Improving the Security of Radioactive Sources in Industrial Radiography in South East Asia

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Abstract

This paper describes the need and new requirements to ensure the security of radioactive sources in the practice of industrial radiography. We describe the discussions and issues arising during the September 2010 South East Asia regional workshop held in Sydney on the application of security measures to industrial radiography practices. The workshop provided the perspectives of both radiation regulators and industry practitioners from some countries in South East Asia. We describe the outputs of the workshop, how they were developed, and make suggestions for further consideration and application of security measures in the practice of industrial radiography. Examples of uptake of the outcomes of the workshop are provided.

Key Words

Radioactive Source Security, Industrial Radiography, Security Level B, Security Plan

1. Introduction

The requirements and methods to ensure radiation protection and safety of radioactive sources used in industrial radiography are long- and well-established [1] - [3]. In recent years there has been recognition of the threat posed by the potential malicious misuse of radioactive material by terrorists [4], [5]. The dispersal of radioactive material using conventional explosives, referred to as a 'dirty bomb', could create considerable panic, disruption and area access denial in an urban environment. As such, radioactive source security is now a priority matter being addressed by the international community. Since it is still a relatively new topic among regulators, users, and transport and storage operators worldwide, international assistance and cooperation in developing the necessary regulatory and security infrastructure is required.

For several years international cooperation programs have been enhancing the security of highly radioactive (Category 1) sources, primarily located at medical and industrial facilities. From a foundational viewpoint, these programs support States in satisfying the elements of the International Atomic Energy Agency (IAEA) *Code of Conduct on the Safety and Security of Radioactive Sources* [6]. Since 2005, the Regional Security of Radioactive Sources (RSRS) Project of the Australian Nuclear Science and Technology Organisation (ANSTO), working with partners from the United States Global Threat Reduction Initiative (GTRI), has assisted many South East Asian countries in the development of national requirements and measures for the physical protection and security management of radioactive sources. The RSRS and GTRI programs have worked with their national partners throughout South East Asia in raising awareness, implementing physical protection upgrades, building knowledge and expertise at the local and national levels, and working with host

countries to develop and implement relevant, applicable and sustainable systems that ensure the secure management, use and storage of radioactive sources. In South East Asia, the international cooperation includes working group meetings with the national regulators that have developed regulations on the Security of Radioactive Sources. For example the Philippines Nuclear Research Institute (PNRI) developed Part 26 of the Code of Philippine Regulations (CPR) on the Security of Radioactive Sources [7] and associated activities such as training courses and support for the development of Facility Security Plans. These regulatory requirements are based on 2003 technical guidance of the IAEA [8] and the 2005 IAEA publication "Categorization of Radioactive Sources" [9], and apply to facilities that use Category 1 sources in medical radiotherapy and industrial, blood and research irradiators. This system of categorisation was also adopted by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) in 2007 and resulted in the publication of its Code of Practice for the Security of Radioactive Sources, Radiation Protection Series No. 11 (RPS 11) [10].

Since the incorporation of this IAEA guidance into regulations in South East Asia and Australia, updated international best practice guidance on the security of radioactive sources has been developed by the IAEA, including:

- IAEA Nuclear Security Series No. 9 (NSS 9), Security in the Transport of Radioactive Material Implementing Guide, September 2008 [11],
- IAEA Nuclear Security Series No. 11 (NSS 11), Security of Radioactive Sources Implementing Guide, May 2009 [12], and
- IAEA Nuclear Security Series No. 14 (NSS 14), Nuclear Security Recommendations on Radioactive Material and Associated Facilities, January 2011 [13].

IAEA NSS 11 includes systematic guidance on measures for the prevention and detection of, and response to, malicious acts involving radioactive sources, and replaces the earlier 2003 IAEA technical guidance [8]. The NSS 11 measures are aimed at preventing the loss of control of high-risk radioactive sources under circumstances of attempts of theft or sabotage. The security measures are intended to complement regulatory and safety requirements, and not to be in conflict with existing requirements.

