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**The International Centre for Environmental and Nuclear Sciences (ICENS) as a TSO in Enhancing Nuclear Safety and Security in Jamaica**

C.O. Boyd1, C.N. Grant1

1International Centre for Environmental and Nuclear Sciences (ICENS), University of the West Indies

2 Anguilla Close, Kingston 7, Saint Andrew, Jamaica

craig.boyd@uwimona.edu.jm

**Abstract.** The existing and potential capabilities of the International Centre for Environmental and Nuclear Sciences (ICENS), formerly the Centre for Nuclear Sciences (CNS), as a Technical and Scientific Support Organization (TSO) are reviewed here. It is envisaged the ICENS will enhance nuclear and radiation safety regulations through capacity building in Jamaica and the Caribbean.

1. **Overview and National Context** 
   1. **30 Years Of Safe Operation And Technical Scientific Support**

The International Centre for Environmental and Nuclear Sciences (ICENS) formerly Centre for Nuclear Sciences (CNS) was conceived as a multi-disciplinary facility based on "Peaceful Uses of the Atom, since its inception the centre has been strongly supported by the University of the West Indies and successive Governments of Jamaica. The SLOWPOKE-2 reactor at ICENS achieved first criticality on March 21, 1984 and remains the only nuclear research reactor in the English speaking Caribbean. The name SLOWPOKE is an acronym for, **S**afe **LOW** **PO**wer “**K**(C)ritical” **E**xperiment, a 20kW reactor with a maximum flux of 1x1012 ncm-2s-1 at all five inner irradiation sites. With a neutron source as its central tool, ICENS envisioned significant interconnections (FIG.1) among several scientific disciplines and a range of application for science and technology to impact sustainable development for member countries of the University of the West Indies.

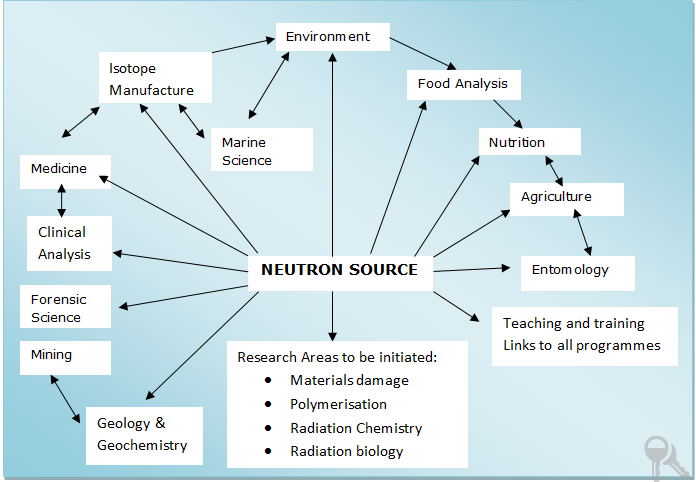


FIG.1 Concept Details for the CNS prior to 1984, source [1]

The work of ICENS has been regarded as an asset to national and regional growth by placing nuclear science in the service of socio-economic and environmental development. The main research programmes of ICENS has involved the investigation of Jamaica’s environmental geochemistry, particularly its relationship to the health and safety of Jamaican foodstuffs, and in mineral explorations, with the overall objective of contributing to critical socio-economic challenges including environmental protection, development of natural resources and the development and retention of local scientific talent. The stakeholders to date having direct or indirect involvement with the operation of the reactor are the University of the West Indies, Ministry of Agriculture, Ministry of Science and Technology Energy and Mining, Ministry of Health, the Private Sector and several Bauxite Mining Companies as well as other local and international academic partners.

The installation of the SLOWPOKE-2 reactor necessitated the development of a radiation monitoring programme, this was largely achieved with assistance of the IAEA, who provided both equipment and training of local personnel. The first Thermoluminescence Dosimetry (TLD), purchased in July 1984, was used for personnel monitoring of ICENS staff members, in line with national and international codes of practice. The quality of our TLD badge measurements is periodically verified through regional inter-comparison, badges being irradiated at a secondary standards laboratory [3]. Ten years after the TLD service had been established there were more than 400 users island-wide being monitored, today we provide the only service for more than 1300 users of ionizing radiation in Jamaica and five other territories in the Caribbean region. The initial external requests were important, as they marked the first instance of our involvement as a technical scientific support organization (TSO) for nuclear safety and security, and uniquely occurring without the advent of local legislation or a regulatory framework. The ICENS as a nuclear institution focusing on research possess competent and trained personnel having technical and scientific expertise in areas such as training (for public workers and in academia), advice on drafting legislation, nuclear safety, emergency preparedness and response, and radiation protection for people and the environment.

