Australian Government

Ansto

The Safety and Security of Radioactive Sources: past, present and future

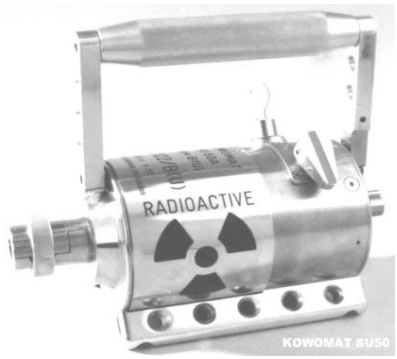
Steve McIntosh

Used worldwide for peaceful purposes

Medical teletherapy

Sterilization & food preservation

Radioisotope thermoelectric generators



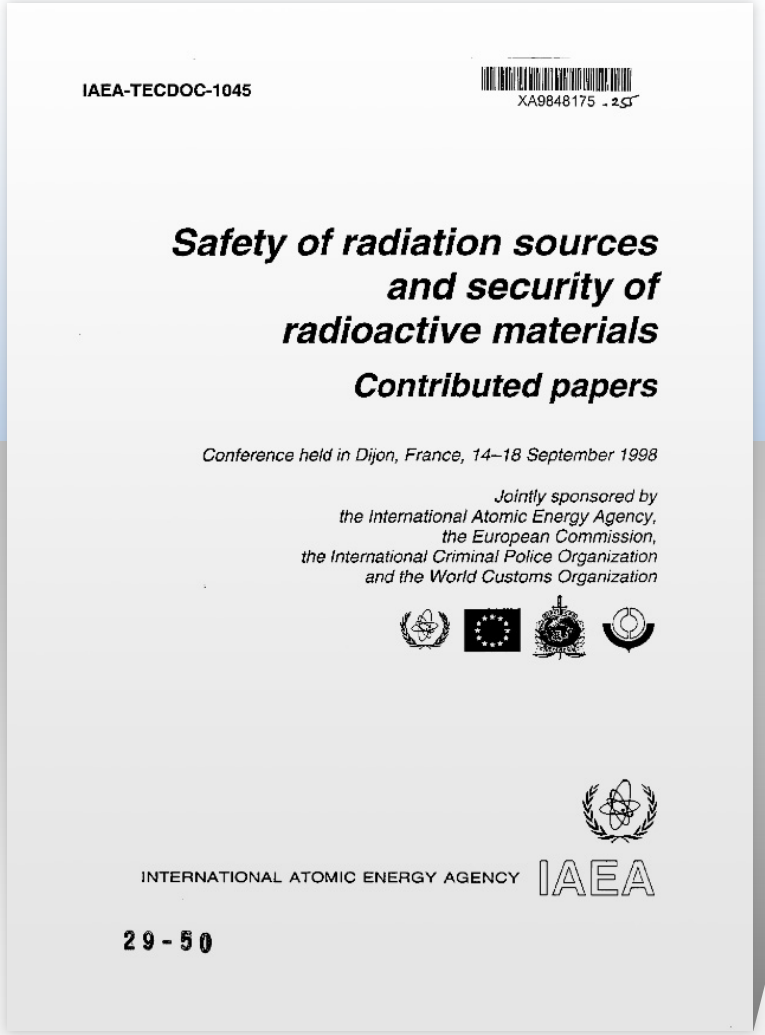
Industrial radiography

Australian Government

Part I – History of the Code

History

1998



IAEA-TECDOC-1045

XA9848175

Safety of radiation sources and security of radioactive materials

Contributed papers

Conference held in Dijon, France, 14–18 September 1998

Jointly sponsored by
the International Atomic Energy Agency,
the European Commission,
the International Criminal Police Organization
and the World Customs Organization

INTERNATIONAL ATOMIC ENERGY AGENCY IAEA

29-50

International undertakings: Action

B

GOV/2001/3
12 February 2001

International Atomic Energy Agency
BOARD OF GOVERNORS

RESTRICTED Distr.
Original: ENGLISH

For official use only

ACTION PLAN FOR THE SAFETY OF RADIATION SOURCES AND THE SECURITY OF RADIOACTIVE MATERIALS

THE INTERNATIONAL CONFERENCE OF NATIONAL REGULATORY AUTHORITIES WITH COMPETENCE IN THE SAFETY OF RADIATION SOURCES AND THE SECURITY OF RADIOACTIVE MATERIALS: IMPLICATIONS OF ITS MAJOR FINDINGS FOR THE ACTION PLAN

BACKGROUND

1. In September 1998, following an assessment of the major findings of the first International Conference on the Safety of Radiation Sources and the Security of Radioactive Materials, held in Dijon, France, from 14 to 18 September 1998 (the Dijon Conference), the Agency's General Conference (in resolution GC(42)/RES/12) - inter alia - encouraged all governments "*to take steps to ensure the existence within their territories of effective national systems of control for ensuring the safety of radiation sources and the security of radioactive materials*" and requested the Secretariat "*to prepare for the consideration of the Board of Governors a report on:*

(i) how national systems for ensuring the safety of radiation sources and the security of radioactive materials can be operated at a high level of effectiveness and

(ii) whether international undertakings concerned with the effective operation of such systems and attracting broad adherence could be formulated".

