IAEA-CN-218/35

Countering the Evolving Threat of Nuclear and Other Radioactive Material out of Regulatory Control: Jamaica's Experience

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Abstract

Developing sustainable approaches to strengthen the safety and security of nuclear and other radioactive materials in Jamaica was propelled by the successful bilateral "Megaports" initiative of the US DOE's National Nuclear Security Administration (NNSA) and their Second Line of Defense and the Government of Jamaica through the Jamaica Customs (2006). Through this initiative, since 2009, four (4) discoveries of source of radiation have been uncovered, all found in shipments for international transport. Jamaica was prompted by these discoveries to becoming the 118th Member State of the then International Atomic Energy Agency's Incident and Trafficking Database (ITDB) as of 2013, and subsequently now in the final stages of completing a Jamaican specific Integrated Nuclear Security Support Plan (INSSP); a non-binding instrument with the IAEA. These two nuclear security systems both have the potential of lowering the evolving threat of nuclear and radioactive material out of control in Jamaica as we develop a legislative and regulatory framework which supports nuclear safety and security issues with reference to international legal instruments and IAEA guidelines.

Introduction

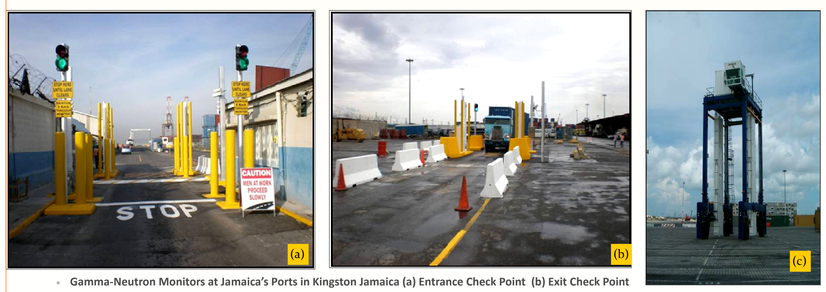
- Jamaica currently has the only nuclear reactor in the English speaking Caribbean, a small 20 kW 93% highly enriched uranium core, used at the University of the West Indies since 1984 as a research tool. Jamaica also has a long history of importing radioactive materials for productive use in medicine, industry, agriculture and other areas of research.
- The presence of sealed radioactive sources (SRSs) in scrap metal and the metal recycling industries, along with customs or border protection incidents are consistent with the problems of orphaned sources in other developing and developed countries.
- Developing countries like Jamaica have significantly lower radioactive source inventories relative to developed states such as the European Union (EU) and the United States of America (USA). Jamaica has also been faced with a weak national regulatory infrastructure which is believed to be the reason for a higher risk of sources becoming orphaned.
- The latest improvements to safety and security at the border protection and transhipment Port in Kingston, for monitoring of nuclear and other radioactive materials in import/export and transhipment trade is due mainly from resources donated through the USA's Department of Energy (DOE) and the National Nuclear Security Administration (NNSA), through their Second Line of Defence (SLD), under the theme "Megaports" Initiative. In June, 2006 the Government of Jamaica and the United States of America signed a Memorandum of Understanding (MOU) implementing the "Megaports" initiative at the ports of Kingston: the Port Authority of Jamaica's Kingston Wharves Limited (KWL) and Kingston Container Terminal (KCT).
- The aim of the program was specifically "to provide equipment, training, and technical support to its international partners to enhance their ability to deter, detect, and interdict illicit trafficking of special nuclear weapons of mass destruction (WMD) and other radioactive materials in the global maritime system"(2009).
- SRSs and other radioactive materials out of regulatory control have been discovered and intercepted at our ports. Sources were taken under control and are temporarily stored due to the efforts of Jamaica's Office of Disaster Preparedness and Emergency Management (ODPEM), the Jamaica Customs and ICENS.

Source	Type of Operation	No. of Sources
Cs-137	Medical	59
Co-60	Medical	2
Am-241	Medical	10
Sr-90	Medical	3
Radium	Medical	380
Linear Accelerator	Medical	1
Ir-192	Industrial	3
Industrial sources	Industrial	Unknown
U-235	Academia	1
TOTAL		459

- Nuclear and Medical Source Inventory in Jamaica , No proper inventory for existing industrial sources (2012).

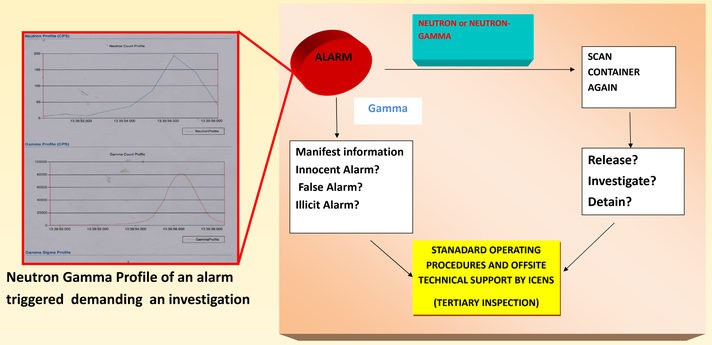
Methods

There are two (2) pairs of radiation portal monitors (RPMs) at entrance and exit check points at the port , with one straddle carrier dedicated to transshipment cargo. Each RPM consists of two (2) gamma and two (2) neutron detectors, control electronics, power supplies and occupancy sensors; a battery backup and communication equipment are also installed. The equipment passively detects radiation, however five (5) alarms can be triggered. These include alarms for neutron and gamma radiation, also tampering, high/low background readings, and internal faults.