A fundamental feature of the guidance is that the measures should be applied on a graded basis to ensure adequate security without imposing unnecessarily restrictive arrangements. This graded approach takes into account the current evaluation of the threat, the relative attractiveness for misuse of the source, and the potential consequences resulting from malicious use. Three security levels of A, B, and C have been developed to allow specification of security goals and performance measures in a graded manner. Using the international guidance and considering the level of radioactivity of the sources, their portable nature and the potential for them to be aggregated in storage, the practice of industrial radiography represents a Category 2 practice in terms of level of dangerous consequences [9]. This in turn requires the application of security measures which meet the security objectives of Security Level B [12]. The overall Security Level B goal is to minimize the likelihood

of unauthorized removal of a source. For comparison, the Security Level A goal (which applies to Category 1 sources) is to prevent unauthorized removal of a source.

At a review meeting of the South East Asia Regional Radiological Security Partnership (RRSP) in Vietnam in March 2010, it was recommended that specific, detailed provisions for the security of Category 2 industrial radiography sources be developed at the national level and implemented at the user or facility level [14]. As a result, the ANSTO RSRS Project in partnership with the US GTRI, the IAEA and the New Zealand Ministry for Foreign Affairs and Trade (MFAT) conducted a South East Asia Regional Workshop on Radioactive Source Security Level B (Industrial Radiography Practices) in Sydney from 6 to 10 September 2010. Sponsorship was provided for all regional country representatives to participate in this workshop.

2. The Radioactive Source Security Level B Workshop

The purpose of the workshop was to:

a) review the IAEA and other relevant security guidance or requirements, such as specific national regulatory requirements, that apply to Security Level B radioactive sources generally and to industrial radiography sources specifically;

b) apply these recommendations or requirements to the development of more detailed security provisions, taking account of all the conditions involved in the practice of industrial radiography;

c) prepare a guidance document and associated training material for use by participating organisations; and

d) make recommendations for additional workshops to further develop guidance, training programs or activities as needed, with the aim of implementing Security Level B guidance or requirements for other practices.

Workshop participants were experts with a background or relevant expertise in radiation safety, security, technical training and industrial radiography practice within their national nuclear operating organisations, regulatory authorities, training organisations, professional non-destructive testing associations and industrial radiography company operators. Regional countries represented were Indonesia, Malaysia, Philippines, Singapore and Vietnam. All of these participants, with their different points of view and concerns, contributed constructively to the discussions and in developing the workshop outputs which resulted in practical and achievable results for all concerned.

The workshop was conducted in an open and interactive manner. This was achieved through presentations and discussions on:

a) a review of the IAEA nuclear security guidance covering radioactive source use and storage (NSS 11) and transport (NSS 9);

b) a review of radioactive source practices that fall within Security Level B, and in particular the practice of industrial radiography. Some incidents involving radiography sources were

presented, with descriptions of root causes, their consequences, implications for security and the need for better protection;

c) reviews of the operational life cycle of an industrial radiography device from import to export by representatives of industrial non-destructive testing companies from the Philippines and Malaysia;

d) five national presentations covering:

- the types and numbers of sources and practices that fall within Category 2, Security Level B;
- the scope of industrial radiography practices, such as number and size of companies, and geographical distribution;
- specific safety and regulatory requirements given in regulations, decrees or guidance;
- description of relevant incidents and issues involving industrial radiography, including examples of theft;
- relevant training course syllabus, delivery, schedule and participation; and
- suggestions for workshop outcomes of interest.

e) introduction and development of a structured framework for applying Security Level B security measures to industrial radiography sources in use, storage and transport.