2. In February 1999, the Secretariat submitted to the Board a report prepared in response to

International undertakings: Code of conduct

Code of Conduct on the Safety and Security of Radioactive Sources

The IAEA's Member States

Noting that radiation sources are used throughout the world for a wide variety of beneficial purposes, e.g. in industry, medicine, research, agriculture and education,

Aware that their use involves risks due to radiation exposure,

Aware that these risks must be restricted and protected against through the application of appropriate radiation safety standards,

Aware that there have been a number of accidents with serious, even fatal, consequences during the use of radiation sources,

Recognizing that such accidents may have an adverse impact on individuals and on the environment,

Recognizing the importance of fostering a safety culture in all organizations and among all individuals engaged in the regulatory control or in the management of radiation sources,

Recognizing the need for effective and continuous regulatory control, both within States and in situations involving the transfer of radiation sources between States,

Noting that serious accidents have occurred during the use of radiation sources, in particular radioactive sources, as a result of ineffective, or lapses in the continuity of, regulatory control, or as a result of lapses in management control during extended periods of storage,

Recognizing that most of these accidents have been caused by the use of radioactive sources, including accidents involving orphan sources,

Recognizing that a number of States may lack appropriate infrastructure for the safe management of radioactive sources, and that consequently exporting States should take due care in authorizing exports,

Objective:

“To achieve and maintain a high level of safety and security of radioactive sources through the development, harmonization and enforcement of national policies, laws and regulations and through the fostering of international co-operation.”

2000 Code - security

- Range of provisions of 2000 Code were relevant to maintaining control over sources
- Some of those provisions explicitly referred to needs of “security”
- Focus very much on incidents such as persons stealing shiny objects for scrap metal resale
- No consideration given at that time to possible use of sources in RDDs

2000: Actions by Agency's governing bodies

Security environment following the events of September 11, 2001

- Radioactive sources, primarily a safety concern in past, now considered a security risk
- A “dirty bomb” could
  - incite widespread panic
  - cause illness and increase cancer risk
  - contaminate large areas
  - result in evacuations
  - severely disrupt the economy
- Shift in international nuclear security efforts to include radioactive materials

Radiological security gains attention

Nuclear experts warned lawmakers that American cities are not prepared to deal with the impact of radiological weapons, or "dirty bombs." (ABCNEWS.com)

Weapons of ‘Mass Disruption’

Experts Warn Lawmakers of Vulnerability to 'Dirty Bombs'

W A S H I N G T O N, March 6 — Nuclear experts told Congress today that terrorists are not just interested in weapons of mass destruction they are also seeking weapons of mass disruption — weapons, that might kill no one but would create widespread psychological trauma.

In testimony before the Senate Foreign Relations Committee, the

abcNEWS.com

Widespread vulnerable and orphan sources

Past radiological incidents

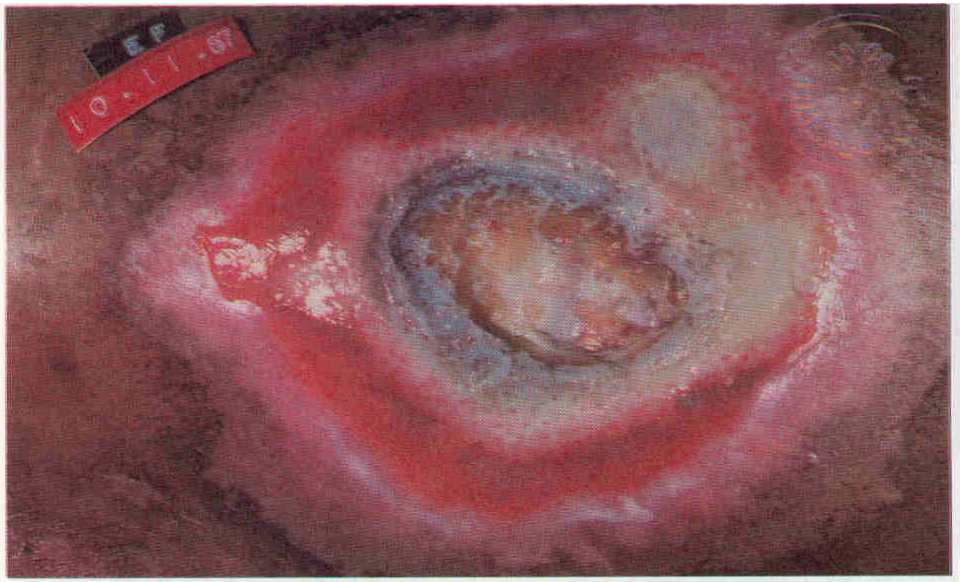
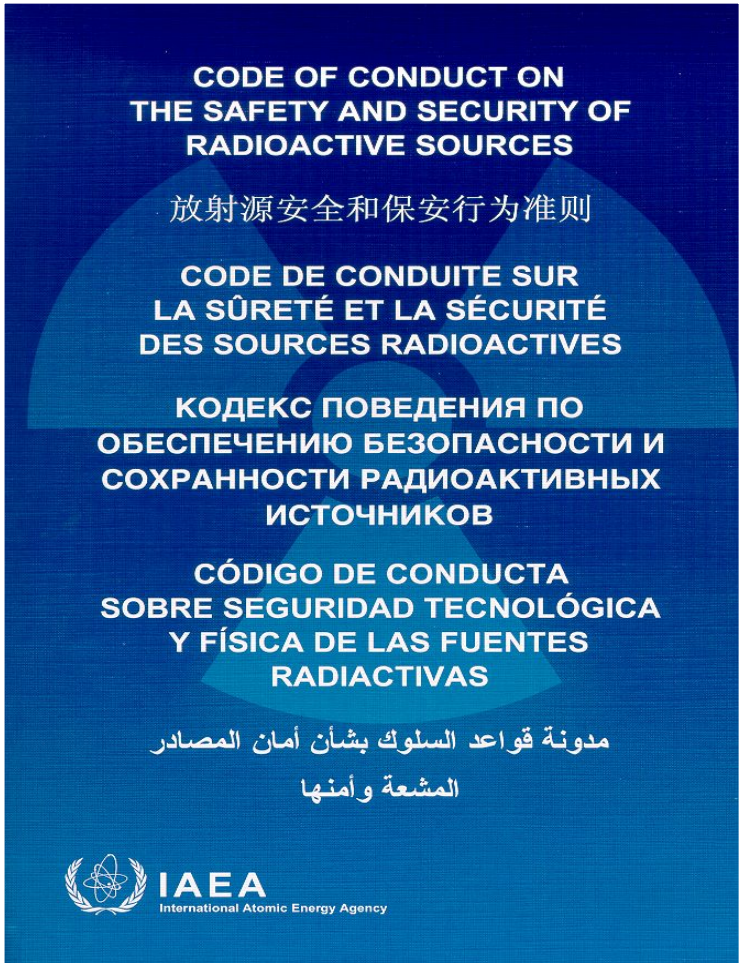


FIG.9.4. Detailed view of the bed of an deep ulcer after partial resection. The blackening of surrounding tissue, fat necrosis and skin suffering are clear indications of poor evolution of this injury.

