vessels that transited in FY2002 had radioactive cargo aboard. This includes two transits with INF [5] cargo. Up to 1 July in FY 2003, we have had twenty-eight transits with radioactive cargo shipments aboard. The radioactive materials shipped include spent fuel, vitrified waste, uranium hexafluoride, minerals, unirradiated fuel rods, empty flasks, industrial sources and uranium dioxide.

The Panama Canal is a highly regulated waterway. All vessel movements are controlled at the Marine Traffic Control Center and all vessel-related activities are performed only when authorized by Canal authorities. Pilotage is compulsory. The Panama Canal pilot takes over the navigational command of the vessel for transit purposes while the master remains responsible for the vessel and its cargo.

All transiting vessels are inspected to insure they meet all the requirements for safe transit. Additional inspections are carried out on all vessels transporting fissile and INF cargo, to verify their compliance with the IMDG Code. Special transit and security measures are applied to the transit of INF-class vessels. The purpose of these measures is to reduce the possibility of any incident that may affect the INF-classed vessel. Examples of special-transit measures include:

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[3] PCA regulations may be accessed at *http://www.pancanal.com*.

— Clear transit through the Gaillard Cut,
— Assignment of a senior pilot,
— Expeditious transit,
— Lockage with security escort vessels, and
— Direct coordination with, and continuous surveillance by, State security institutions.

The security measures include full support from, and participation by, Panamanian government institutions responsible for public security[4]. Additionally, the Panama Canal has established weight limits of 150 000 kg (150 tonnes) per package and lifting accessories for all radioactive material.

5. IMPROVEMENTS TO THE CANAL

The ACP is constantly developing and updating long-term plans that encompass personnel training and a variety of maintenance and improvement projects, including:

— Further deepening of the Gaillard Cut and other sections of the channel in Gatun Lake,
— Widening and straightening selected curves of channels,
— Enhancement of the aids to navigation and lock-chamber light systems.
— Enhanced fire-fighting capabilities at all locks.

Examples of already implemented projects are:

— Replacement of the marine traffic control system with an enhanced, satellite-based vessel traffic management system permitting an automatic flow of information;
— Replacement of locomotive tracks;
— Modernization of the telecommunications network;
— Procurement of new tugboats with more power and manoeuvrability;
— Modern locomotives with increased towing power;
— Conversion to hydraulics of all machinery operating the lock mitre gates; and
— Full bridge simulation.

[4] The Republic of Panama is a signatory of the Convention on the Physical Protection of Nuclear Material.

The Panama Canal's aggressive, $1 billion modernization and improvement programme aims to guarantee safe and efficient operations and to increase the waterways capacity. The core purpose of these programmes is to ensure that the Canal remains a competitive and economically viable international shipping route for many decades to come. In addition, the ACP has maintained its ISO 9001:1994 certification, and is now taking steps to re-certify under ISO 9001:2000, thus reinforcing the emphasis on quality for our customers for a safe, expeditious and reliable transit service.

6. INTER-INSTITUTIONAL PROMOTION OF SAFE TRANSPORT

The Republic of Panama has placed considerable interest in the safe transport of radioactive cargo through the Canal. An excellent working relationship has been in existence between the ACP and the Panamanian Ministry of Health since 31 December 1999, in contrast with limited interaction beforehand between the Panama Canal Commission[5] and the Panamanian Ministry of Health. Numerous public activities involve both institutions, for example:

- The Minister of Health and the Administrator of the ACP signed an agreement on cooperation to exchange information pertaining to the transit of INF-classed vessels.
- In 2001, the Ministry of Health together with the Panama Canal Authority and with the assistance of the IAEA held two one-week-long seminars on judicial and technical aspects relative to the transit of radioactive cargoes. Over eighty government officials and interested members of the public attended each of the seminars. The IAEA support included a complete and detailed presentation on the IAEA Regulations for the Safe Transport of Radioactive Material. In addition, Mr. A.J. González, Director of the IAEA Division of Radiation and Waste Safety, and Mr. L. Soberhart of Argentina made key presentations on the International Radiation Safety Policies and on Civil Liability related to the transport of radioactive material, respectively.
- The Republic of Panama requested the IAEA to carry out a Transport Safety Appraisal Service (TranSAS) mission to Panama, with specific emphasis on evaluating the regulations and procedures applicable to the ACP with regard to the transport of radioactive material through the

[5] Federal Government agency of the USA, predecessor of the Panama Canal Authority.

Canal. The IAEA honoured this request and the TranSAS mission to Panama was carried out from 9 to 20 June 2003.
— Participation in three conferences organized by Committees of the National Legislative Assembly on the transport of radioactive materials through the Panama Canal, in 2000 and 2001.

7. CONCLUSIONS

The Panama Canal Authority promotes safety for all vessels transiting the Panama Canal through:

— The strict application and forceful compliance with:
- The mandates from IMO Conventions;
- The IMDG Code, which incorporates the IAEA Regulation for the Safe Transport of Radioactive Materials;
- The INF Code;
- The Maritime Regulations for the Operations of the Panama Canal;

— Strict control of the transit operations;
— Continuous improvement to the Canal.

Our safety record is noteworthy. There has never been an incident involving vessels transporting radioactive cargoes through the Panama Canal.

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[1] INTERNATIONAL MARITIME ORGANIZATION, Consolidated Text of the International Convention for the Safety of Life At Sea, 1974, and its Protocol of 1988: Articles, Annexes and Certificates SOLAS, Consolidated Edition, IMO, London (2001).
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[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, Safety Standards Series No. ST-1, IAEA, Vienna (1966).
[4] INTERNATIONAL MARITIME ORGANIZATION, International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships, IMDG Code Supplement, IMO, London (2002).
[5] PANAMA CANAL AUTHORITY, Maritime Regulations for the Operation of the Panama Canal, ACP, Panama (1999).

Panel 1

DISCUSSION

Y. NISHIWAKI (Austria): What guidelines has the IAEA produced for minimizing the likelihood of terrorist hijacking of radioactive material during transport?

R.B. POPE (IAEA): IAEA document INFCIRC/225/Rev.4 (Corrected), The Physical Protection of Nuclear Material and Nuclear Facilities, contains guidance relevant to the transport of nuclear fuel cycle material. As to the transport of other radioactive material, the IAEA Secretariat is preparing draft guidelines for maximizing security during transport, which will be addressed later this year at a technical meeting.

D.J. AMMERMAN (United States of America): The presentations just made have demonstrated that the hypothetical accident conditions on which the IAEA's Transport Regulations are based are more severe than the environments experienced in sea transport accidents. In fact, none of the analyses reported on involves conditions beyond those postulated in the Transport Regulations, so there would be no release of radioactive material. Even in the case of a postulated accident that leads to a release of radioactive material, the consequences are far from catastrophic. Moreover, as shown in paper IAEA-CN-101/58 presented by Mr. Booker, the requirement that large quantities of spent fuel, vitrified high-level waste, and plutonium be transported in purpose-built ships (according to the IMO's INF Code) makes for additional safety. Accordingly, I see no reason why shipments of Class 7 radioactive material should be treated differently from shipments of other dangerous goods.

K.K. LO (Canada): I have a question for Mr. Tani about ship fires. I believe that the IAEA regulatory fire-test conditions are more severe than the fire accident conditions postulated in the study described in paper IAEA-CN-101/56. Would the fire postulated in that study result in the sinking of the ship?

H. TANI (Japan): In the simulation study of a fire accident on an INF-3 ship, there is no flammable material in the cargo hold. Consequently, the only place where a fire could spread is the engine room.

R.A. STEANE (Canada): What is the purpose of the 30 day advance notification requirement in the case of the shipment of Class 7 material or other radioactive material through the Panama Canal?

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

F. CHEN (Panama): The purpose is to enable shippers to present all the documents required pursuant to the IMDG Code: for example, competent authority certificates of approval of flask designs.

R.A. STEANE (Canada): Is there a similar advance notification requirement for other dangerous goods?

F. CHEN (Panama): For other dangerous goods there is a 48 hour advance notification requirement.

C. ANNE (United States of America): What percentage of the vessels passing through the Panama Canal have dangerous goods aboard?

F. CHEN (Panama): About 30%.

C. ANNE (United States of America): What sort of HAZMAT-related training is provided in Panama?

F. CHEN (Panama): We have a HAZMAT school — perhaps the best in Central America — which provides training at various levels, including training in how to respond to incidents involving dangerous goods. Also, HAZMAT information is provided to members of the public on request.

E. VELARDE (Panama): We at the Panamanian Ministry of Health greatly benefited from the recent TranSAS mission to Panama. In fact, even before the mission, the process of completing the mission-related questionnaire sent to us by the IAEA Secretariat was very useful. We are now explaining to various groups what happened during the TranSAS mission, and we are doing so transparently and using plain language, as advised by the TranSAS team.

F. CHEN (Panama): The TranSAS mission was a very valuable experience also for us in the Panama Canal Authority. An important aspect of the mission was that it made members of the various participating Panamanian institutions think hard and work closely together during the two and a half years from the time when preparations for the mission started. I encourage other IAEA Member States to request TranSAS missions.

G.J. DICKE (IAEA): It is good for us in the IAEA Secretariat to hear what representatives of host countries feel about TranSAS. I encourage people from countries that have not yet hosted a TranSAS mission to speak with people from countries that have hosted one, in order to ascertain whether their countries could benefit. We can provide brochures and other information material, but word-of-mouth accounts of TranSAS missions are probably the best recommendation.

Panel 1

SUMMARY BY THE CHAIRPERSON

The five contributed papers for this panel discussed the high degree of safety and positive experience in maritime transport in general and of Type B packages in the maritime environment. In addition, transport through the Panama Canal was reviewed. The conference found that, relative to maritime transport, the test requirements for Type B packages (thermal test and 9-metre drop test) are based on good science and engineering. The integrity of packages transporting irradiated nuclear fuel, plutonium or high-level waste was highlighted, as was the survivability and stability of purpose-built vessels in a severe ship–ship collision.

The TranSAS mission to Panama held in June 2003 was discussed in an invited paper. It was noted that the pre-mission questionnaire was an important tool in assisting the host Member State in considering the purpose of certain existing regulatory activities.

The conference suggested that Member States speak to those Member States that have hosted TranSAS mission regarding the benefits of such missions.

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EFFECTIVENESS OF THE REGULATORY PROCESS

(Technical Session 5)

Chairperson

N.C. BRUNO
Brazil

Rapporteur

J. AGUILAR
France

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Invited Paper

EFFECTIVENESS OF THE REGULATORY PROCESS AT THE INTERNATIONAL LEVEL

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Abstract

A comparison between the regulatory review processes of the International Atomic Energy Agency and of the International Civil Aviation Organization is presented. Their differing approaches to audits are examined.

1. INTRODUCTION

When asked to present this paper, I admit my first reaction was, "What on earth am I supposed to cover?" This question remained my second reaction and my third reaction. Then I fell back on that old reliable Oxford English Dictionary to see what assistance I could get from knowing the precise definition of "effectiveness". Well, the first attempt was not very successful or even effective. The second, defining what's meant by "effective" certainly was successful, i.e. being "concerned with, or having the function of carrying into effect, executing or accomplishing".

I can be very philosophical at times, which made me start to think about the whole process of incorporating the IAEA Regulations, or rather recommendations, into the International Civil Aviation Organization (ICAO) Technical Instructions, and to question how effective the process was and is. I used the past tense "was" so that I could refer to the old system and the present tense "is" so that I could refer to the new two-year cycle and then to compare that process with the process in ICAO, not just for amendments for Class 7 (radioactive) dangerous goods, but for all dangerous goods and also for amendments to the annexes to the Chicago Convention.

2. ICAO'S PROCESS FOR AMENDING AN ANNEX

The ICAO process for amending an annex provides an extremely fast review of Standards and Recommended Practices (SARPS) and annexes, but is also extremely complex.

In my presentation on Monday morning, I referred to the Chicago Convention. The Convention has eighteen annexes, of which Annex 18 is for the safe transport of dangerous goods by air. In those annexes to the convention we have the SARPS, which are adopted by our Council.

A definition for a Standard in the annexes is as follows:

"Any specification for physical characteristics…personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention."

Thus, through the Chicago Convention, it is mandatory that States conform to the Standards. The definition for Recommendation is essentially self-explanatory; rather than saying it is recognized as being necessary (mandatory), it is recognized as being desirable.

