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
Part I – History of the Code
Safety of radiation sources and security of radioactive materials
Contributed papers

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

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and the World Customs Organization

INTERNATIONAL ATOMIC ENERGY AGENCY

IAEA
International undertakings: Action

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(43)/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 the request made of it in the General Conference. The report presented was the Board at its
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 the 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
Nuclear experts warned lawmakers that American cities are not prepared to deal with the impact of radiological weapons, or "dirty bombs." (ABCNEWS.com)

WASHINGTON, 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
Widespread vulnerable and orphan sources
Past radiological incidents

FIG. 9.4. Detailed view of the bed of a deep ulcer after partial resection. The blackening of surrounding tissue, fat necrosis, and skin suffering are clear indications of poor evolution of this injury.
In 2002-2003, the IAEA carried out a number of technical meetings to revise the Code of Conduct to more adequately address security concerns. The 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

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

National regulatory infrastructures that specify requirements for:

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<tr>
<th>TABLE I. ACTIVITIES CORRESPONDING TO_THRESHOLDS OF CATEGORIES</th>
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<td>Bi-210</td>
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* 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 paragraphs relating to national registries (11) or the paragraphs relating to import and export control (23 to 26).
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

- 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.
• 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 by 155 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
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

International support for the IAEA Guidance on the Import and Export of Radioactive Sources (as of 17 July 2013)

Legend
- Written to IAEA to express support for the ‘Guidance on the Import and Export of Radioactive Sources’
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
Initial activity estimated about 1.5GBq of Cs-137 No neutrons detected (i.e. no Am-Be or Ra-Be)

ANSTO survey results indicated 350 $\mu$Sv/h near the centre of the door (50 $\mu$Sv/h at 1m)

Also measured 70 $\mu$Sv/h on the right hand side, and

150 $\mu$Sv/h on the left hand side
Orphan sources in scrap metal
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 Guidelines 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

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 РАДИАЦИОННЫХ ИСТОЧНИКОВ КАТЕГОРИИ 1 ИЛИ ИМПОРТ ИСТОЧНИКОВ КАТЕГОРИЙ 1 И 2 В ИСКЛЮЧИТЕЛЬНЫХ ОБСТОЯТЕЛЬСТВАХ

В соответствии с пунктами 6, 7, 8, 14, 15 и 16 Рекомендаций МАГАТЕ по импорту и экспорту радиационных источников и пунктами 23-25 Кодекса поведения по обеспечению безопасности и сохранности радионуклидных источников

SOLICITUD AL ESTADO IMPORTADOR PARA QUE PERMITA LA IMPORTACIÓN DE FUENTES RADIOACTIVAS 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 تتنتمي إلى الفئة 1 أو استيراد المصادر التي تنتمي إلى الفئة 1 والفئة 2 في ظل ظروف استثنائية

عن طريق الفقرات 6 و 7 و 8 و 14 و 15 و 16 من إرشادات الوكالة
 بشأن استيراد المصادر المشعة وتصديرها، والفرائض 23 إلى 25
من مدونة قواعد السلوك بشأن آمن 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

IAEA

United States of America Department of Energy

National Nuclear Security Administration

Australian Government

NEW ZEALAND MINISTRY OF FOREIGN AFFAIRS & TRADE

MANATU AORERE

OFFICE OF ATOMS FOR PEACE

TINT

BAPETEN

ATOMIC ENERGY LICENSING BOARD

MINISTRY OF HEALTH MALAYSIA

VARANS

VIETNAM AGENCY FOR RADIATION AND NUCLEAR SAFETY
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


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

Vietnam VARANS

Indonesia BAPETEN

Philippines PNRI
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.
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.
Orphan Source Search and Secure Workshops

Hanoi, Vietnam
October 2006

Bangkok, Thailand
April 2007

Indonesia
February 2006

Subic Bay, Philippines
April 2007
Radiological Emergency Preparedness and Response Workshops

- Bangkok, Thailand: May 2008
- Rayong, Thailand: April 2010
- Selangor, Malaysia: January 2010
- Selangor, Malaysia: March 2011
Thank you