Improving international standards

- In 2002-2003, the IAEA carried out a number of technical meetings to revise the Code of Conduct to more adequately address security concerns
- Code contains non-legally binding guidance for life-cycle control of radioactive sources
- Revised Code was approved by IAEA Board of Governors in 2003 and published in 2004.



The IAEA Code of Conduct on the Safety and Security of Radioactive Sources

National regulatory infrastructures that specify requirements for:

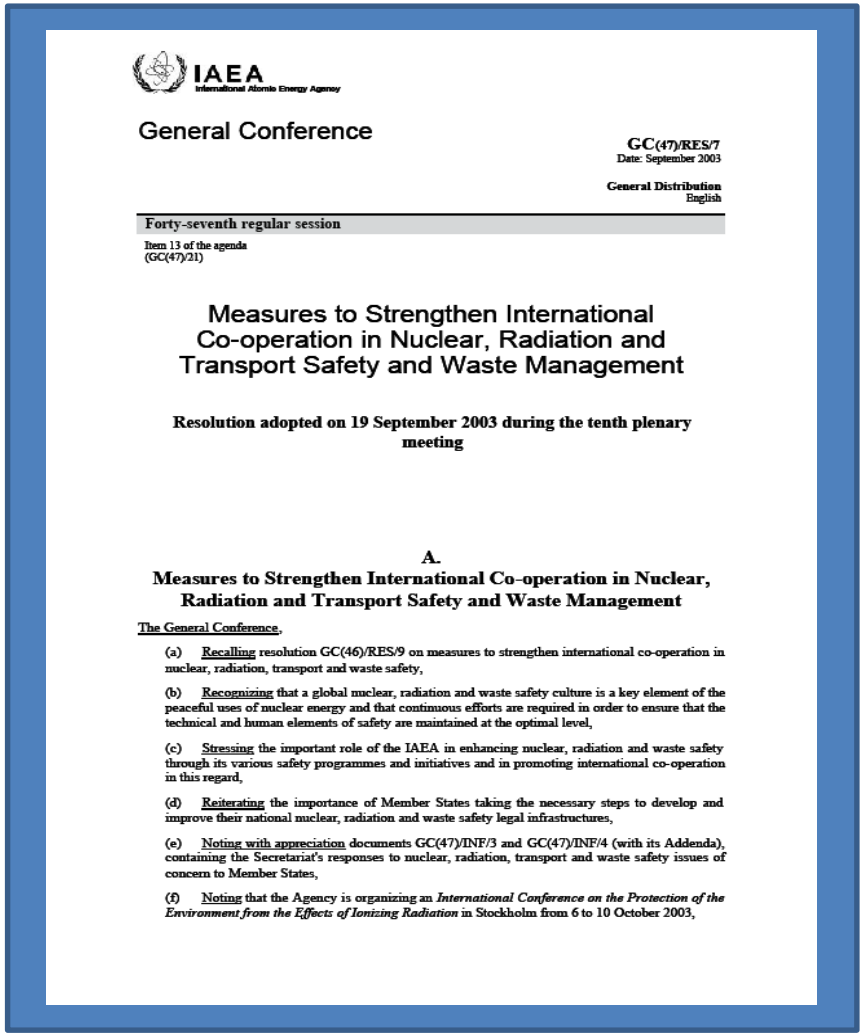
- physical protection of materials
- access controls
- national registries
- training
- notification requirements
- orphan source recovery
- import/export guidelines
- emergency planning
- inspections / enforcement

TABLE I. ACTIVITIES CORRESPONDING TO THRESHOLDS OF CATEGORIES

Radionuclide	Category 1		Category 2		Category 3	
	1000 x D		10 x D		D	
	(TBq)	(Ci)*	(TBq)	(Ci)*	(TBq)	(Ci)*
Am-241	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Am-241/Be	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Cf-252	2.E+01	5.E+02	2.E-01	5.E-00	2.E-02	5.E-01
Cm-244	5.E+01	1.E+03	5.E-01	1.E+01	5.E-02	1.E+00
Co-60	3.E+01	8.E+02	3.E-01	8.E+00	3.E-02	8.E-01
Cs-137	1.E+02	3.E+03	1.E+00	3.E+01	1.E-01	3.E+00
Gd-153	1.E+03	3.E+04	1.E+01	3.E+02	1.E+00	3.E+01
Ir-192	8.E+01	2.E+03	8.E-01	2.E+01	8.E-02	2.E+00
Pm-147	4.E+04	1.E+06	4.E+02	1.E+04	4.E+01	1.E+03
Pu-238	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Pu-239/Be	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Ra-226	4.E+01	1.E+03	4.E-01	1.E+01	4.E-02	1.E+00
Se-75	2.E+02	5.E+03	2.E+00	5.E+01	2.E-01	5.E+00
Sr-90 (Y-90)	1.E+03	3.E+04	1.E+01	3.E+02	1.E+00	3.E+01
Tm-170	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02
Yb-169	3.E+02	8.E+03	3.E+00	8.E+01	3.E-01	8.E+00
Au-198*	2.E+02	5.E+03	2.E+00	5.E+01	2.E-01	5.E+00
Cd-109*	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02
Co-57*	7.E+02	2.E+04	7.E+00	2.E+02	7.E-01	2.E+01
Fe-55*	8.E+05	2.E+07	8.E+03	2.E+05	8.E+02	2.E+04
Ge-68*	7.E+02	2.E+04	7.E+00	2.E+02	7.E-01	2.E+01
Ni-63*	6.E+04	2.E+06	6.E+02	2.E+04	6.E+01	2.E+03
Pd-103*	9.E+04	2.E+06	9.E+02	2.E+04	9.E+01	2.E+03
Po-210*	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Ru-106 (Rh-106)*	3.E+02	8.E+03	3.E+00	8.E+01	3.E-01	8.E+00
Tl-204*	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02