In order to amend a standard or even a recommended practice, a complex process is followed. The process followed by ICAO is at least as complex as the review process the IAEA is following for the review and revision — as needed — of the IAEA's Transport Regulations (TS-R-1). The ICAO process is making an amendment to the annex to the convention.

The ICAO process is described in step-by-step fashion below. Figure 1 depicts the first part of the process.

A proposal for the initiation for any specific technical issue can originate from a Contracting State, the Council, the Air Navigation Commission (ANC), the group of technical experts in ICAO, the Secretariat, or from international organizations.

Figure 2 depicts the action initially taken on a proposal. The ANC refers the issue to a panel such as the Dangerous Goods Panel (DGP), for which I act as secretary, or may go to a divisional meeting. There are various ways of handling the proposal in-house. Draft Standards or Recommendations are then developed and sent back to the ANC for preliminary review.

Figure 3 depicts the next step, the review phase.

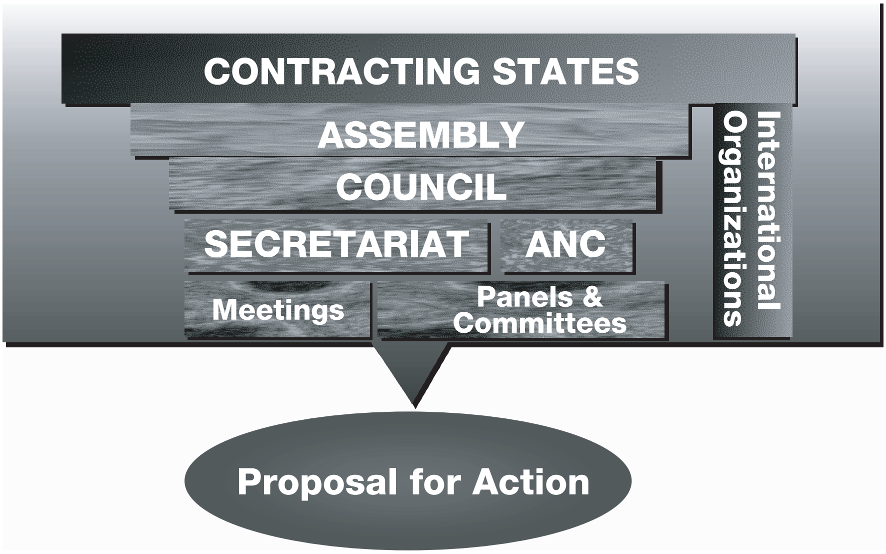

FIG. 1. The proposal phase: developing a proposal for action on an ICAO annex.

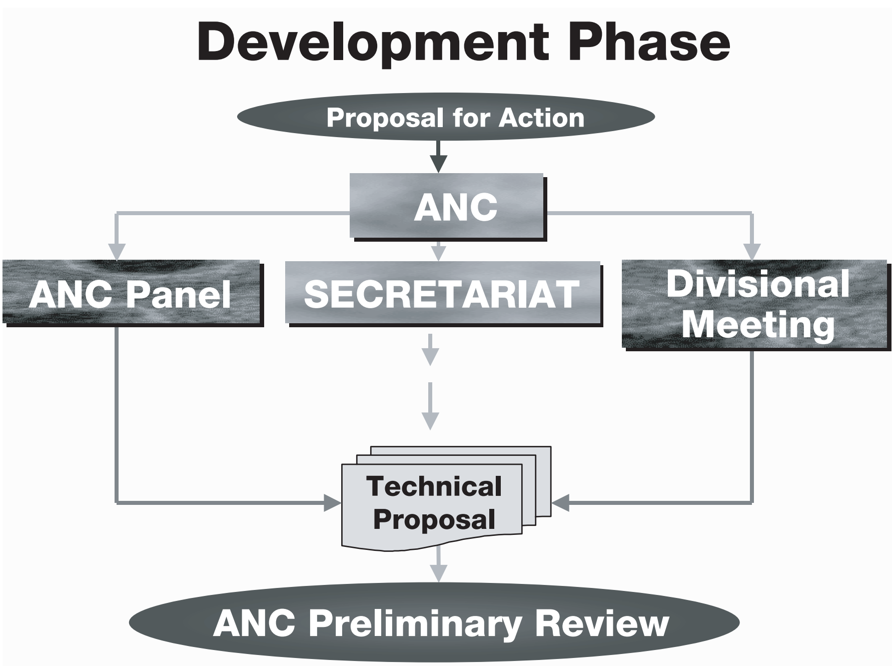

FIG. 2. The development phase: preparing for a preliminary review of a proposed action on an ICAO annex.

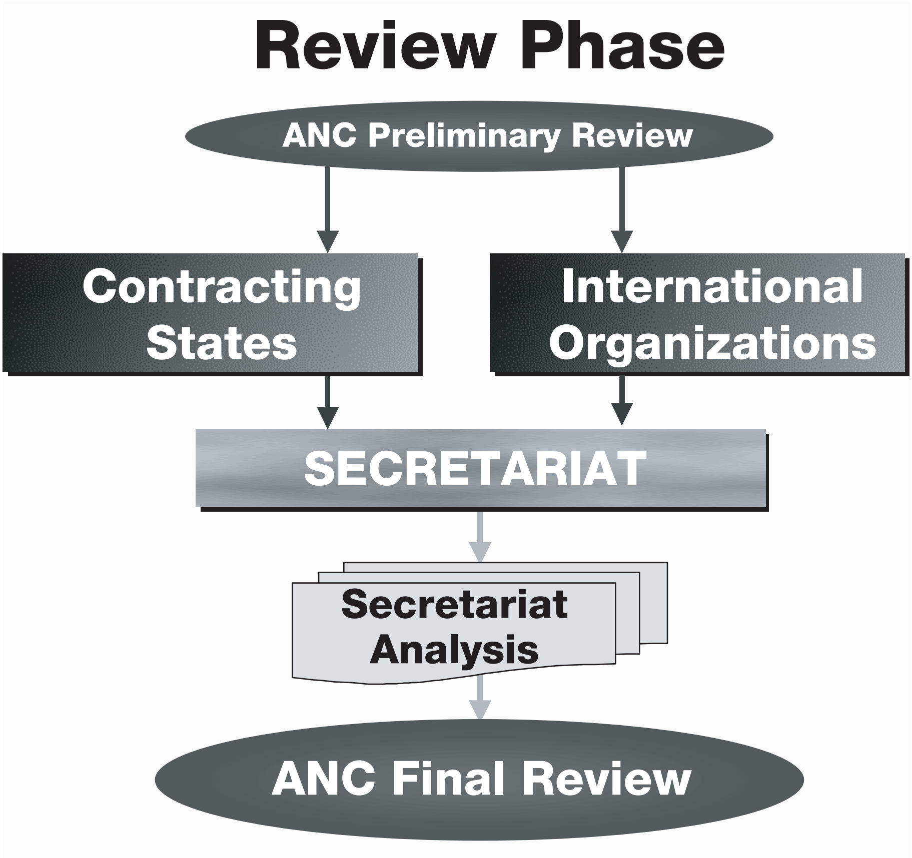

FIG. 3. The review phase: reviewing, analysing and approving a proposed action on an ICAO annex.

The original recommendations for these SARPS, along with any alternative proposals that the ANC may develop, because the proposals may need further amendment, are then submitted to Contracting States and selected international organizations for comment. States are normally given 3 months for this; similarities between the two systems are clear. The comments are then analysed by the ICAO Secretariat and submitted to the ANC for final review.

Figure 4 depicts the final phase in the process: adoption and publication.

In this final phase of the process, the commission then establishes the final text of the proposed amendment and recommends it to our Council for adoption. If at least two thirds of the Council agree, then the amendment is approved. Within two weeks of that adoption, an interim addition called the

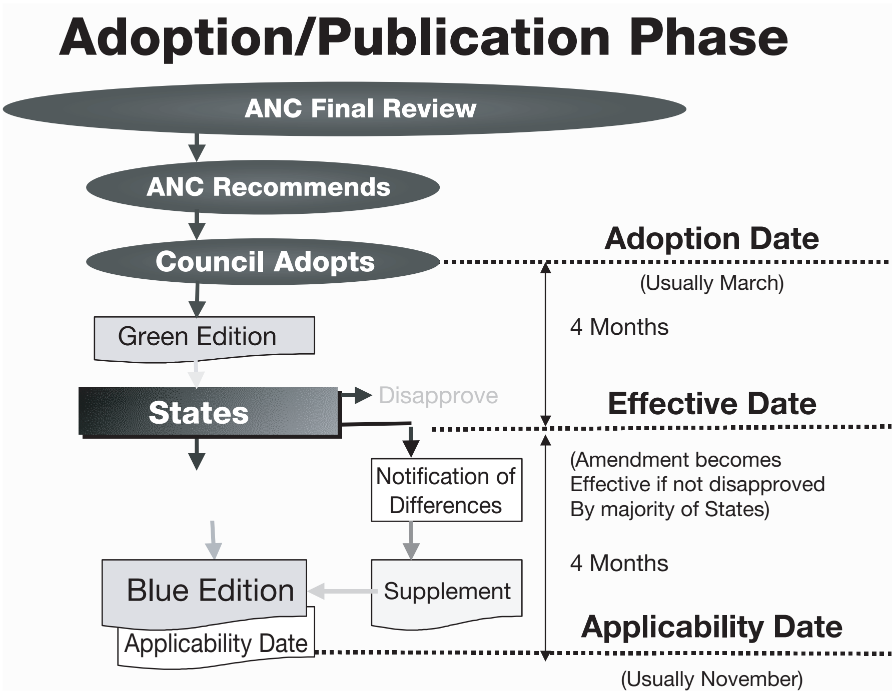

FIG. 4. The adoption/publication phase: adopting and publishing an approved action on an ICAO annex.

Green Addition is sent to States. This allows an opportunity for States to review what has been adopted by the Council. If any State disapproves of the amendment it must notify the council by a certain date, termed the effective date. If a majority of States disapproves of the amendment, perhaps it has changed rather dramatically from what they saw in the original proposal, then the amendment is deemed not to be accepted. And finally, for surviving actions, the applicability date becomes effective, which is normally 4 months after the effective date when the amendment becomes binding on States.

This illustrates the complexity of the process. However, it must be kept in mind that this is for an annex amendment.

3. ICAO'S PROCESS FOR AMENDING ITS TECHNICAL INSTRUCTIONS

Annex 18 paragraph 221 states that each Contracting State shall take the necessary measures to achieve compliance with detailed provisions in the

Technical Instructions. This implies that States must either incorporate them or adopt them by reference, into their national law. The updating of the Technical Instructions (commonly identified as the TIs) is then done by the Dangerous Goods Panel (DGP).

The DGP was established by our Air Navigation Commission. It presently has fifteen members: thirteen experts from Member States and two from international organizations, the International Air Transport Association (IATA) and the International Federation of Air Line Pilots' Associations (IFALPA), which bring specific expertise. For this process we have a biennial cycle: two Working Group meetings are held, the first before the final UN Committee of Experts, at which, of course, the IAEA amendments are now included; and the second occurs in the following spring to review the outcome of that meeting and to prepare for our panel.

Each of the Working Group meetings typically deal with seventy to a hundred working papers. For the DGP meeting itself, all papers are translated into French, Russian and Spanish. The cycle lasts just over two years.

In the case of an urgent safety-based amendment, ICAO has the possibility of a fast-track system, which has been used once, 7 years ago. In May 1996 a ValueJet airliner crashed into the Florida Everglades following an onboard fire, with the loss of a hundred and ten passengers and crew. After a short period of investigation, oxygen generators were suspected of having contributed to the fire. They had been at a maintenance facility and were being returned to Atlanta from Miami. Unfortunately they were not declared as dangerous goods and had not been properly packaged. Therefore, although an airline may purport to refuse dangerous goods as cargo, sometimes it is forgotten that company material — COMAT as we call it in the business — is still dangerous goods and has to be handled as such.

Now consider the timeline for our urgent amendment. The accident happened in May 1996. Approximately one week later, IATA had a total prohibition for its member airlines and by mid-June 1996 ICAO had approval by the council to go to our Air Navigation Commission and our Council for approval for an urgent amendment to the Technical Instructions. Within six weeks, ICAO had the amendment.