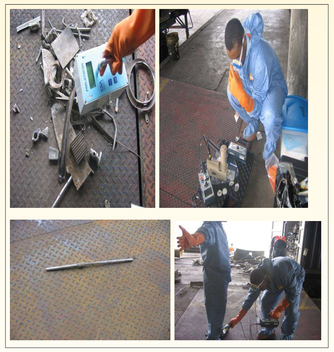


- Gamma-Neutron Monitors at Jamaica's Ports in Kingston Jamaica (a) Entrance Check Point (b) Exit Check Point (c) Straddle carrier for transshipped cargo monitoring

THE STANDARD PROCEDURE AND RESPONSE FRAMEWORK IN EFFECT FOR THE CATEGORIZATION AND CHARACTERIZATION PROCESS FOR NUCLEAR OR OTHER RADIOACTIVE MATERIAL INCIDENTS:

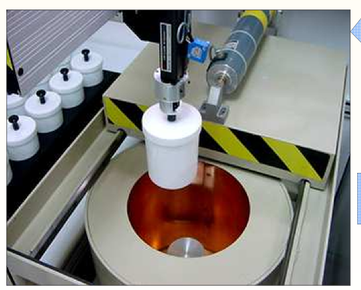


- Neutron Gamma Profile of an alarm triggered demanding an investigation
- Secondary Inspection Process Leading up to a Tertiary Inspection by Technical personnel



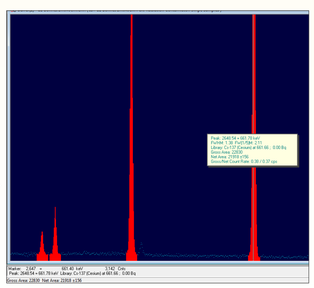
- Source Recovery and Inspection for a Neutron-Gamma Alarm. Surface Moisture Density Gauge with Cs-137 and Am-241,Be Sources

- Source Recovery and Inspection for a Gamma Alarm. Static Eliminator, a Ra– 226 lined H-Strip of Metal



Some Additional Forensics capabilities offered by ICENS:

- High Purity Germanium Detectors
- Neutron Activation Analysis
- X-ray Fluorescence Spectrometry & ICP OES



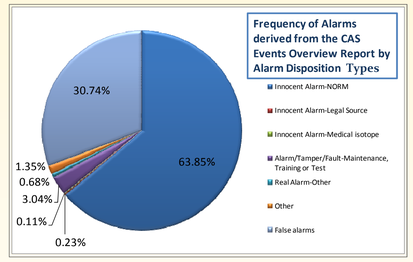
- Results and reports generated, INF's for the ITDB produced

Results

Year Log	Source of Radiation	Location	Dose Rate at Surface / (Radioactivity)	Half Life of Source/	Agency Involved	Alarm category
2008	Cs-137	Linstead, Saint Catherine	Undetermined	30.1	Retrieved by ICENS	Gamma
2009	Ra-226	KWL	Unknown	1601	Retrieved by US DOE	Gamma
2009	Ra-226	KWL	0.20mSv hr^{-1}/ (22MBq)	1601	Retrieved by ICENS	Gamma
2010	Cs-137, Am*(Be)-241	KWL	0.45mSv hr^{-1}/ (1.63GBq)	30.1, 432.2*	Retrieved by ICENS	Neutron-Gamma
2012	Cs-137 & Cs- 134	KCT	1.68µSv hr^{-1} (21.4 Bq/m^2)	30.1, 2.0652	Analysed by ICENS	Gamma

- Incident log of radiological materials discovered in Jamaica

As of May 2013 the "*Alarm Details*" section of the Jamaica Customs' Central Alarm Station (CAS) report indicated that a total of 4842 alarms were detected since August of 2009; 88 secondary inspections were further conducted on these alarms, of which, 3 alarms required tertiary inspections which identified 3 radioactive sources and 1 radioactive contamination. The statistics from the CAS overview report indicate that for approximately every 90,000 Twenty Foot Equivalent Units (TEUs), one (1) container occupying Jamaica's major import/export and transhipment Port will have a radioactive signature.



CHALLENGES HIGHLIGHTED BY THE MEGAPORTS INITIATIVE IN JAMAICA

- Capacity building deficiencies exists
- Lack of a dedicated nuclear forensics infrastructure aid by traditional forensics
- Lack of a national management strategy (a Model Action Plan) for emergencies, and safety and security relevant events involving nuclear and other radioactive sources
- National repository issues for radioactive sources out of control; for radioactive waste management
- Introduction of the "Megaports" Initiative in a developing State (Jamaica) further revealed the gaps and the implications from not having a proper regulatory framework
- Radioactive materials and sources out of regulatory control are being uncovered in scrap metal and imported trade
- Lack of a State System of Accounting and Control (SSAC) for radioactive sources exist
- A comprehensive legislative framework for safety and security of nuclear and other radioactive materials

Conclusion

The discovery of radioactive sources in scrap indicates that the management systems in place for accounting and control of nuclear and other radioactive materials are inadequate. An efficient regulatory framework is needed to minimize orphaning of sources and to maintain control over those currently in peaceful operation. With these challenges in mind and the philosophy that the responsibility of nuclear security rests entirely with each individual Member State, Jamaica has taken steps to be a part of the IAEA's illicit trafficking database and to finalize an Integrated Nuclear Security Support Plan (INSSP). We await legislation concerning nuclear and other radioactive materials in line with international legal instruments and IAEA guidelines.