* These radionuclides are very unlikely to be used in individual radioactive sources with activity levels that would place them within Categories 1, 2 or 3 and would therefore not be subject to the paragraph relating to national registries (11) or the paragraphs relating to import and export control (23 to 26).

Building International Support – IAEA General Conference



IAEA
International Atomic Energy Agency

General Conference

GC(47)/RES/7
Date: September 2003

General Distribution
English

Forty-seventh regular session

Item 13 of the agenda
(GC(47)/21)

Measures to Strengthen International Co-operation in Nuclear, Radiation and Transport Safety and Waste Management

Resolution adopted on 19 September 2003 during the tenth plenary meeting

A.
Measures to Strengthen International Co-operation in Nuclear, Radiation and Transport Safety and Waste Management

The General Conference,

(a) Recalling resolution GC(46)/RES/9 on measures to strengthen international co-operation in nuclear, radiation, transport and waste safety,

(b) Recognizing that a global nuclear, radiation and waste safety culture is a key element of the peaceful uses of nuclear energy and that continuous efforts are required in order to ensure that the technical and human elements of safety are maintained at the optimal level,

(c) Stressing the important role of the IAEA in enhancing nuclear, radiation and waste safety through its various safety programmes and initiatives and in promoting international co-operation in this regard,

(d) Reiterating the importance of Member States taking the necessary steps to develop and improve their national nuclear, radiation and waste safety legal infrastructures,

(e) Noting with appreciation documents GC(47)/INF/3 and GC(47)/INF/4 (with its Addenda), containing the Secretariat's responses to nuclear, radiation, transport and waste safety issues of concern to Member States,

(f) Noting that the Agency is organizing an *International Conference on the Protection of the Environment from the Effects of Ionizing Radiation* in Stockholm from 6 to 10 October 2003,

2003 Resolution GC(47)/RES/7 calls for States to make a political commitment to follow Code:

"…urges each State to write to the Director General that it…is working toward following the guidance contained in the IAEA Code of Conduct…"

Development of Export Controls: efforts to improve the security of sources transferred across borders

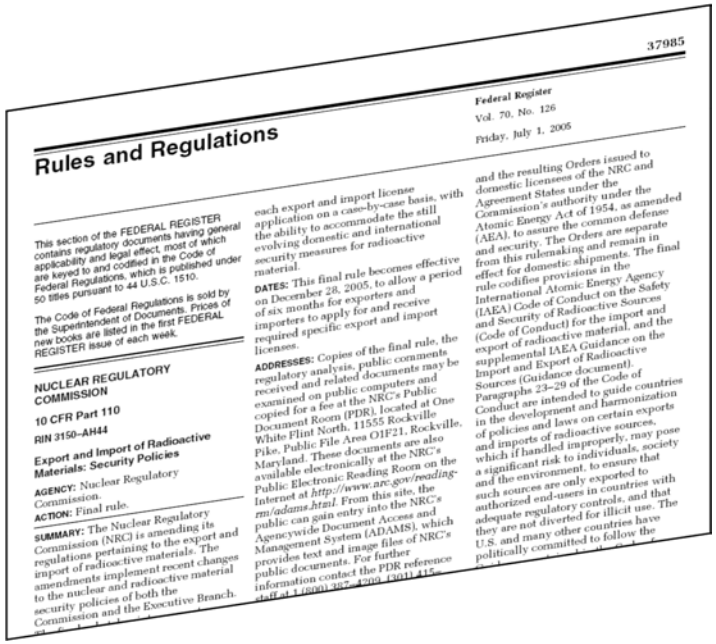
- In 2003-2004, the IAEA began development of international export control guidelines for radioactive sources.
- Security of these transfers were of concern because they were not being tracked and countries were often unaware that large sources had entered their territories.
- There was minimal evaluation of whether the recipient was licensed to possess the sources and whether the receiving State had adequate controls.
- While Code contained general export provisions, States requested specific guidelines so that these transactions were carried out in a harmonized fashion.

Guidance on the Import and Export of Radioactive Sources

Applies to Category 1 and 2 sealed sources

- In 2004, the non-legally binding Guidance was approved by the IAEA Board of Governors; it was published in 2005.
- Represents the first international export control framework for radioactive sources.
- An important step forward in preventing theft and diversion of materials being transferred across borders.

Adoption of export controls



37985

Rules and Regulations

Federal Register
Vol. 70, No. 126
Friday, July 1, 2005

This section of the FEDERAL REGISTER contains regulatory documents having general applicability and legal effect, most of which are keyed to and codified in the Code of Federal Regulations, which is published under 50 titles pursuant to 44 U.S.C. 1510.

The Code of Federal Regulations is sold by the Superintendent of Documents. Prices of new books are listed in the first FEDERAL REGISTER issue of each week.