A second example of an urgent amendment followed from the events of 11 September 2001. ICAO has another annex, Annex 6, which is linked to operations of aircraft. There was extensive and immediate discussion about the need for reinforcement of cockpit doors. Preliminary discussion had taken place in the ANC on 25 January 2001, and it was adopted by our council on 15 March 2002. It was achieved in about 14 months. The usual period of implementation following from the Council's adoption meant that it was applicable from November: States had to ensure that their operators had reinforced cockpit doors for international flights.

4. HARMONIZING THE IAEA'S REVIEW CYCLE WITH ICAO'S CYCLE

A comparison of ICAO amendments, be it for an annex or for the technical instructions, with the old IAEA revision cycle reveals difficulties in the latter:

— The length of the cycle — although theoretically about ten years, sometimes IAEA had a revision mid-cycle;
— The periodicity of the cycle was, therefore, always unknown and problematical for those of us who follow a well-defined regular cycle; and
— The format created a lot of work for the Secretariats of the other modal organizations with the possible introduction of errors.

4.1. Format of the regulations

With regard to the format, agreeing to provide the provisions in the reformatted UN Model Regulations has probably been the biggest help to those of us in the modal regulation organizations. This came about as the result of a request made by the former International Maritime Organization (IMO) secretary and myself when we attended an IAEA-hosted Inter-Agency Coordination Meeting. Prior to this, we would have to take the IAEA amendments and incorporate them ourselves, which could, of course, lead to differences in presentation. Thanks to the Secretariat and to the revision panels, the fact that they now undertake this additional task has assisted us greatly and, I believe, has introduced uniformity for all of the dangerous goods transport regulations.

4.2. The two-yearly review cycle

With regard to the revision cycle itself and noting the number of papers on this subject (over 20% of the papers in this section) it is clear that there is apprehension on the part of some over the relatively fast cycle. However, I'd like to say that once the revision occurs, when it is necessary, in some multiples of two years, we have no problem because this will still fit in within the UN cycle and the cycles for the modal organizations. I would also note that, for all other classes of dangerous goods, we seem to be able to cope, without difficulty, with a two-year cycle so some fresh thinking may be needed for radioactive material to define whether this class of material presents some special problem.

From a Secretariat viewpoint, I find it difficult to understand why editorial corrections, and I call them that rather than editorial amendments, go before the Transport Safety Standards Committee (TRANSSC). It should be an automatic procedure. If there's a spelling or typing error, or language clarification is needed from a expert, then the Secretariat should have the authority to make the change. That such changes currently go to TRANSSC is an inappropriate use of meeting time.

I believe that meetings should be held in plenary as much as possible. That comment comes from the weary voice of experience of one who attended that infamous revision panel, when, we ended up with, I believe, seven working groups, which for those of us who had only one person representing, be it an organization or a Member State, it was rather difficult to decide which working group to attend. For the air mode, we try as much as possible for the representatives of IATA, IFALPA and ICAO to share the burden, but obviously it's a difficulty so I would strongly encourage, as much as possible, that communication should be through plenary. I would note that, again for the other organizations involved with dangerous goods, this is the method of working. We have very few working groups and, if they are held, they are held outside of the meeting time.

5. IMPLEMENTATION

I believe that the implementation of the regulatory process is important. We all know that great efforts were made to try to achieve 1 January 2001 as the common date and those efforts were again largely due to the communication we were able to have thanks to the Inter-Agency Co-ordination Meeting. I am a strong supporter of those Inter-Agency Co-ordination Meetings. Reading the papers — I believe Mr. Duffy just mentioned it in the last presentation — it is clear that the domestic regulations need to be implemented as closely as possible on the same date.

The need for training and awareness is vitally important, as is the need for the IAEA to develop suitable material. I would note that the new training book is excellent, but I have one small observation to make from the air-mode perspective. Initial dangerous goods training courses are generally of 3 to 5 days' duration. For many freight orders or operators acceptance staff, a 5-day course is too long for a single class, i.e. radioactive material. The people taking this course should already be aware of the major principles. Perhaps this is a contributing factor for some airlines refusing shipments.

Finally, I'd like to touch on State variations. For those not familiar with the Technical Instructions, we make provision for States that want to be more restrictive than the instructions themselves to notify ICAO so that their variations can thus be published and promulgated. From some preliminary discussion with colleagues in the air industry, it seems to me that it is not just a simple case of airlines saying that they will not handle Class 7 (radioactive) material because it is too dangerous or it is too difficult or whatever. Rather, I've been told that frequently within Member States some other agency, e.g. a health authority, imposes additional restrictions that may make it very difficult for operators, no matter how much they might want to transport radioactive material, especially if they see it as a potential revenue generator. So I would say to all regulators, when you set up a meeting with all potential interested parties, you might be interested or you might be surprised by the outcome from discussions concerning refusals to ship.

6. SAFETY OVERSIGHT AND APPRAISALS

My final comments are directed towards the ICAO safety oversight programme and the link with the IAEA appraisal. When I spoke before about the safety oversight audit programme, I showed Fig. 5, which provides the total

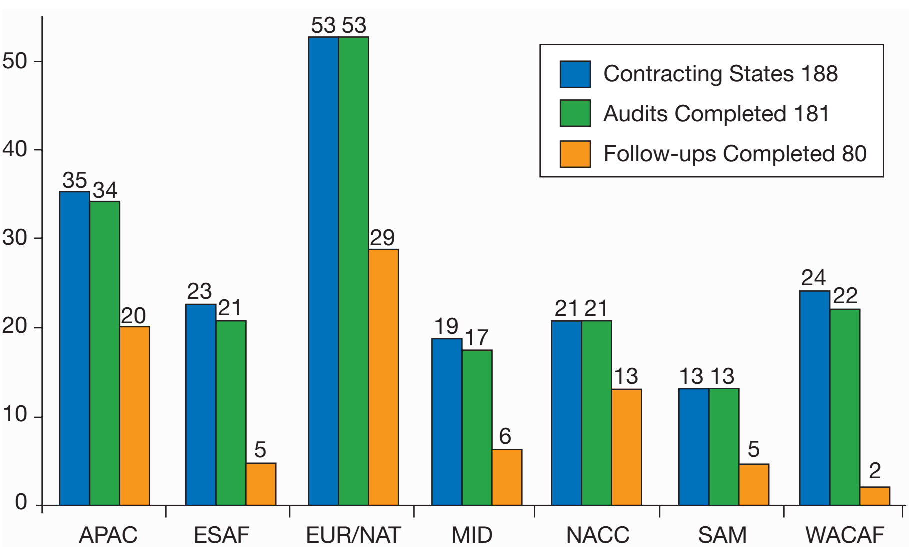

FIG. 5. ICAO audits and audit follow-ups completed (as of 31 March 2003).

number of ICAO Member States, 188, the audits completed, with the number of 181 obviously being a very high percentage, and the number of follow-up audits that had been completed at the end of March 2003. We have had eighty follow-up audits.

Figure 6 illustrates that, when one considers that in the follow-up audit a Member State has to provide a corrective action plan if problems have been identified in the initial audit, the implementation of corrective action plans and the resolution of various safety concerns show a positive trend. For example, the average lack of effective implementation of critical elements of a safety oversight system declined from 21.7% to 7.6%, which is a very impressive improvement.

After the presentations on the appraisal service by the IAEA, I discussed with R.B. Pope and G.J. Dicke my surprise at the lack of interest of competent authorities in requesting appraisals (Table 1). Within the same timeframe, there were approximately six requests for the IAEA appraisal service, of which five were carried out, whereas with the ICAO assessment, which was similarly on a voluntary basis, we had eighty-five requests, of which sixty-seven were carried out. So, even allowing for the fact that we have 188 Member States and the IAEA has approximately 120, there is still a large difference between the two numbers of requests.

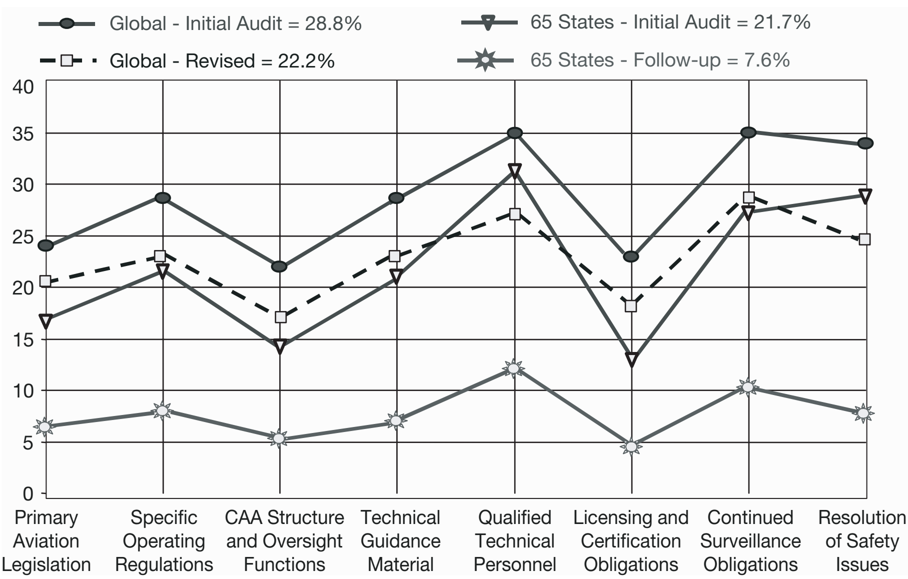

FIG. 6. Critical elements of a safety oversight – lack of effective implementation comparison of audit and audit follow-up results.

TABLE 1. COMPARISON OF IAEA APPRAISALS WITH ICAO ASSESSMENTS IN THE TRANSPORT AREA

	IAEA Appraisal	ICAO Assessment
Requested	6	85
Carried out	5	67

7. CONCLUSION

The United States Federal Aviation Administration (FAA) provided me with data on the generic causes of incidents involving dangerous goods shipped by air (Fig. 7).

In the past three years, incidents involving dangerous goods resulted predominantly from human error. Regardless of how effective regulations or regulatory processes are, we must remember to allow for Murphy and his law. Although Murphy is an Irish name, I believe he was an American — a positive note on which to conclude.

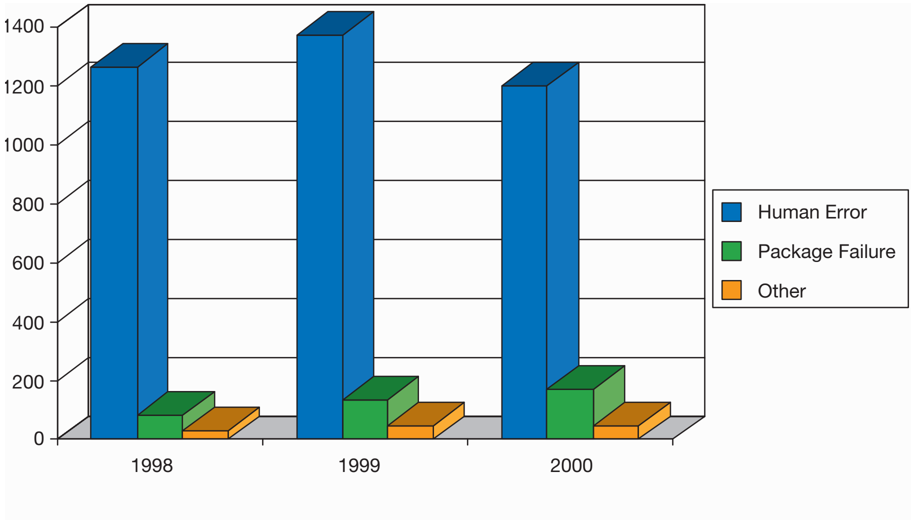

FIG. 7. Causes of dangerous goods incidents by air (Source: US FAA).

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Technical Session 5

DISCUSSION

N.C. BRUNO (Brazil): The United States Congress has taken a decision allowing airline pilots, after suitable training, to be armed during flights. What has been the reaction of ICAO to that decision?

K. ROONEY (ICAO): The decision applies only to domestic flights within the United States, and no such decision has been taken in ICAO regarding international flights. IFALPA is opposed to the decision, as are many members of ALPA — the North American Air Line Pilots Association.