3. Workshop outputs

The discussions and issues arising during the regional workshop provided the practical perspectives of both radiation regulators and industry practitioners in developing recommended security measures for industrial radiography sources. These measures were then used to produce guidance on the structure and contents of a security plan for industrial gamma radiography. Both the recommended security measures and the security plan guidance are structured in terms of use and storage at home base and in the field, as well as transport by the licensee, see Figure 1.

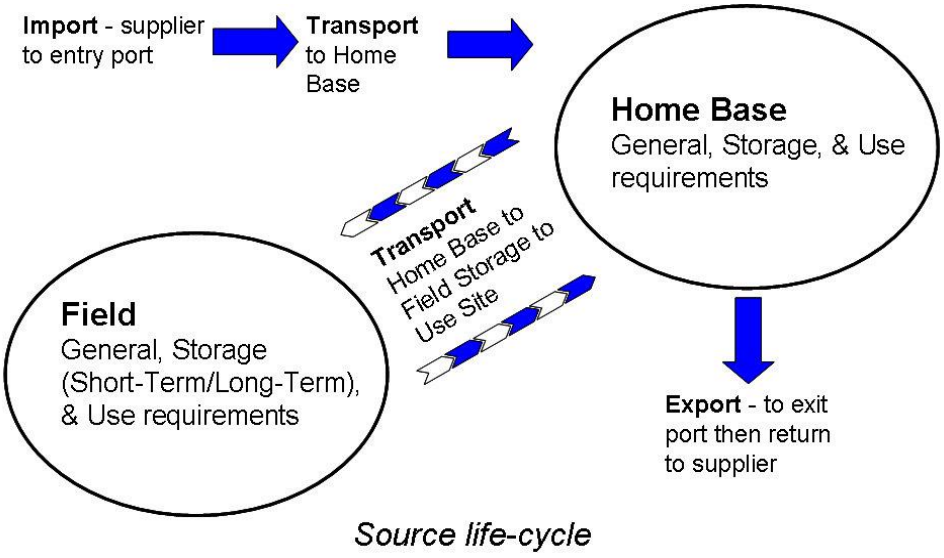

Figure 1: Source life-cycle

The recommended security measures and associated contents of security plans for industrial radiography sources in use and storage are based on IAEA NSS 11 guidance, utilising its table 7 structure as follows [12]:

IAEA NSS 11 Guidance, Table 7 - Recommended Measures for Security Level B [12]		
Security function	**Security objective**	**Security measures**
Detect	Provide immediate detection of any unauthorized access to the secured area/source location	Electronic intrusion detection equipment and/or continuous surveillance by operator personnel
	Provide detection of any attempted unauthorized removal of the source	Tamper detection equipment and/ or periodic checks by operator personnel
	Provide immediate assessment of detection	Remote monitoring of CCTV or assessment by operator / response personnel
	Provide immediate communication to response personnel	Rapid, dependable means of communication such as phones, cell phones, pagers, radios
	Provide a means to detect loss through verification	Weekly checking through physical checks, tamper detection equipment, etc.
Delay	Provide delay to minimize the likelihood of unauthorized removal	System of two layers of barriers (e.g. walls, cages)
Response	Provide immediate initiation of response to interrupt unauthorized removal	Equipment and procedures to immediately initiate response
Security management	Provide access controls to source location that effectively restrict access to authorized persons only	One identification measure
	Ensure trustworthiness of authorized individuals	Background checks for all personnel authorized for unescorted access to the source location and for access to sensitive information
	Identify and protect sensitive information	Procedures to identify sensitive information and protect it from unauthorized disclosure
	Provide a security plan	A security plan which conforms to regulatory requirements and provides for response to increased threat levels
	Ensure a capability to manage security events covered by security contingency plans	Procedures for responding to security-related scenarios
	Establish security event reporting system	Procedures for timely reporting of security events

This was further developed during the workshop with considerations of actual operational practice, recognising national regulatory and individual company differences to the extent practicable. The approach to transport security is based on IAEA NSS 9 guidance [11] and regulatory requirements using the Malaysian Atomic Energy Licensing Board (AELB) model and actual operational practice.