NUCLEAR REGULATORY COMMISSION

10 CFR Part 110

RIN 3150–AH44

Export and Import of Radioactive Materials: Security Policies

AGENCY: Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its regulations pertaining to the export and import of radioactive materials. The amendments implement recent changes to the nuclear and radioactive material security policies of both the Commission and the Executive Branch.

each export and import license application on a case-by-case basis, with the ability to accommodate the still evolving domestic and international security measures for radioactive material.

DATES: This final rule becomes effective on December 28, 2005, to allow a period of six months for exporters and importers to apply for and receive required specific export and import licenses.

ADDRESSES: Copies of the final rule, the regulatory analysis, public comments received and related documents may be examined on public computers and copied for a fee at the NRC's Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Public File Area O1F21, Rockville, Maryland. These documents are also available electronically at the NRC's Public Electronic Reading Room on the Internet at *http://www.nrc.gov/reading-rm/adams.html*. From this site, the public can gain entry into the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents. For further information contact the PDR reference

and the resulting Orders issued to domestic licensees of the NRC and Agreement States under the Commission's authority under the Atomic Energy Act of 1954, as amended (AEA), to assure the common defense and security. The Orders are separate from this rulemaking and remain in effect for domestic shipments. The final rule codifies provisions in the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct) for the import and export of radioactive material, and the supplemental IAEA Guidance on the Import and Export of Radioactive Sources (Guidance document). Paragraphs 23–29 of the Code of Conduct are intended to guide countries in the development and harmonization of policies and laws on certain exports and imports of radioactive sources, which if handled improperly, may pose a significant risk to individuals, society and the environment, to ensure that such sources are only exported to authorized end-users in countries with adequate regulatory controls, and that they are not diverted for illicit use. The U.S. and many other countries have politically committed to follow the

- Export controls, consistent with the Guidance, were incorporated into national laws.
- Again, IAEA General Conference called for States to make a political commitment – this time to follow the Guidance – in GC(48)/RES/10.D.

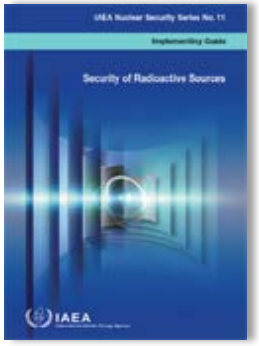
2011 Revision of the import/export Guidance

- In 2011, IAEA convened a consultants meeting to consider what revisions may be necessary to Guidance. Later, it was followed by a technical meeting to consider the consultants' recommendations. The technical meeting was attended by155 experts from 82 States.
- There was general consensus that the main provisions of the Guidance should not be altered. Participants supported revisions to update and clarify text in order to improve harmonized implementation. The biggest change was to Annex 1 which provides a questionnaire for helping assess a State's ability to safely & securely manage sources.
- September 2011 IAEA Board of Governors approved revised Guidance and the revised Guidance was published in 2012.

Other IAEA Activities Supportive of Radioactive Source Safety & Security Efforts

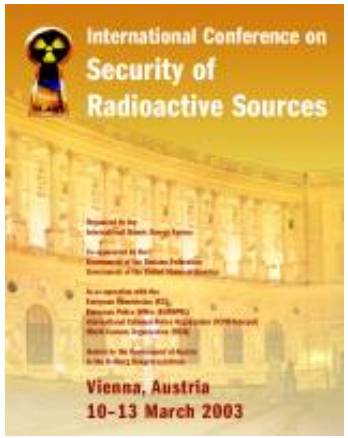
- Nuclear Security Fund
- Integrated Regulatory Review Service (IRRS)
- Integrated Nuclear Security Support Plans (INSSP)
- RAIS software for national source registry
- Workshops, Training, Outreach
- Development of International Guidance for Security of Sources