J.T. DUFFY (Ireland): From Ms. Rooney's presentation, it appears that the number of safety assessments carried out within the ICAO framework far exceeds the number of IAEA TranSAS missions to date. Could Ms. Rooney and/or Mr. Dicke explain the difference?

K. ROONEY (ICAO): Safety assessments carried out within the ICAO framework started in March 1996, funded from voluntary contributions made by ICAO Member States. In 1998, the ICAO Assembly adopted resolution A 32-11 establishing a Universal Safety Oversight Audit Programme that is funded as part of ICAO's regular programme. Thus, ICAO safety assessments — now called safety audits — started earlier than IAEA TranSAS missions, and in recent years they have not been dependent on voluntary contributions.

G.J. DICKE (IAEA): Expanding on Ms. Rooney's reply, I would recall that, in 1998, the IAEA's General Conference requested the Secretariat "to provide for application of the Transport Regulations by, inter alia, providing a service, within existing resources, for carrying out, at the request of a State, an appraisal of the implementation of the Transport Regulations by that State." I draw particular attention to the phrase "within existing resources"; no additional resources were to be made available to the Secretariat, whose ability to provide the service in question (TranSAS) was, therefore, very limited. In addition, as with some other safety-related services of the IAEA, it took a couple of years for the Member States as a whole to gain a clear understanding of the nature of TranSAS. We received the first request for a mission almost immediately after the establishment of TranSAS, but it was quite a long time before further requests were received. As regards the funding of TranSAS missions, it was agreed that developed Member States, which do not normally request or receive technical assistance through the IAEA's technical co-operation programme, should themselves pay for TranSAS missions that

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

they host. For developing countries, there was initially no guideline, but now that the TranSAS missions that they host are funded as IAEA technical co-operation projects, the individual Member State must decide whether IAEA technical co-operation funds should be devoted to a TranSAS mission rather than to another technical co-operation project. There has been some reluctance on the part of developing Member States to forego "conventional" technical assistance in favour of a TranSAS mission, and the IAEA's General Conference, recognizing the problem, has twice requested the Secretariat "to ascertain whether there are available spare resources to satisfy further requests for TranSAS missions from developing Member States." The IAEA Secretariat is having difficulty in finding "spare" resources.

M.S.T. PRICE (United Kingdom): In my opinion, comparing numbers of TranSAS missions with numbers of ICAO safety audits is like comparing apples with oranges. As to the funding of TranSAS missions, I think that the number of requests is going to increase and that the IAEA Secretariat will simply have to find a way of acquiring the necessary financial resources.

I. KOCA (Turkey): Could Ms. Rooney give us some idea of how ICAO safety audits are carried out and of their scope?

K. ROONEY (ICAO): An audit team consists of three to eight members and an audit lasts between five and fifteen days depending on the complexity of the air navigation system of the State. The areas covered so far have specifically addressed topics out of only three of the eighteen annexes to the Convention on Civil Aviation (i.e. the Chicago Convention). The topics addressed have included personnel licensing, aircraft operations, and airworthiness of aircraft; six questions on dangerous goods were also asked during the audits. An audit on aviation security was recently started and is being performed separately from the others. Future audits will cover air-traffic management, accident investigation and airports.

V.N. ERSHOV (Russian Federation): During the poster session, we found that many of those we talked with did not have a clear understanding of some of the provisions discussed in our paper Status and Perspectives of Safety Management for Transport of Radioactive Material in Russia (IAEA-CN-101/79). I would, therefore, like to give a brief explanation of that paper.

In the Russian Federation, we are not going to refuse applications for the special arrangement provision for radioactive material shipments, in spite of the fact that we apply the full set of requirements from the IAEA Transport Regulations. In the past, prior to the implementation of the IAEA Transport Regulations in the former USSR, transport was typically carried out under a special regime — that is to say, with the application of special organizational arrangements.

In the late 1970s and early 1980s, the IAEA Transport Regulations were adopted by the USSR, and have been carried forward into the Russian Federation. Throughout the history of the transport of radioactive material in the Russian Federation, no serious radiation exposures have been recorded either for the public or for workers, nor have there been any serious accidents as a result of transport.

Using the IAEA's Transport Regulations, we now have a reliable method for demonstrating that the packages used are designed, tested and certified to appropriate standards. And now, the use of the special arrangement provision is not to compensate for inadequacies in package design but to impose additional requirements to enhance assurance of safety, including those deemed necessary for adequate physical protection of some of the more dangerous materials.

Here, I would mention an old Russian proverb: "Do not seek good when you have good already." How long it will be good depends on the future.

M.C. MONTUORI (Australia): The ICAO Dangerous Goods Panel is planning to introduce regulations that will prevent the carriage of packages of radioactive materials in the passenger cabins of aircraft. Can anything be done to prevent the introduction of such regulations, which will cause problems for many patients and medical practitioners in locations worldwide, who rely on light aircraft with no dedicated cargo compartments for the speedy delivery of radiopharmaceuticals?

K. ROONEY (ICAO): A working group of the Dangerous Goods Panel took the decision in question, which still has to be ratified by the Panel when it meets in October. Unfortunately, the IAEA Secretariat was not represented at the meeting where the working group took the decision, but I hope the Secretariat will be able to attend the October meeting, to whose attention the ICAO Secretariat will draw the issue raised by Mr. Montuori.

R.R. RAWL (United States of America): It is clear from papers contributed and/or presentations made at this conference that transport operations carried out in accordance with the IAEA's Transport Regulations are very safe. Also, we have heard that major changes to the Transport Regulations can be costly and can have operational impacts both on the availability of different modes of transport and on the security of shipments. We should bear these points in mind when considering proposed changes to the Transport Regulations. Of course, the concept of "justification" is already applied when the Transport Regulations are reviewed, but the rigour with which it is applied has varied widely from one review to the next. How might we be more systematic when applying the "justification" concept?

L. BAEKELANDT (Belgium): Nobody will deny that the IAEA's Transport Regulations should be reviewed on a regular basis or that the competent authorities of as many countries as possible should participate in the review process. However, participation in the review process represents an appreciable burden for competent authorities.

A review cycle now starts every second year, but it takes three years to have the revised edition of the Transport Regulations published. That means that participating competent authorities have to propose amendments to a text that has not yet been published and, more importantly, has not yet entered into force. The problem is even worse if carriers, consignors and other stakeholders are involved in the review process. Moreover, although revised editions of the IAEA's Transport Regulations, which are published in English, do not have to be translated before being incorporated into the regulations of the international modal organizations, they do have to be translated before being incorporated into the national regulations of countries in which English is not the official language. Such countries may have difficulties in keeping their national regulations in line with the international ones. In my view, the IAEA's Transport Regulations are reviewed too frequently.

K. ROONEY (ICAO): Mr. Baekelandt said that revised editions of the IAEA's Transport Regulations do not have to be translated before being incorporated into the regulations of the international modal organizations. ICAO publishes its Technical Instructions in English, French, Russian and Spanish, which was one of the reasons why the date for implementation of the IAEA's Transport Regulations in ICAO's Technical Instructions was postponed from 1 January to 1 July 2001.

G.J. DICKE (IAEA): Regarding Mr. Baekelandt's comment that, in his view, the frequency of reviews of the IAEA's Transport Regulations is too high, I would recall that they used to be reviewed far less frequently, but many IAEA Member States found that inconvenient because they sometimes had to wait several years for desired changes to the Transport Regulations. The recently introduced arrangement of reviewing the Transport Regulations on the basis of a two-year cycle is in line with the regulation review cycles of the United Nations Committee of Experts on the Transport of Dangerous Goods and the international modal organizations (IATA, ICAO, IMO, ADR, ADN and RID). Moreover, following completion of the first two-year review cycle, it has been decided that the approved changes to IAEA Safety Standards Series No. TS-R-1 are so minor that a further revised edition of the Transport Regulations is at present necessary only as an "as amended" version. We have found that, when the approved changes to the Transport Regulations are minor, States do not have much difficulty in making the corresponding changes to their national regulations.

H. TANI (Japan): I agree with Mr. Baekelandt that the reviews of IAEA's Transport Regulations are too frequent. It is important that the Transport

Regulations be implemented effectively, but that is difficult to achieve if the national transport regulations of some countries reflect the latest version of the Transport Regulations and those of other countries do not, which can readily happen with a short review and revision cycle. The argument that the present arrangement of reviewing the IAEA's Transport Regulations is in line with the regulation review cycles of the international modal organizations does not convince me. The regulations of those organizations have to be revised frequently because there are constantly new non-radioactive dangerous goods with unfamiliar physical and chemical properties that have to be transported, whereas the basic physical and chemical properties of the radioactive materials being transported are well known, such that surprises are far less likely. In my view, when a review cycle has been completed and a revised edition of the IAEA's Transport Regulations has been published, a further review cycle should not be started before the practical results of previous revisions have been evaluated. If the Transport Regulations are going to be reviewed every two years in the future, I believe that there should be less intensive reviews, for which broad coordination is not necessary, and more intensive reviews, for which broad coordination is necessary, and that the more intensive reviews should not take place more frequently than once every 4 to 6 years.

C.N. YOUNG (United Kingdom): As indicated by Mr. Dicke, the first two-year review cycle has been completed, and I hope we shall not have to wait too long for the "as amended" version of IAEA Safety Standards Series No. TS-R-1. To those who consider the reviews to be too frequent, I would point out that, in the course of the second two-year review cycle, which is now under way, over 200 proposals have been made for changes, so there are obviously quite a few people who want to keep the Transport Regulations up to date.

I would add that last September the IAEA's General Conference expressed satisfaction with "the progress that has been made in establishing a schedule for regular reviews of the Agency's Transport Regulations with a view to issuing a revised or amended addition, as necessary, every two years, beginning in 2003, consistent with the schedules of the United Nations Committee of Experts on the Transport of Dangerous Goods and of the relevant international modal organizations."

Also, in TRANSSC, there is virtually unanimous support for reviewing the Transport Regulations on the basis of a two-year cycle. Perhaps those who consider the frequency of reviews to be too high should argue their case within TRANSSC.

J.A. ABOUCHAAR (IATA): I should like to endorse what Mr. Dicke said. A two-year review cycle does not mean that the IAEA's Transport Regulations have to be revised every two years. A two-year review cycle gives one greater flexibility than, say, a ten-year one, which brings with it very substantial changes requiring a great deal of retraining of personnel.

J.R. COOK (United States of America): While supporting the idea of a two-year review cycle, we believe that stability of the IAEA's Transport Regulations is important and consequently that proposed changes to them should, before being approved, undergo a risk and/or cost analysis.

M. CLAPPER (United States of America): From various presentations made here, it is clear that TranSAS missions increase the confidence of national regulatory bodies regarding the way in which they are carrying out their tasks and also the confidence of the public in the national regulatory bodies. We would like to see TranSAS being used to help countries that are experiencing rising levels of perceived risk associated with the transport of radioactive materials and/or where public confidence in the national regulatory bodies is declining. We would also like to see sufficient financial resources being provided for TranSAS.

W.L. WILKINSON (WNTI): Reverting to the question of the frequency of reviews of the IAEA's Transport Regulations, I would like to emphasize that the nuclear transport industry is firmly committed to implementing the approved changes to the Transport Regulations whatever the review frequency may be. There is a general feeling in the industry, however, that the frequency of reviews is rather too high. Radioactive material transport is not a rapidly developing science, certainly as far as nuclear fuel cycle material is concerned, and the first two-year review cycle resulted in only minor changes to the Transport Regulations. That having been said, I would add that a lot of valuable experience was gained from the first review cycle, which highlighted the need for closer cooperation between the nuclear transport industry and regulators, in order that they may learn from each other.

V.K. PARAMI (Philippines): With regard to paper IAEA-CN-101/78, I would like to emphasize that the Philippine regulatory structure for the safe transport of radioactive materials needs to be improved, especially with regard to the allocation of responsibilities between competent authorities on one hand and modal authorities on the other. The regular importation of radioactive material is limited to small amounts used in diagnostic and therapeutic medicine, industry, research and teaching. Large radioactive sources, like those used in irradiation for sterilization purposes, are very seldom imported into the country, but their importation requires the involvement of modal authorities. It is important that the suppliers of large radioactive sources make administrative and technical arrangements in advance for their transport into and within the Philippines, so that hassle and delays may be minimized if not totally eliminated.