The recommended security measures developed at the workshop, and the guidance on the structure and contents of a security plan for industrial gamma radiography are available for download from the ANSTO website [15],

http://www.ansto.gov.au/__data/assets/pdf_file/0014/52232/Appendix_to_IRPA13_paper.pdf.

A security plan should include all information necessary to describe the security approach and system being used for protection of the source(s). The level of detail and depth of content should be

commensurate with the security level of the source(s) covered by the plan. The workshop participants acknowledged that these documented methods and measures will form a practical and effective approach for industry practitioners and regulators to ensure and verify appropriate security of Category 2 industrial radiography sources.

Intangible outcomes also emerged over the course of the workshop including:

- the value of developing and maintaining networks;
- a common understanding and consensus on future challenges and a shared sense of commitment to radioactive source security;
- changed attitudes and mind sets via sharing insights about long-term developments to orient people's thinking towards longer-term issues. This enriched their views of desirable and feasible options – and of futures to avoid – by interaction with each other; and
- the indirect integration of the workshop results into the projects, programmes, strategies and policies of national authorities, regional organisations or companies.

These intangible outcomes are expected to impact on radioactive source security culture.

4. Workshop discussions and issues arising

During the workshop the following issues were considered of particular importance to source security from the perspectives of both radiation regulators and industry practitioners.

a) *Agreement on satisfying the Security Level B goal*

The value of the IAEA nuclear security series guidance as a comprehensive starting point to further develop and implement the requisite security measures from both regulatory and operator viewpoints was acknowledged. There was recognition that interpreting such guidance can be somewhat subjective and the translation for use requires careful consideration. It was highlighted that regulators are ultimately responsible for correct terminology and interpretation within their national regulatory contexts. A primary challenge for regulators and operators is to obtain substantial agreement on the operational or practical meaning of the Security Level B goal "to minimize the likelihood of unauthorized removal of a source" and to recognise when this goal has been satisfied.

b) *The variable nature of the environment that industrial radiography is conducted in*

A distinctive feature of industrial gamma radiography operations is that they routinely involve changing circumstances for storage and use at home base and in the field, with many movements of the device. The variety of scenarios highlights that any regulation or guidance produced should be broad, and may use a combination of the prescriptive and performance-based approaches [12]. For example, if a license condition or regulation requires a security plan to be submitted by a licensee, then the regulator may choose to specify the required contents of the security plan at a general level. Nevertheless, regulatory verification of the adequacy and effectiveness of a security plan requires that the regulator acquire, or have access to, the requisite security knowledge, expertise and experience to perform an assessment.

c) *The frequent transport of industrial radiography sources*

The transport of industrial radiography sources is an integral part of the licensee's operations and should not be compartmentalised or considered separate for purposes of security (and safety). Therefore, security arrangements for transportation by the licensee in its own vehicles should form key elements of the licensee's operational plans and procedures. In this case, there would be no requirement for a separate transport security plan. This is reflected in the workshop's guidance on the security plan [15].

d) *The aggregation of sources in storage or transport*

There is the possibility that aggregation of sources in storage or transport could result in a change to the higher Security Level A requirements. The consensus was that Category 2 and Security Level B is generally the appropriate classification for industrial radiography sources when aggregated in typical numbers. For companies represented at the workshop and from knowledge of industrial gamma radiography practices, including shared storage facilities, it was determined to be very unlikely that an aggregation of industrial radiography sources would require Security Level A measures.

e) *Companies sharing access to storage facilities at field sites*

The issue of companies sharing access to storage facilities at field sites was discussed. It was considered that the access control and associated measures could be implemented in a manner that would complement the current storage controls without disrupting the operations. Industry practitioners currently exercise a high level of source and device accounting during all movements. This is considered a good example of where best safety practice in source and device control also satisfies security needs.