IAEA Nuclear Security Series

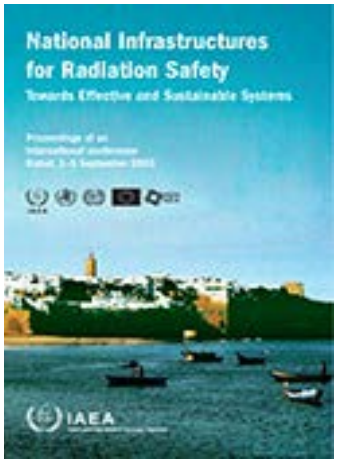


Guide on Security of Radioactive Sources
IAEA Nuclear Security Series No. 11

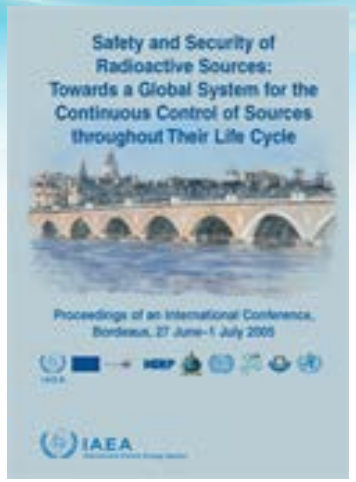
International Conferences



Vienna, 2003



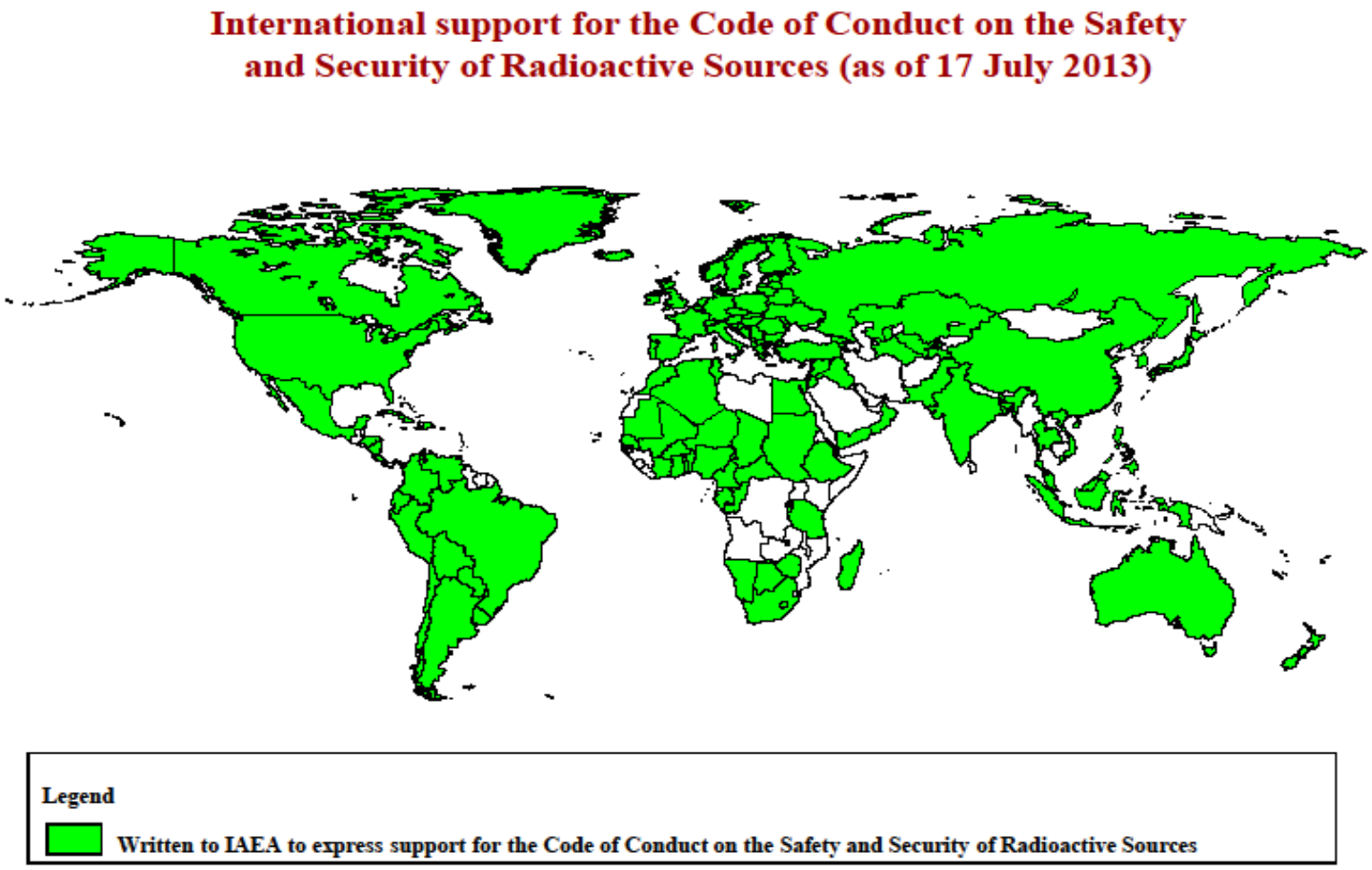
Rabat, 2003



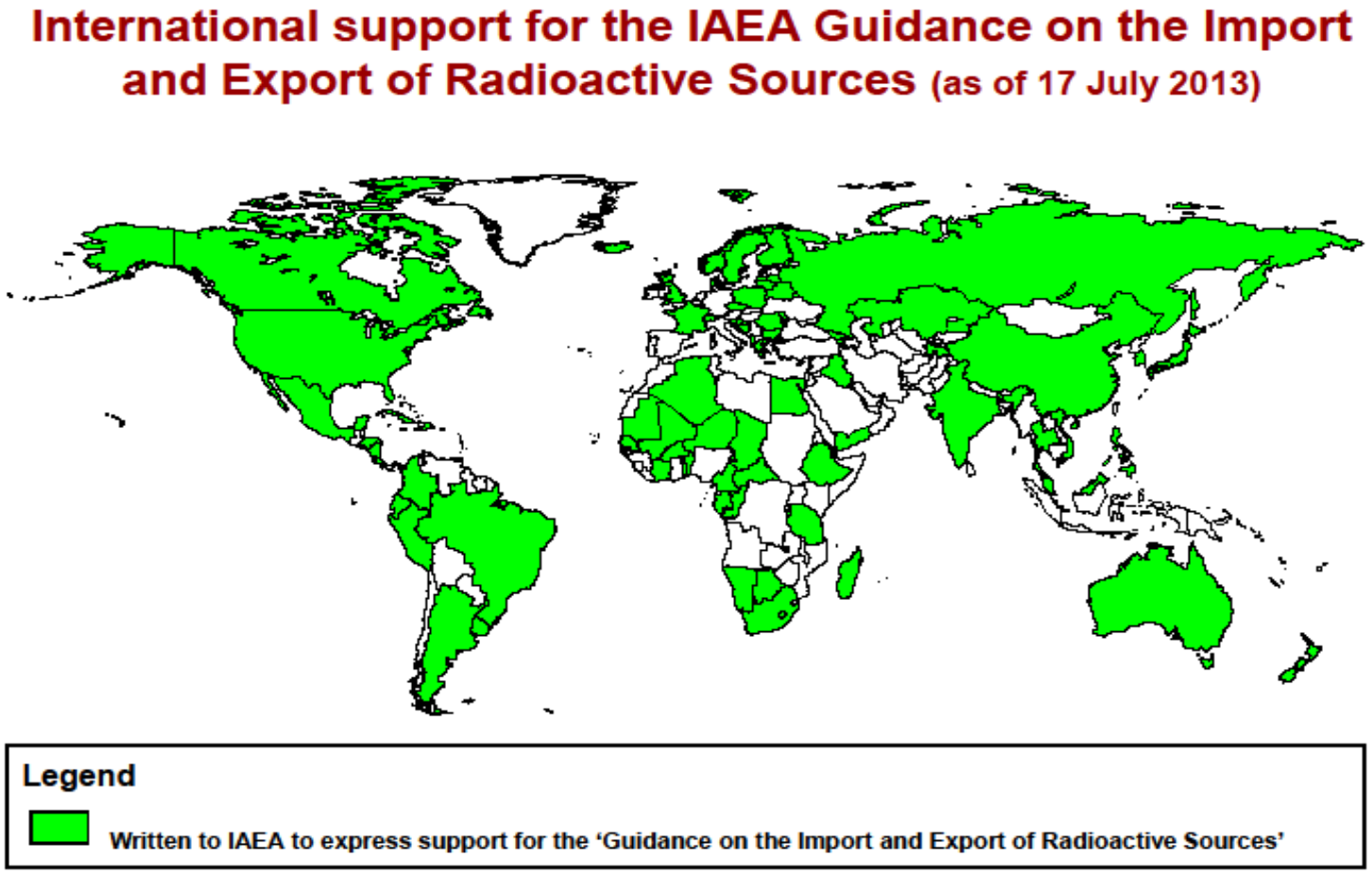
Bordeaux, 2005

Abu Dhabi, 2013

As of October 2013, 119 States have made a political commitment to follow Code of Conduct



And 84 States have made political commitment to follow the Guidance



Information exchange

Regional cooperation

Dirty bomb response exercises and orphan source searches

Philippines PNRI Source Security Working Group

National Training Course on Physical Protection & Security Management of Radioactive Sources

International endorsement

Work still to be done

Orphan sources in scrap metal

The dose rates, geometry, and all that stuff

ANSTO survey results indicated 350 μSv/h near the centre of the door (50 μSv/h at 1m)

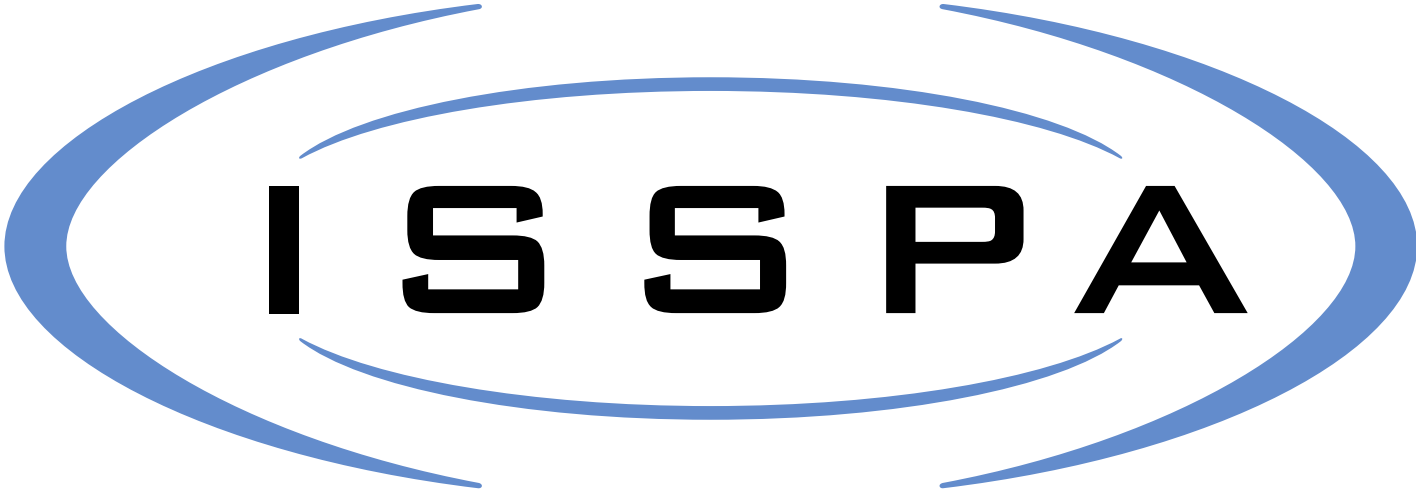
Also measured 70 μSv/h on the right hand side, and

150 μSv/h on the left hand side