C. PECOVER (United Kingdom): We found that receiving a TranSAS mission was a very worthwhile experience. The mission to the United Kingdom prompted us to review our practices and arrangements even before the mission started and to look at ourselves very critically. As a result, we identified overlaps and, more importantly, gaps in our system. We welcome TranSAS and hope that it will develop further.

N.C. BRUNO (Brazil): The title of this technical session is Effectiveness of the Regulatory Process. In my view, in order to be effective, the regulatory process must be independent. In that connection, I would recall that in IAEA Safety Standards Series No. GS-R-1, requirements for Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, it is stated that one of the requirements for the legislative and governmental mechanisms of States is that “a regulatory body shall be established and maintained which shall be effectively independent of organizations or bodies charged with the promotion of nuclear technologies or responsible for facilities or activities.”

C. PECOVER (United Kingdom): In supporting Mr. Bruno’s view that the regulatory process must be independent in order to be effective, I would add that, for the regulatory process to be independent, the regulatory body must be independent.

N.C. BRUNO (Brazil): I would recall that in IAEA Safety Standards Series No. GS-R-1 it is also stated that “the regulatory body shall issue guidance on the format and content of documents to be submitted by the operator in support of applications for authorization.” In that connection, I would also recall that, during the TranSAS mission to the United Kingdom, we on the TranSAS team concluded that the United Kingdom Department for Transport’s Guide to an Application for UK Competent Authority Approval of Radioactive Material in Transport (reference 6 in paper IAEA-CN-101/17) was an excellent document. As indicated by Mr. Young in paper IAEA-CN-101/30, the TranSAS team determined — in the “good practices” part of its report — that the Department for Transport’s Radioactive Materials Transport Division had for many years been providing prospective applicants with a document that contained guidance with regard to the information that was necessary in an application for approval.

C. PECOVER (United Kingdom): The guidance document that Mr. Bruno just referred to has been found by many applicants in the United Kingdom to be very useful. The United States Nuclear Regulatory Commission has produced a similar document. In addition to guidance documents for applicants, it would be useful to have a guidance document for competent authority assessors evaluating applications for approval of package designs, and in that connection I would note that one of the findings of Technical

Session 2, which I chaired, is “the request for a guidance document for Competent Authority assessors should be considered by the IAEA Secretariat and suitable material developed, if the need is confirmed.”

R.B. POPE (IAEA): Mr. Pecover’s latest intervention reminds me that it was recommended some time ago in TRANSSC that the Secretariat collect the guidance documents developed in IAEA Member States and make them available on request, it being recognized that such documents would be State-specific and not internationally approved. Because of insufficient resources, the Secretariat has not yet acted on that recommendation. With the recent advances in Internet technologies, however, it would now be possible for the Secretariat to simply link on its website to other website locations for specific guidance documents that a Member State suggests might be considered for application outside its national boundaries.

B. DROSTE (Germany): Further to what Mr. Pecover and Mr. Pope have just said, I would mention that Germany’s Federal Institute for Materials Research and Testing (BAM) and France’s Institute of Radiation Protection and Nuclear Safety (IRSN) are, under contract to the European Commission, assessing the approval and package design safety assessment methodologies being applied in the European Union Member States and applicant countries. From the assessment we should obtain information about existing guidance material that we can pass on to the IAEA Secretariat.

Technical Session 5

SUMMARY BY THE CHAIRPERSON

In the view of the Chairperson, the conference found that the IAEA Transport Regulations provide an excellent basis for the establishment of an effective regulatory process:

— There are Member States in which such a process needs to be put into practice. This may require empowerment of regulatory bodies. In other States, differences in interpretation by the competent authorities may result in delays and higher costs for international shipping.
— The industry can play a positive role in the improvement of the regulatory process, and transparency is a means to credibility with benefits to all parts.
— The nuclear transport industry is fully committed to meeting its obligations in this area and is working to ensure it meets all regulatory requirements.
— A standardized format and review process, including performance criteria for packaging, was presented and a Standard Review Plan developed on this basis was outlined.
— Regarding transport by sea, double hulls, reliable power systems, radiation shielding, cargo cooling and fire detection/fire fighting are all vital to ensure safety.
— In the event of an accident, an emergency response plan and notification of the nearest coastal State are crucial to avoid or mitigate consequences.

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ADEQUACY OF SAFETY REQUIREMENTS

(Technical Session 6)

Chairperson

J. DUFFY
Ireland

Rapporteur

B. DROSTE
Germany

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Technical Session 6

DISCUSSION

J.T. DUFFY (Ireland): When presenting paper IAEA-CN-101/95, the United States Nuclear Regulatory Commission's Package Performance Study for Spent Nuclear Fuel Transportation, Mr. Lewis said that over 200 written comments on the performance test protocols had been received from the public. In the abstract of the paper it is stated that "a public participatory process is being used to design and conduct this project." Is this the first time that the Nuclear Regulatory Commission is involving the public in such a study?

R.J. LEWIS (United States of America): It is the first time that we are involving the public so early.

B. DROSTE (Germany): The full-scale testing of transport casks has been carried out in Germany and Japan. What is the rationale for full-scale testing in the study described by Mr. Lewis?

R.J. LEWIS (United States of America): As stated in paper IAEA-CN-101/95, "some stakeholders have voiced concerns regarding...the lack of full-scale testing of SNF casks." In my view, full-scale testing is not necessary for certification by the competent authority. Again, as stated in paper IAEA-CN-101/95, the United States Nuclear Regulatory Commission (NRC) has certified SNF casks "using a combination of analyses and testing of scale models or cask components." It would probably call for full-scale testing if the cask design included exotic features, but, in the case of the study described by me in this paper, the NRC decided upon full-scale testing in order to meet the concerns of people about our ability to apply scaling laws.

E.W. BRACH (United States of America): In the opening session, the IAEA's Director General said that, despite the strong safety record and general good performance in the radioactive material transport area, some concerns remain. I think this session would be an excellent opportunity for people with concerns about the safety of radioactive material transport to present their views.

R.B. POPE (IAEA): The planned full-scale tests described by Mr. Lewis will result in very severe environments for the tested packages. I should like to ask Mr. Lewis whether the NRC has received any assurances or commitments from concerned stakeholders that, if the tests produce the results expected by the NRC, the stakeholders will not demand even more rigorous tests?

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

R.J. LEWIS (United States of America): We have not sought such assurances. Inevitably, some people will ask new questions and some will continue asking the same questions. However, we believe that the tests will lead to an increase in public confidence, although we shall not be able to measure it. There is a lot of evidence that the NRC's large investment in increasing public confidence is paying off. We have a good working relationship with stakeholders — both those who support the transport of spent nuclear fuel and those who oppose it. Many of them are beginning to believe in our dedication to public health and safety.

R.B. POPE (IAEA): Mr. Brach called for people with concerns about the safety of radioactive material transport to present their views at this session. In that connection, I noted that the problems identified in the papers summarized by Mr. van Aarle appeared not to be safety-related; for example, problems with UN numbers and the format of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR). If some here are concerned about technical inadequacies of the IAEA's Transport Regulations, I would like to request them to identify those inadequacies.

J.R.H. VAN AARLE (Switzerland): The problems identified were administrative, and they were identified only in paper IAEA-CN-101/85 by Mr. Malesys of COGEMA Logistics and colleagues. However, I suspect that they have been experienced by others.

The structure of IAEA Safety Standards Series No. TS-R-1 is fairly similar to that of the IAEA predecessor document, Safety Series No. 6, but the changes in the UN Orange Book due to the incorporation of TS-R-1 resulted in many changes to the ADR and Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) documents, with which many users are not familiar.

P. MALESYS (France): I would like to note that the UN number issue has not yet been resolved. Several proposals have been made for modifying the IAEA Transport Regulations to resolve this issue, but they have not yet been accepted.

B. DROSTE (Germany): Some time ago, a proposal was made to the IAEA regarding a coordinated research project on the evaluation of severe transport accidents, the aim being to bring together the results of past studies involving tests that went beyond regulatory requirements. What became of that proposal?

R.B. POPE (IAEA): In view of the very limited resources available to the Secretariat, in February 2003 TRANSSC recommended that the proposed project receive a low priority, until higher-priority tasks have been addressed.

N.C. BRUNO (Brazil): I should like to hear Mr. Lewis's views regarding the idea of an internationally accepted system for the review and licensing of package designs.

R.J. LEWIS (United States of America): We hope that the results of the NRC's package performance study will be useful for the entire world, and to that end we have had meetings with French, German and Japanese colleagues; in addition, we invited Mr. Pope of the IAEA to the first meeting on the scope of the study. This is a very expensive project and it will not be repeated, so we plan to make the results available to all.

For the international acceptance of package designs, considering the unilateral approval approach specific to the IAEA's Transport Regulations, I think it is important that each country retain the ability to evaluate packages in the light of its domestic situation, in order to adequately protect its population.

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Technical Session 6

SUMMARY BY THE CHAIRPERSON

In the view of the Chairperson, the conference found that:

— Additional training is required in certain disciplines, specifically those involving transport of radioactive material by air.
— Tests on uranium hexafluoride packages meet IAEA requirements.
— A methodology for validation and verification of safety of a C-Type container for air transport of fresh nuclear fuel has been developed.
— The designer of a package for the transport of radioactive material strives not only to meet the requirements of the Regulatory Tests but also to produce a package that is safe under all conceivable conditions.
— Based on transport risk studies, current regulations are sufficient to provide adequate protection of public health and safety during transport of radioactive material.
— Administrative procedures, training and control measures ensure minimum contamination levels connected with the transport of spent fuel.
— A well balanced regime of technical and administrative controls ensures the maximum benefit with minimum human hazard by the use of radioisotopes in medicine.
— Experience with implementation of the new modal regulations has been positive. However, sufficient time is needed to ensure the common implementation of new requirements and, in the case of industry, to provide for any necessary changes, including staff training, new design and/or approvals and updates of operating procedures.
— A careful examination of reports revealed that severe accidents were bounded by regulatory conditions.
— The test protocols of the US NRC package-performance study developed in a public participation process foresees fire tests and drop tests at 120 km/h with full scale spent nuclear fuel rail and road casks.

Concluding the discussions in this session, it was pointed out that:

— The use of full-scale casks in the tests being proposed by the United States of America is for the purpose of improving public confidence. For regulatory testing, other methods (model testing and/or calculations) are adequate.

— The results of current risk studies, e.g. on package performance, as well as results of other activities in extra-regulatory testing to demonstrate the high level of safety, should be consolidated.

IDENTIFYING AREAS FOR POTENTIAL IMPROVEMENT OF THE REGULATORY REGIME

(Panel 2)

Chairperson

F. NITSCHE
Germany

Co-Chairperson

P. BUBAR
United States of America

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Invited Paper

THE ROLE OF THE AIRLINE INDUSTRY IN THE CARRIAGE OF RADIOACTIVE MATERIAL, INCLUDING ISSUES THAT MAY BE IMPEDING TRANSPORT

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Abstract

Issues related to the refusal of some airlines and airports to accept shipments of radioactive material, especially those important to medical diagnoses and treatment and those of short half-life, are reviewed from the perspective of the airlines. Problems that have precluded resolution of these refusals are also outlined, and the factors that will need to be addressed before this problem can be resolved are summarized. Potential solutions are explored, where it is recommended that priority be given to training and education at both the government and the industry levels with a view to establishing trust in the existing regulatory system.

1. INTRODUCTION

One major goal of dangerous goods (DG) transport is to get the specially packaged, marked and labelled box or container to its destination without an incident. As long as the package and paperwork are right, it is easy to forget what specifically is being shipped. But with some DG, that oversimplification may obscure an entire spectrum of other critical issues.

2. THE ISSUES

With short half-life radioactive compounds for medical use, shippers, carriers and regulators have responsibilities extending far beyond safeguarding flight crews and handling staff. Such material must be specially packaged to safeguard passengers as well as transport workers. Once passenger and worker safety is ensured, it is crucial that the shipment be delivered to its destination in the timeliest fashion. Some radioactive material decays at 1% per hour; if waylaid for a day, its efficacy would decrease by 24%. Such products have a very short shelf life. Its “best before” date is usually the next day or within a few days. Beyond that date the product is useless because insufficient radioactivity is left to administer to a patient. Therefore, shippers of medical radioisotopes work hard to build a relationship with the carriers to track the shipments, resolve any issues and make deliveries in time.