f) *Cross-border movements and off-shore operations*

Participants noted the particular issue of cross-border movements and off-shore operations involving industrial radiography sources licensed in one country but temporarily used in another country's territory, either offshore or onshore. This situation highlighted that regulatory control of sources - which is essential to security - would be enhanced by further development and implementation of arrangements to ensure that national regulatory bodies are aware of all operations involving industrial radiography sources in their jurisdiction, especially those that occur on a temporary basis. The Code of Conduct and its associated Guidance on the Import and Export of Radioactive Sources require that national regulatory bodies be notified of the international transfer of all Category 1 and 2 sources [6], [16]. The workshop recognised that regional regulators should share knowledge of the movement of sources between jurisdictions through a cooperative approach among regulators and operators within the region, in accordance with the procedures set out in the Guidance [16]. It must be recognised by all regulators and operators that even short duration operations requiring movement of sources from one jurisdiction to another requires satisfying such Guidance. This networking and proactive regulatory interaction will improve national and regional capabilities and consistency in implementing and sustaining Security Level B security measures.

g) *Operator implementation of security measures*

It was acknowledged that these recommended security measures are readily achievable for larger enterprises, but a concern was raised that small and medium enterprises (SMEs) may require additional support. It was agreed that further consideration must be given on how SMEs can adequately implement these security measures. Support for SMEs was encouraged particularly through professional bodies, such as the Philippines Society for Non-Destructive Testing (PSNT).

5. Workshop recommendations for next steps

The workshop discussed and identified the following activities for further consideration and possible actions:

National Regulatory Authorities

a) Update to Codes of Practice, Regulations and/or Guidance based on Workshop products and IAEA guidance. This is underway in the Philippines, Malaysia, and Vietnam.

b) Promulgation of guidance for, and/or an example of, a security plan for Category 2 industrial radiography sources.

c) Information outreach to licensees on requirements.

Operators / Licensees

a) Large Enterprises (particularly those represented at the Sydney Workshop) - implementation and leading by example.

b) NDT Associations, Societies or related professional/business groupings - promotion of best practice via education and outreach. An example of this in practice was the Philippines Society for Non-Destructive Testing presenting the outcomes and recommendations of the Sydney workshop at their 25th Annual Convention in Manila on 19 November, 2010.

c) Small and Medium Enterprises - training and awareness of requirements.

d) Client companies - source security awareness seminars.

International cooperation

a) Between national regulatory authorities, covering import/export, transit, and agreements or arrangements for notification of the temporary presence of sources within their respective jurisdictions, in accordance with the IAEA Guidance on the Import and Export of Radioactive Sources.

b) Training courses and technical train-the-trainer programs.

c) Support the development and peer review of Regulations, Codes of Practice and Guidance.

d) Operator equipment needs assessments and upgrades.

e) Security Plan workshops for Operators.

f) Development of public understanding of Category 2 industrial radiography sources via outreach material, including brochures and posters to assist recovery of lost or stolen devices.

g) If required in future, conduct additional review meetings of progress of implementation of guidance and the next steps.

- At the third regional review meeting of the Radiological Security Partnerships on radioactive source security held in Bohol, Philippines from 18 to 20 January 2012, the ANSTO RSRS Project announced an intention to hold a follow-up meeting in the region in 2012 [17].

6. Conclusions

This first of a kind workshop addressing Security Level B in industrial radiography practices agreed the following outcomes from the discussions and outputs:

a) The application of international guidance on the security of radioactive sources for the widespread practice of industrial gamma radiography can be readily achieved. This has implications for other practices, such as well logging.

b) Regulatory authorities can appropriately set requirements and use a licensee's or licence applicant's Security Plan to ensure adequate and effective implementation and compliance.

c) The draft Recommended Security Measures and the draft Guidance on the Contents of a Security Plan for Industrial Radiography developed at the Sydney Workshop form a practical and effective approach for industry practitioners and regulators to ensure and verify appropriate radioactive source security.

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