Initial activity estimated about 1.5GBq of Cs-137 No neutrons detected (i.e. no Am-Be or Ra-Be)

Orphan sources in scrap metal

Return to supplier



Implementation of import / export guidance

REQUEST TO THE IMPORTING STATE FOR CONSENT TO IMPORT CATEGORY 1 RADIOACTIVE SOURCES OR TO IMPORT CATEGORY 1&2 SOURCES UNDER EXCEPTIONAL CIRCUMSTANCES
Pursuant to Paragraphs 6, 7, 8, 14, 15 & 16 of the IAEA Guidance on the Import and Export of Radioactive Sources, and Paragraphs 23-25 of The Code of Conduct on the Safety and Security of Radioactive Sources

请求进口国同意进口一类放射源
或在特别情况下同意进口一类和二类放射源申请表
根据国际原子能机构《放射源的进口和出口导则》第 6 段、第 7 段、第 8 段、第 14 段、第 15 段和第 16 段以及《放射源安全和保安行为准则》第 23 段至第 25 段

DEMANDE DE CONSENTEMENT DE L'ÉTAT IMPORTATEUR POUR L'IMPORTATION DE SOURCES RADIOACTIVES DE CATÉGORIE 1 OU DE SOURCES RADIOACTIVES DE CATÉGORIES 1 ET 2 DANS DES CIRCONSTANCES EXCEPTIONNELLES
En vertu des paragraphes 6, 7, 8, 14, 15 et 16 des orientations de l'AIEA pour l'importation et l'exportation de sources radioactives, et des paragraphes 23 à 25 du Code de conduite sur la sûreté et la sécurité des sources radioactives