Airlines and authorities balance end-user needs for radioactive medicine and the material’s short transport time-frame with what they deem to be the maximum allowable risk for DG transport by air.

The transport index (TI), defined in the Transport Regulations, is used by airlines to control radiation exposure to staff and members of the public. The required separation, segregation and maximum transport-index, both for individual packages and total packages, must all be observed. Transport-index limits are sometimes considered an obstacle to transporting medical radioisotopes by air on small aircraft. Other limiting factors include the infrequency of flights to some areas or the distance, and thus the amount of time of transport.

In the autumn of 2002, the IAEA was made aware that it was itself encountering difficulties in delivering radionuclide sources to Member States qualified to receive assistance under the IAEA’s technical co-operation programme. The sources were being rejected by airline companies, airline pilots and airport operators. The IAEA was also advised that a number of consignors of radionuclides for application in agriculture, industry, medicine, etc., were having difficulty in shipping their products by air, thus constraining the beneficial use of that material in particular areas.

This issue was raised and discussed at TRANSSSC VIII (February 2003). It was recognized that the IAEA Transport Safety Unit had been aware of this problem for some time, but had not been able to pursue a solution for a number of reasons including:

— the pilot in command of a commercial aircraft has the right to refuse the transport of any cargo or passenger on his aircraft;
— an operator (airline) has the option of refusing carriage of certain types of cargo (e.g. radioactive material), which had recently occurred with some air carriers;
— an operator (airline) may choose to impose specific and additional requirements before it will accept radioactive material consignments; and
— many airline pilots and other airline employees have insufficient knowledge of radioactive material consignments, and resulting fear may lead to refusal to handle or carry such cargo.

The above appears to indicate that radioactive material may be refused out of sheer ignorance, because involved personnel are not well informed on the subject and, therefore, fear the cargo. The obvious solution to such a problem would appear to be the development of awareness training for airline personnel to improve understanding of the issues associated with the transport of radioactive material.

The above point of view is based on the premise that the IAEA Transport Regulations have evolved from extensive efforts since 1961 and represent consensus between both the "regulators" and the "regulated". There can be no question of relaxing the requirements of the IAEA's transport regulations for IAEA activities. The IAEA requirements are binding on Members States worldwide for air and sea transport through the corresponding DG requirements of the relevant modal organizations:

— the International Civil Aviation Organization (ICAO) for the air mode, and
— the International Maritime Organization (IMO) for the maritime mode.

The requirements of the IAEA's Transport Regulations are also binding in Europe for land transport (rail, road and inland waterway) through the legally binding documents of the European Economic Commission.

It is, therefore, normal to assume that the solution to the problem raised lies in ensuring that those who are involved in the air transport of radioactive material (shippers, operators and competent authorities) fully understand how they can meet the requirements of the IAEA's Transport Regulations, and work together to ensure that radioactive material is transported to the places where their benefits can be put to the intended good use.

In preparation for the discussion on this problem at TRANSSSC VIII, the Dangerous Goods Board of the International Air Transport Association (IATA) discussed the issues relating to the denial of air shipments of radioactive material and several operators indicated that the major deterrent they faced in handling radioactive material was regulatory. Government policies differ from country to country and the lack of a single protocol for radioactive protection programmes created an onerous environment for the airlines. Since radioactive material is a small segment of the cargo traffic for airlines, the cost of implementing a radioactive protection programme is a further deterrent to that business, and several airlines accept only humane shipments such as radioactive isotopes destined for medical use.

The 44th edition (2003) of the IATA Dangerous Goods Regulations indicates that thirty countries have variations that impose stricter requirements on the carriage of DG by air. Of these thirty, nineteen — Belgium, Canada, Switzerland, Germany, Denmark, Egypt, France, United Kingdom, India, Islamic Republic of Iran, Italy, Japan, Malaysia, Netherlands, the Russian Federation, Saudi Arabia, Singapore, Ukraine and the United States of America — have variations further restricting the carriage of radioactive material. For example, a major country in Asia requires that an airline submit the transportation plan for each Type B(U) shipment one month in advance. The detailed requirements that they request are so stringent that most airlines have decided not to transport Type B(U) containers into that country.

Airlines that previously transported larger quantities of radioactive material have indicated that the lack of consistent requirements and paperwork from country to country affects their ability to keep their personnel adequately trained. Rather then risk penalty or fine, and the cost of onerous training, they have removed themselves from this business. In addition, within countries, the movement of radioactive material, both by land and air, is becoming more onerous. Airports are placing restrictions and conditions. Again, differing national requirements affect the carriage of radioactive material. For example, in several countries not only the carrier need comply with the ICAO Technical Instructions/IAEA requirements, but also whilst the consignment is on the ground, the environmental agency and the health and safety department may impose additional requirements. When radioactive material is carried, the airline is required to contract a radiological protection adviser and is also required to have radiological protection supervisors. This, together with the extra training required for their staff, is very costly to the airlines. Also to be considered is the risk of an incident and possible consequences when transporting radioactive material. Clean-up costs, possible sanctions (penalties) and public perceptions must be taken into account.

In the end, the following factors are taken into account by the airlines:

— revenue potential,
— cost of operation,
— training,
— incident handling,
— complexity and logistics,
— public perception.

Unfortunately, very often for the airlines, the reward (i.e. the revenue) does not match the risk, cost and effort required to carry radioactive material.

3. POTENTIAL SOLUTIONS

Possible remedial steps include:

— through the IAEA, educate and encourage fewer State-to-State variations;
— simplify requirements and standardize acceptance and paperwork issue;
— for low-activity level shipments, eliminate radioactivity protection programmes except where high volumes of radioactive materials are handled;
— formalize transport worker safety issues (handlers and loaders) in terms of exposure norms on a world-wide basis; and
— educate all shipping companies on the hazards of radioactive material.

The best precaution with respect to radioactive material is to gain a thorough understanding of the hazards from creation to destination. Effort may be needed to properly train pilots, crew and freight handlers to ensure they understand the bases upon which radioactive materials are transported, so that they more fully understand the risks posed and the steps that have been taken in the regulations to minimize those risks. Carriers and shippers alike would benefit from increased communication among all involved, from what the shippers expect or hope to achieve, to why the airlines may have chosen to restrict or eliminate carriage of radioactive material.

The last point is especially valid for flight personnel. An education outreach to the International Federation of Air Line Pilots' Associations (IFALPA) and its national chapters would help reduce refusals. Distrust is inherent when companies attempt to educate flight members, as their perception is that the airline company is driven by revenue at any cost and not principally by safety.

It has been suggested that individual shipments of medical radioactive material should somehow be classified differently in the regulations to facilitate their transport. Research in some countries on transport workers shows that, even though doses are all within acceptable limits, medical radioactive materials are no less a factor in exposure than other radioactive material.

4. CONCLUSION

It is clear that efficient transport of radioactive material by air is a key element in ensuring that these products can be used effectively in the various industries that rely on them, including healthcare. It is also clear that although several UN agencies are actively working towards harmonizing the DG regulations on radioactive material, considerable work remains to be done, particular in the area of transport and work-site safety.

The way forward is clear: training and education both at the government and industry levels are essential to ensuring increased harmonization of standards around the world. This training and education is necessary to ensure that the basis for the existing rules and regulations is well understood, so that the risks and hazards of radioactive material transport are properly and effectively managed. By establishing trust in the system of regulations for Class 7 material, we will ensure efficient and effective transportation of these essential industry products.

Panel 2

DISCUSSION

J.A. READ (Canada): With regard to paper CN-101-96 by Mr. Colgan — Too Many Placards? Do all Vehicles Carrying Radioactive Material Require a Placard? — I would point out that some shipments of non-radioactive dangerous goods have more potential for harm than some radioactive goods shipments of the same size. In this context, consider, say, a shipment containing smallpox or SARS virus, or a container with 100 litres of chlorine. Despite their great potential for harm, they are required to carry only a small safety mark (a label), whereas radioactive goods shipments are required to carry a large safety mark (a placard). In the United Nations system of safety marks (labels and placards), information is conveyed through shapes, colours, numbers, symbols and text. The size of the safety mark normally indicates only the quantity, with a small container carrying a label and a large container carrying a placard. Perhaps the IAEA's Transport Regulations are too onerous in requiring that containers of very small quantities of radioactive material carry a placard.

P.J. COLGAN (Australia): Mr. Read may well be right.

R.W. BROWN (United States of America): In the United States, "radioactive" placards are required only for Yellow-III packages. This has prompted shippers to improve the packaging and increase the radiation shielding of Yellow-III packages in order to have them classified as White-I or Yellow-II packages. The result has been lower radiation doses to transport workers.

J.-Y. RECULEAU (France): As we are considering ways of improving the regulatory regime, I would like to draw attention to a user-friendly feature of the International Civil Aviation Organization (ICAO) Technical Instructions: they contain, in the margins, indications of inclusions, deletions and other modifications made since the previous edition. Such indications in, first, the IAEA's Transport Regulations, second, the UN Orange Book and, third, the regulations of the international modal organizations (with the exception of ICAO, which is already doing it) would help translation services and the users of the modal regulations.

R. BOYLE (United States of America): The United States Department of Transportation recently completed a study regarding the advisability of removing placards from packages of hazardous material because of security concerns. The conclusion of the study was that the emergency-response benefits of placards outweigh the security risks associated with them.

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

I would like to confirm, as noted by Mr. Brown, that in the United States (as compared with what is required in the IAEA Transport Regulations), placards are not required for White-I or Yellow-II packages unless the shipment is under exclusive use.

One way of improving the regulatory regime would, in my view, be to make the package review guides, which have been issued for internal use in many countries, available internationally. Perhaps the Secretariat of the IAEA could request IAEA Member States to send it copies of their package review guides and publish the guides received in some appropriate form. The World Nuclear Transport Institute (WNTI) might be able to help in that connection.

Regarding problems with the acceptance of medical radioisotopes for shipment, displaying the pharmaceutical company name prominently on packages does not always convince carriers that the contents are for medical use. Would an additional "FOR MEDICAL USE" label help? The addition of such a label would not mean that the radiation protection requirements would not apply.

There has been talk about delays in the transport of radiopharmaceuticals due to security concerns following the events of 11 September 2001. There were such delays during a period of about a week immediately after 11 September — and in my view, they were justified —but I would be interested to know whether there have been any since. What unnecessary security precautions have been routinely encountered?

J.A. ABOUCHAAR (IATA): Regarding what Mr. Boyle just said about an additional "FOR MEDICAL USE" label, the idea is an interesting one and I shall bring it to the attention of International Air Transport Association (IATA) Dangerous Goods Board. However, such a label would have to be accepted for all modes of transport — not just by air transport — and by all States, since a carrier accepting a package may have to transport it through several countries and by more than one transport mode. Without general acceptance of the label, the carrier might still be deterred from accepting the package by the likely amount of hassle. Regarding what Mr. Boyle said about the United States Department of Transportation's security-related study, I would mention that IATA is discussing questions of safety versus security with the United Nations and ICAO. We have not changed our security arrangements, which are still in force.

R.W. BROWN (United States of America): A "FOR MEDICAL USE" label on the lines of that envisaged by Mr. Boyle would, in my view, be useful as far as package handlers are concerned, and many manufacturers of medical products do put such labels on their packages. However, it would still leave the problem of the rejection of packages containing radiopharmaceuticals by aircraft pilots because the accompanying documentation indicates that the packages contain radioactive material. I agree with Mr. Boyle that the delays in the transport of radiopharmaceuticals immediately after 11 September 2001 were justified. Regarding subsequent delays due to unnecessary security precautions, I recall two recent delays in the shipment of medical radionuclides from the Russian Federation to the United States of America: in one case, a consignment of strontium-82 was held at John F. Kennedy Airport, New York, for three days because the accompanying documentation did not meet new paperwork requirements that had been introduced only two days previously; in the other case, a consignment of palladium-103 was held at the same airport for two weeks, a long time relative to the half-life of that radionuclide (16.96 days), which underwent significant decay. In both cases, the delays were due not to the competent authority, either in the Russian Federation or in the USA, but to the United States Customs Service.

J.A. ABOUCHAAR (IATA): Further to what I, and then Mr. Brown, have said about labelling, I would mention that, for exempted non-radioactive dangerous goods, we have a label indicating that the aircraft captain does not have to be told about the presence of such goods. We designed a similar label for radioactive material, but, before adopting it, decided to check it with the IAEA's Secretariat, which, however, referred us to ICAO and the United Nations. ICAO referred us back to the IAEA Secretariat, and we are now in a vicious circle, with no decision taken yet on adoption of the label.

F. NITSCHE (Germany): I should like to express support for what Mr. Boyle said about the collection of States' package review guides by the IAEA's Secretariat.

W.A. WICKENS (Belgium): I am here on behalf of an international association, with member companies in more than twenty countries, that is involved with metals. We expect our member companies to have a responsible attitude towards the transport of the minerals that they use (minerals which they use for the extraction of metals other than uranium and thorium, but which can have low-specific-activity levels of uranium and thorium) and to comply with the governing regulations based upon the IAEA's Transport Regulations.

In that context, I should like to warn against over-regulation. As a result of the latest revisions of the Transport Regulations, many minerals have come to be classified as Class 7 dangerous goods although their activity levels are well below the accepted limits and pose no danger to workers or the public. In the background session, Mr. Pope said that such low activity materials pose no terrorist threat and in Technical Session 4, Mr. Stewart very rightly said, "If we regulate where there is no need to do so from a safety standpoint, we devalue the regulatory process, which is a problem for us all." The association that I represent would like its views in this matter to be taken into account when the Transport Regulations are being reviewed.

G.J. DICKE (IAEA): We are keen that such views be brought to the attention of the review panel that considers proposals for revising the Transport Regulations, which should be sent to us through IAEA Member States' competent authorities responsible for regulating the transport of radioactive material.

Y. NISHIWAKI (Austria): As the transport of medical radionuclides with very short half-lives is a problem, perhaps there should be more of a focus on the production of such radionuclides at hospitals.

M.S.T. PRICE (United Kingdom): Just how serious are the problems caused by delays in the shipment of medical radioisotopes?

R.W. BROWN (United States of America): To my knowledge, no one has ever died because of such delays. However, I know of many cases where diagnostic or therapeutic procedures have had to be postponed.

E.S. MARTELL (Canada): I propose that the IAEA's Secretariat convene a technical meeting on how to facilitate the shipment of medical radioisotopes and that it invite, among others, representatives of manufacturers and distributors, regulators, customs officials, and representatives of transport organizations to the meeting.

J.A. ABOUCHAAR (IATA): I support that proposal.

I.R. GIBBS (Australia): I also support that proposal. Regarding what Mr. Boyle said about labelling, I would mention that all packages with medical products dispatched by the Australian Nuclear Science and Technology Organization (ANSTO) carry an indication, in fairly large letters, that they contain urgently needed medical products. Nevertheless, carriers have sometimes rejected such packages. ANSTO discusses such problems with QANTAS, Australia's only national air carrier, which is receptive to ANSTO's suggestions. However, ANSTO has no influence over the twenty to thirty non-Australian carriers with aircraft flying into and out of Australia.

F. NITSCHE (Germany): Clearly, there are substantial problems associated with the transport of radiopharmaceuticals by air. However, as indicated in paper CN-101-102 by Mr. Horner and Mr. Yates, such problems can be solved in specific cases. Finding general solutions will probably have to be a step-wise process. Perhaps a technical meeting of the kind proposed by Mr. Martell would be a good start.

R.B. POPE (IAEA): The IAEA's Secretariat will give Mr. Martell's proposal serious consideration.

J.T. STEWART (United Kingdom): In a recent survey by our National Radiological Protection Board, many air carriers stated that they carry only medical products, so no one should be interested in their activities. For example, in the United Kingdom air transport industry, there is obviously already an understanding that some products are “medical” and beneficial. Would changes in labelling requirements affect the willingness of some carriers to carry radiopharmaceuticals? Possibly. Perhaps we should consider that as an option.

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Panel 2

SUMMARY BY THE CHAIRPERSON

Many of the papers submitted for this session found that the current regulations provide a high level of safety and are "implementable" for Member States and industry. However, the developers of the regulations should consider the need for additional flexibility in light of their applicability. Some participants recognized that a "one size fits all" approach can be unnecessarily burdensome when applied to particular applications. On the other hand, a high degree of stability of the regulations is needed to facilitate implementation.

An area that received much attention in contributed papers was the increasing frequency of use of radioactive material for medical use including lifesaving applications requiring urgent transport. The current regulatory system provides adequate safety, but does not include special provisions to promote the rapid distribution of medical isotopes when warranted. In this regard, the discussion showed that there is a need for improved and more specific communication among all parties involved. Primarily, dialogue is necessary between the consignors and carriers and dialogue is necessary with the authorities and organizations at the national as well as international levels.

Specific recommendations were made for improvement related to a continued dialogue on the regulatory review process at the international level with a view to ensuring that the process remains robust and consistent. As stated above, we want to ensure there is enough flexibility for implementation, but also sufficient stability. Multiple papers stressed the need for the consistent and timely application of IAEA regulations by Member States. Separate treatment of transport of radioactive materials for the medical industry may be warranted.

In summary, a good regime is in place through the IAEA Review and Revision Process that addresses safety of transport of material adequately. But, in relation to shipment of radioactive material for medical application, there is a need for more communication between consignors, carriers and regulators. The dialogue after the panel presentations resulted in a recommendation that the IAEA convene a discussion with the relevant entities (which may include IMO, ICAO, IATA, shipping companies and Member States) to address the issues of communication and cooperation in that particular area.

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EMERGENCY PREPAREDNESS AND RESPONSE

(Technical Session 7)

Chairperson

J. TURNBULL
New Zealand

Rapporteur

M. MILLER
United Kingdom

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Technical Session 7

DISCUSSION

E.J. MORGAN-WARREN (United Kingdom): With regard to my paper CN-101-109, Emergency Arrangements for Civil Transport of Radioactive Materials in Great Britain: The Regulatory Framework, I would emphasize that, in the United Kingdom, the consignor has a duty to ensure that arrangements are in place for responding to an emergency; governmental departments, for their part, need to ensure that the public is informed and protected. Accordingly, the transport industry in the United Kingdom has established a nation-wide response scheme, RADSAFE, to which the major consignors subscribe.

For protection of the public, National Arrangements for Incidents Involving Radioactivity (NAIR) have been set up. NAIR, which is coordinated by the National Radiological Protection Board, would provide defence in depth — helping the police to protect the public — in the event of failure of RADSAFE for any reason.

I. RAHIM (IMO): In his presentation of paper CN-101-116, Mr. Ugletveit said that the most serious accidents are those during maritime transport. In agreeing with him, I would note that maritime transport accidents are due mainly to non-compliance with the relevant international conventions and codes. Also, I agree with him that States and the relevant international organizations should work together on tightening up the existing requirements or on formulating new ones.

V. McCLELLAND (United States of America): Emergency preparedness and response programmes worldwide could be strengthened through the more effective implementation of the Early Notification Convention and the Assistance Convention, through greater State involvement and through effective utilization of the IAEA's emergency preparedness and response arrangements.

Norway has been a strong advocate of the enhancement of nuclear emergency preparedness and response arrangements worldwide, and the USA — together with France, Germany, Japan, the United Kingdom and many other countries — is supporting Norway through very active involvement in the work of the national competent authorities' coordination group established for the purpose of improving implementation of the Early Notification Convention and the Assistance Convention. The national competent authorities'

Note: The contributed papers cited here can be found on the CD-ROM that accompanies this volume.

coordination group has set up a communications working group and an assistance working group that are already doing a great deal to improve radiological emergency preparedness worldwide.

Emergency preparedness and response arrangements are effective if they enable one to respond at any time to any situation that threatens worker and public health and safety and the environment. That means that the underlying programmes must be properly organized, documented, staffed, equipped and funded, and they must be tested through drills and exercises. The lessons learned from drills and exercises — and also from actual incidents — provide a basis for the continuing enhancement of emergency preparedness and response programmes.

The Early Notification Convention and the Assistance Convention are vehicles for addressing emergency preparedness and response issues, but only eighty-four and eight States, respectively, are party to them. I should like to see greater involvement in the implementation of emergency programmes worldwide through broader adherence to these two conventions.

B. BRIDGE (New Zealand): In presenting paper CN-101-112, Mr. Fox mentioned a BNFL manual with data on landing sites suitable for use by helicopter. If an incident occurred near New Zealand, I would imagine that landing sites in New Zealand would be important, but to the best of my knowledge none of our authorities were involved in the compilation of that manual.

Mr. Fox mentioned an emergency response team in the United Kingdom permanently ready to respond worldwide. However, it would take the team some 36 hours to reach the scene of an incident in our region, the South Pacific, and our Government could not be expected to do nothing pending the team's arrival.

In addition, Mr. Fox mentioned equipment for use in emergencies that is held in Europe and Japan. However, even Japan is 10 to 12 hours in flight time from the South Pacific region.

The point I wish to make is that effective emergency response is impossible without information sharing and cooperation with coastal States, especially in regions like the South Pacific.

I have real problems with the statement in paper CN-101-112 that "the provision of such emergency arrangements ensures that the carrier is not reliant upon the assistance and the preparedness of the nearest State and therefore prior notification should not be an issue." We in the coastal States know our regions, and we believe that prior notification is important for enabling coastal States to ensure that their contribution to any emergency response is optimal. However, the issue is not just prior notification. It is also involvement in the general planning for emergencies. In paper CN-101-116, presented by Mr. Ugletveit, it is stated that “increased international cooperation, especially regarding coordinated accident emergency planning...is of prime importance.” We agree with that statement, and we believe a lot of work still has to be done in the emergency response planning area.

M. FOX (United Kingdom): Regarding the helicopter landing-site manual just referred to by Ms. Bridge, I apologize for not having made it clear that it covers only landing sites in the United Kingdom for use for getting response personnel to the nearest airport and onto the earliest long-haul flight. Regarding the time needed by the emergency response team in order to reach the scene of an incident, the initial — immediate — response measures would be taken by the crew of the PNTL vessel, who have undergone training in fire-fighting, basic health physics and so on.

As for strategically located equipment for use in emergencies, each PNTL vessel has equipment with which the crew and the emergency response team sent by BNFL — or one sent by a coastal State — could mitigate the consequences of an incident. In that connection, I would emphasize that we would never turn away help offered by any State; we would draw on it in implementing our emergency management arrangements.

M. MILLER (United Kingdom): I would add that each PNTL vessel carries a shipboard marine emergency plan that requires the captain to contact the nearest coastal State immediately in the event of an incident, nuclear or conventional.

P. BRAZEL (Ireland): I should like to associate myself with much of what Mr. Ugletveit said in presenting paper CN-101-116. We have heard this week how, through the efforts of the IAEA, the risk inherent in the marine and other transport of radioactive material is being reduced to low levels on the basis of knowledge regarding that risk which is generated by research and other activities. Emergency preparedness must also be based on knowledge regarding the risk, however small this may be, and part of that knowledge should come, in the view of coastal States, from prior notification. Coastal States need to know what the risk is in order to comply with their international obligations in respect of, for example, search and rescue and, most importantly, in order — as sovereign States — to represent and protect the interests of their citizens.

This week we have also heard about the considerable efforts of States involved in the internal transport of radioactive material to inform their own citizens in detail about what is taking place. Such efforts are now universally regarded as necessary. That being so, is it tenable that the citizens of a coastal state should not be informed in a similar manner about what a shipping State — perhaps nearby — is doing with radioactive material in the sea close to their country. In my view, the citizens of the coastal State should receive, through their government, the information necessary in order to make effective emergency preparedness arrangements, in the same way that the citizens of a State involved in the internal transport of radioactive material are provided with detailed information.

M. MILLER (United Kingdom): When shipping radioactive material, we in the nuclear industry have to comply both with requirements of the International Maritime Organization and with the IAEA's Transport Regulations. Also, before the start of a maritime transport operation we have to obtain approvals from competent authorities in the flag State, the departure State, and the arrival state. To the countries that will be passed by the shipment, we send representatives who talk with governmental departments, the media and the general public about, for example, the types of material being transported, the radioactivity levels, the package types and the vessel. We devote a lot of effort to disseminating information about our maritime transport operations.