ЗАПРОС ИМПОРТИРУЮЩЕМУ ГОСУДАРСТВУ О СОГЛАСИИ НА ИМПОРТ РАДИОАКТИВНЫХ ИСТОЧНИКОВ КАТЕГОРИИ 1 ИЛИ ИМПОРТ ИСТОЧНИКОВ КАТЕГОРИЙ 1 И 2 В ИСКЛЮЧИТЕЛЬНЫХ ОБСТОЯТЕЛЬСТВАХ
В соответствии с пунктами 6, 7, 8, 14, 15 и 16 Руководящих материалов МАГАТЭ по импорту и экспорту радиоактивных источников и пунктами 23-25 Кодекса поведения по обеспечению безопасности и сохранности радиоактивных источников

SOLICITUD AL ESTADO IMPORTADOR PARA QUE PERMITA LA IMPORTACIÓN DE FUENTES RADIACTIVAS DE LA CATEGORÍA 1 O LA IMPORTACIÓN DE FUENTES DE LAS CATEGORÍAS 1 Y 2 EN CIRCUNSTANCIAS EXCEPCIONALES
Con arreglo a los párrafos 6, 7, 8, 14, 15 y 16 de las Directrices sobre la importación y exportación de fuentes radiactivas del OIEA, y a los párrafos 23 a 25 del Código de Conducta sobre la seguridad tecnológica y física de las fuentes radiactivas

طلب إلى الدول المستوردة بشأن الموافقة على استيراد المصادر المشعة
التي تنتمي إلى الفئة 1 أو استيراد المصادر التي تنتمي إلى الفئة 1 والفئة 2 في ظل ظروف استثنائية
عملاً بالفقرات 6 و 7 و 8 و14 و15 و16 من إرشادات الوكالة
بشأن استيراد المصادر المشعة وتصديرها، والفقرات 23 إلى 25
من مدونة قواعد السلوك بشأن أمان المصادر المشعة وأمنها

Security of sources

Contractual liability issues

Third party liability

The ANSTO Regional Security of Radioactive Sources Project

What if?

Australian Embassy
Jakarta, September 2004

Marriott and Ritz-Carlton hotel
bombings, 17 July 2009

Objectives

- to improve the physical protection and security management of high risk radioactive sources throughout their life-cycle, primarily in South East Asian countries, and therefore
- to mitigate the risk of malicious use of radioactive material affecting Australian and other States' interests and,

Objectives

- in the event that prevention fails, ensure adequate measures are in place to detect, respond to and mitigate the consequences of any attempted, or actual, malicious use of radioactive sources.

Methods

a) assistance to regulators and operators in implementing the physical protection and security management of radioactive sources and their associated facilities

b) needs analyses and development, including training courses and train-the-trainer workshops

c) provision of radiation detection equipment, training and exercises using that equipment

Methods

a) training for, and conducting, orphan radioactive source searches and management; and

b) building radiological emergency preparedness and response capabilities to deal with dirty bomb or sabotage scenarios.

South East Asia

- Indonesia
- Malaysia
- Philippines
- Singapore
- Vietnam
- Thailand
- Laos
- Brunei
- Cambodia

South Pacific

- Fiji
- Papua New Guinea

Regional Security of Radioactive Sources Project

Lead Agencies

Australian Government

ansto

NASA
National Nuclear Security Administration

NEW ZEALAND MINISTRY OF
FOREIGN AFFAIRS & TRADE
MANATŪ AORERE

BATAN

MINISTRY OF HEALTH
MALAYSIA

Regional Security of Radioactive Sources Project Implementation

- International cooperation – relatively informal, peer-to-peer, needs-based users in medicine and industry in each country
- Collaboration with the US NNSA Office of Global Threat Reduction programs via the Pacific Northwest National Laboratory
- Enhancing national expertise and capability, and a security culture
- Promoting sustainable national resources and infrastructure to address radiation safety, regulation and radioactive source security
- Continuity of program delivery since July 2004 leads to trust building and further cooperation in the region

South East Asian Regional Radiological Security Partnership (RRSP)

Review meetings of the RRSP activities and achievements

1. July 2008, first meeting hosted by the Indonesian National Nuclear Regulatory Agency (BAPETEN) in Bali, Indonesia.
2. March 2010, second meeting hosted by the Vietnam Agency for Radiation and Nuclear Safety (VARANS) in Da Lat, Vietnam.

South East Asian Regional Radiological Security Partnership (RRSP)

3. *January 2012* – third meeting hosted by the Philippine Nuclear Research Institute (PNRI) in Bohol, Philippines
4. February 2014 – fourth meeting hosted by Office of Atomic Energy for Peace in Phuket, Thailand

Outcomes

- Regulations and guidance (international best practice)
- Radiation detection equipment
- On-going cooperative activities on orphan source searches and emergency response

Regulatory Infrastructure for Source Security Working Groups with National Authorities

Improvement of the Buried Radioactive Source situation at a Hospital in Cambodia

1. In situ improvement works were determined to be the best practicable option.
2. Improvements to the security, safety and area amenity have been completed.
   - The site now has enhanced security and is safe for nearby occupancy.
3. Radiation doses to the public and hospital staff from the buried source well below internationally recommended dose constraints for members of the public.

Site prior to commencement of works

Sign installation on top of existing concrete slab

Improvement of the Buried Radioactive Source situation at a Hospital in Cambodia

4. Minimal ongoing maintenance.
   - design life will allow the source to decay to a safe state without any further interventions.
5. The success of these improvement works in Cambodia is indicative of the RSRS Project's efforts in developing close working relationships and gaining a good understanding of local situations and needs. This approach promotes and develops sustainable radiation safety and security of radioactive sources in less developed countries.


Completed shielding enclosure


Site after completion

Orphan Source Search and Secure Workshops

Radiological Emergency Preparedness and Response Workshops

Australian Government

Ansto

Thank you