F. UGLETVEIT (Norway): In my view, in the interests of effective emergency response, we should assess the feasibility of establishing a reliable mechanism for the prior notification of maritime shipments of radioactive material that will pass close to a coastline.

C. AZURÍN ARAUJO (Peru): Most regulations relating to radiological emergencies were established in the light of experience in dealing with incidents and accidents at land-based nuclear facilities, some of them with transboundary consequences, where there was reasonable clarity as regards competence and jurisdiction. In the case of incidents and accidents at sea, there is far less clarity. Consequently, I should like to see the IAEA Secretariat carrying out a survey of the ability of States to respond to incidents and accidents during the maritime transport of radioactive material. In the course of such a survey, it might organize an international emergency exercise involving coastal and shipping States in order to test, inter alia, emergency arrangements and channels of communication with competent authorities and to ascertain the usefulness of prior notification.

I should like to encourage States to make greater use of the IAEA Secretariat's EVTRAM database for exchanging information about events occurring during the transport of radioactive material.

H. TANI (Japan): The International Maritime Organization (IMO) INF Code, which is mandatory pursuant to the SOLAS Convention, requires every vessel with INF cargo to carry a shipboard emergency plan that has been approved by the flag State on the basis of guidelines issued by the IMO. Thus, we already have clear emergency preparedness regulations relating to INF cargo at sea.

A.C. HEINRICH (United States of America): Regarding emergency management, I should like to make two points. First, the emergency management programme of a country must be responsive to all foreseeable emergencies in that country, it is simply not prudent to “select out” a particular hazard. Second, emergency management programmes must be rapidly responsive 24 hours a day.

Regarding communication with the public, there is a gap between factual information and public perception, and it is incumbent on those of us who are governmental representatives to help close that gap. Some of the papers contributed for this and other sessions were very encouraging in this connection.

A. HART (Peru): On behalf of the members of the Permanent Commission for the Southeast Pacific (Chile, Colombia, Ecuador, Panama and Peru), I should like to express support for what Mr. Ugletveit said when presenting paper CN-101-116. We recognize that shippers and the nuclear industry have sound plans for honouring their own responsibilities in the event of an emergency. However, we believe that the nuclear industry and the IAEA should assist coastal States with the development of emergency response plans, which should lead to the improvement of regional response capabilities, the implementation of which requires special training. In our view, there is a direct link between emergency response, liability and the prior notification of governments and regional authorities.

V.N. ERSHOV (Russian Federation): In paper CN-101-108, Emergency Response in the Field of the Transport of Radioactive Material in Germany, reference is made to emergency response intervention cards (ERICs). In the Russian Federation, we have such cards for road, rail, and air transport. Are ERICs used for all three transport modes in European Union countries?

C. FASTEN (Germany): No, they are used only for road transport.

V.N. ERSHOV (Russian Federation): The last sentence in paper CN-101-108 reads, “After the completion of all class 7 ERICs within the involved European countries, it is planned to submit them to the International Atomic Energy Agency for implementation into the TS-G-1.2[1].” Does that mean incorporation into the IAEA’s Transport Regulations? Perhaps ERICs for worldwide — not just European — use could be developed under the auspices of the IAEA.

C. FASTEN (Germany): That is a very interesting idea.

C.N. YOUNG (United Kingdom): When presenting paper CN-101-116, Mr. Ugletveit seemed to be suggesting that prior notification of relevant coastal

[1] Editor’s note: TS-G-1.2 referred to here is the IAEA Safety Standards Series, Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material – Safety Guide, No. TS-G-1.2 (ST-3), which was issued by the IAEA in 2002.

States regarding shipments of nuclear material was necessary. In that connection, I would note that Mr. Malesys concluded from an analysis of several contributed papers that prior notification regarding particular shipments was not a prerequisite for having appropriate emergency response arrangements in place.

F. UGLETVEIT (Norway): As just indicated, we are not calling for the establishment of a prior notification mechanism, merely for an assessment of the feasibility of establishing such a mechanism.

C.N. YOUNG (United Kingdom): Does Mr. Ugletveit believe that advance notification should be given for shipments of oil, liquid petroleum gas, chemicals and explosives?

F. UGLETVEIT (Norway): The diplomatic answer to that question is that such shipments do not fall within my field of responsibility.

M. CRICK (IAEA): The IAEA Secretariat advocates comprehensive emergency management of the kind described in paper CN-101-111 presented by Mr. Fox, and we are looking into how it might be implemented at the international level.

Regarding public information, in the event of an incident involving a vessel with INF cargo in the South Pacific, a CNN team would probably be on the scene before the emergency response team from the United Kingdom, commenting on the lack of coordination which it is witnessing. The lack of coordination might well be due, in part, to the fact that the nearby coastal States had not been involved in the shipment planning process. That does not necessarily mean that there should have been prior notification of the shipment. In my view, it is more important that coastal States know what kinds of shipment are taking place so that they can provide authoritative information to their media regarding specific situations that arise. To that end, coastal States must themselves be provided with authoritative information. Mechanisms for providing coastal states with authoritative information exist, created by international conventions. We need to make them work better.

J.T. STEWART (United Kingdom): Some States are calling for prior notification in the interests of more effective emergency response. In that connection, I would note that most emergencies connected with radioactive material transport result from road accidents. In the United Kingdom, prior notification plays no part in the response to such emergencies. Planning and preparedness are the key to effective emergency response, not the submission of prior notifications to civil servants like me. We would be interested to hear of any cases where the prior notification of shipments and their tracking by governments have led to improved emergency response.

Regarding the IAEA Secretariat's EVTRAM database, to which the General Conference of the IAEA has invited IAEA Member States to provide reports, we are committed to supporting EVTRAM and I was pleased to hear Ms. Azurín Araujo expressing support for it.

H.J. NEAU (France): In my opinion, the question of prior notification relates to the implementation of UNCLOS and should, therefore, be discussed within the framework of the International Maritime Organization rather than that of the IAEA.

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Technical Session 7

SUMMARY BY THE CHAIRPERSON

In the view of the Chairperson, the conference found that IAEA guidance provides a framework for a comprehensive strategy for anticipating and dealing with transport accidents involving radioactive material.

The IAEA Transport Regulations recognize the need for relevant national and international organizations to establish and implement emergency provisions to prepare for transport accidents involving real or envisaged radioactive release.

The IAEA guidance recognizes differences between the potential consequences of road, rail, ship and air transport accidents and recommends a "command and control" mode to ensure that coordination, direction and communication strategies are properly employed.

The national infrastructure for emergency response must anticipate a range of accident scenarios and ensure that human resources, equipment, medical response, remediation and waste storage are made available and capacity is maintained.

Training of emergency response personnel is seen as a critical component of the programme that must be maintained, especially through the means of frequent practical courses and simulations.

A further key element of emergency response planning is to recognize the importance of confidence building, especially within government, with the public, media and all other potentially affected parties.

Progressive movement in terms of the sophistication of emergency response capability was discussed, with recognition given to a need to develop more integrated international emergency response plans, including integration of national resources information sharing, and mutual capability building.

In the view of the Chairperson, the conference also found that additional dialogue is warranted to improve overall international emergency response capability, especially with respect to potential maritime incidents; coordinated management between agencies and governments, accident notification, communication, environmental monitoring and salvage/remediation issues were especially considered.

The conference observed that multiple applicable documents and conventions exist that do not necessarily clarify the roles of States with respect to leadership in the management of an incident in international waters. It was further noted that affected parties might include consignor, carrier, shipping state, State of vessel registry and the nearest State(s) to the location of the incident. The possible involvement of multiple entities was considered to be a source of possible confusion and a hindrance to an effective response initiative.

It was noted that response capability varies considerably among States. If States are to develop an improved local emergency response capability, access to external assistance may be required.

It was further noted that while some States or organizations felt that they could support a global emergency response initiative, others did not accept this. It was concluded by all that further discussion was required between States in order to develop an international response capability and that this should become part of an integrated global emergency response capability.

It was also noted that issues of prior notification and informal information sharing for planning purposes were useful in managing emergency response plans, especially with respect to communication.

Finally, it was concluded that the IAEA had a vital role to play in facilitating the development of model plans for international emergency response and to facilitate the development of regional plans that satisfy the concerns and needs of States within regions.

CLOSING SESSION

Chairperson

M.W. HUGHES
Australia

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PRESIDENT'S CLOSING STATEMENT TO THE CONFERENCE

M.W. Hughes
Ambassador,
Permanent Mission of Australia to the IAEA

In his opening address, the Director General of the IAEA outlined some of the history of this topic and the background to this conference. I do not intend to repeat that account, but simply to recall that efforts by the international community to harmonize international practices for the safe transport of radioactive material have a history going back four or five decades. Over that period, the IAEA's Regulations for the Safe Transport of Radioactive Material, in their various editions, have played a central role. In more recent years, the IAEA General Conference has been a major forum for debating transport safety issues. It is, therefore, fitting that the IAEA has taken the lead in organizing this conference.

The level of participation — well over 500 nominated participants from 82 States and 14 organizations — is a clear indication of the level of interest, and the lively discussions during the week have confirmed this. The objective of the conference was to foster the exchange of information on critical issues relating to the safety of transport of radioactive material and to formulate findings based on the papers contributed and the discussions held, and we have certainly achieved that.

The transport of radioactive material is essential for a very wide range of beneficial uses: the generation of electricity and many industrial, medical and other applications. It will, therefore, be accepted providing people are confident that it is safe. Historically, the safety record of radioactive material transport is excellent, and all parties involved should continue to cooperate to ensure that this excellent record is maintained. Nevertheless, many people continue to be concerned. The high level of confidence that is needed for widespread acceptance depends on convincing people that the transport of radioactive material is subject to rigorous safety requirements and that those requirements are always complied with.

There was broad agreement among participants that the IAEA Transport Regulations, and the regulations of the modal organizations based on those regulations, provide a sound technical basis for the safe transport of radioactive material. There is room for improvement of the regulations in a number of technical areas, and the detailed issues involved — and discussed during this conference — should continue to be pursued by the relevant organizations, with due account of the need to balance the benefits of flexibility and continuing improvement against those of regulatory stability. In particular, we want to be sure that the regulations can readily be applied to all the types of radioactive material that might need to be transported, while leaving some flexibility in the handling of some materials, such as urgent medical supplies. This means making sure not only that the regulations are applicable to all these types of material and are as simple to apply as possible, but also that those who have to apply the regulations have sufficient guidance to be able to apply them correctly. The detailed findings from the technical sessions indicated some areas in which such guidance might be particularly desirable, and, in most cases, the IAEA would be an appropriate body to provide it.

There remains the challenge of extending the broad agreement that the regulations provide a good basis for safety beyond the conference room: to convince all those involved in the transport of radioactive material and also the wider public that the regulations provide effectively for their safety.

The larger issue in relation to the regulations is that of compliance. The regulations are already very widely applied, but the goal must be to reach a situation in which they are applied consistently by all States to all transports of all types of radioactive material, and furthermore are *seen* to be applied consistently to all transports. In this regard, the conference findings emphasized the importance of rigorous compliance assurance and quality assurance, and noted the value of the IAEA's TranSAS service as a tool both for promoting and for demonstrating compliance with the regulations.

Looking beyond the technical findings, there are clearly issues on which real differences of opinion remain, notably those of comprehensive adherence to a global liability regime and certain aspects of communication between governments. These issues can be resolved only through dialogue, and the conference provided a valuable opportunity for such dialogue. But complex legal issues are involved, and it is unrealistic to expect their resolution during a weeklong conference. Although progress has been made, the dialogue needs to continue, and the IAEA should continue to promote it. I would like to acknowledge the willingness of States with different positions on these issues to work together constructively in defining possible ways forward with a view to enhancing communication and understanding. I hope that this will open avenues to better cooperation by all concerned in addressing these issues.

In my opening address, I said that we would be judged on the basis of whether we had used the opportunity of this major conference to build on the new consensus embodied in last year's General Conference resolution regarding transport, on new communication initiatives and on the growing interest in TranSAS missions. You have responded very positively to the challenge to undertake a thorough review of the regulatory and technical issues on the agenda, to maximize discussion, and to seek dialogue and communication where differences exist.

The summary and findings of the conference are evidence of achievement and, in some cases, identify the way ahead on difficult issues. Thank you for your good work this week.

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