* 1. **The next 30 years**

Jamaica has a history of importing radioactive materials for productive use primarily in medicine, industry, research and agriculture. Nuclear power generation might one day be considered to be a viable alternative to the majority imported energy source, petroleum. A market potential study for nuclear power generation in Jamaica undertaken by the International Atomic Energy Agency (IAEA) in the 1970s determined that Jamaica was below the critical 1,000 MW threshold for deploying nuclear energy economically. Present installed capacity as of 2010, was approximately 815MW and is expected to increase beyond the critical threshold in the near future. Notwithstanding, new research in small modular reactor designs ranging in capacity from thousands of Kilowatts to hundreds of Megawatts increase the feasibility for the deployment of nuclear power in small developing States. However, the current capacity building challenges of human resource development, education and training, and implementation of the impending legislative and regulatory framework are areas that will need to be addressed.

**2. Legal and Regulatory Framework**

**2.1 National impact**

The Bureau of Standards Jamaica (BSJ) in the Ministry of Industry Investment and Commerce (Fig.2) was declared the Radiation Safety Authority (RSA) by a Cabinet approved decision No. 01/11 on January 10th, 2011. The authority of the BSJ is to be extended to regulate the importation, storage, usage, transportation and disposal of radioactive sources. The approval also extends to enactment of legislation to provide the requisite legal and institutional framework for the RSA. Jamaica’s Office of the Parliamentary Counsel delivered the draft to the BSJ as of October 2013.



FIG. 2 Position of the RSA in the Ministry, source [3]

The RSA under the general theme of “Radiation Safety Infrastructure” has enacted the “Jamaica Action Plan” (2012-2014) for managing the national nuclear security regime. Under this action plan there is a prepared draft legislation which supports nuclear safety and security issues with reference to international legal instruments and IAEA guidelines such as the GS-R1 requirements. Cooperation agreements are being established between the RSA and other competent authorities. One of the RSA’s first duties was the establishment of an independent reactor oversight committee to act as the de facto nuclear regulator. The ICENS was also involved in an IAEA led regulator training programme for the BSJ’s RSA personnel for authorization and inspection of its research reactor facility.

**2.2 International impact**

Jamaica in its commitment to exercise peaceful use of nuclear technology has ratified several legally binding international instruments relevant to nuclear safety and security, and is in the process of being party to other important conventions and practices once the relevant local legislation has been implemented. The Terrorist Bombings Convention and the Convention for the Suppression of Acts of Nuclear Terrorism have also been ratified. The Comprehensive Safeguards Agreements was signed in 1978 and Additional Protocols entered into force since 2003. The Convention on The Physical Protection of Nuclear Material (CPPNM) was entered into force since September 15, 2005. TheUnited Nations Security Council Resolution 1540, under Chapter VII, 5 April 2005 - S/AC.44/2004/ (02)/111; 30 May 2013 - S/AC.44/2013/7 has a position of being regularly reported with a continuous projected date of completion. A political commitment was given as of April 23rd, 2013, for the Code of Conduct on the Safety and Security of Radioactive Sources.

**3. Assumed Role of ICENS as a TSO in Establishing and Supporting Nuclear Safety and Security in the Absence of Legislation**

Before the 2011 Cabinet approval of the RSA, the ICENS provided technical support for nuclear safety and security in several areas:

* Immense role in Regional Radiation Safety & Protection- Personal radiation monitoring using TLD badges for workers occupationally exposed to Ionising radiation in Jamaica and other small island states
* Certification of scrap metal free of contamination from nuclear and other radioactive materials in containers for export in the lucrative international scrap trade
* Certificate of accepted NORMs in Fertilizers for import/export
* Certification of the radiological contents for international transport guidelies in sugar export
* Certification of imported goods for general contamination and from nuclear fall-out contamination associated with accidents in Chernobyl (1986) and Fukushima Diiachi (2011)
* Research collaborators with Ministry of Agriculture to determine fall out radionuclides (Cs-137, Pb-210, Ra-226) in Jamaican soil for the determination of land erosion for soil conservation and food security
* Providing training in radiation safety and protection for several user institutions with radioactive sources and radiation emitting instruments, such as the Jamaica Defense Force, the Jamaica Customs, the Post and Telecom of Jamaica and several Industrial Institutions
* Offering nuclear forensics and radioactive source recovery technical support to Kingston’s major transhipment port (for every 90000 container TEU’s occupancies one will have a radioactive signature radioactive, since 2009 -2012)
* Providing lectures for (Radiation Protection and Radiation Biology) the University Hospital of the West Indies School of Medical Radiation Technology
* Enhanced Nuclear Security/Physical security (internal and external)
* HEU repatriation under the GTRI is in progress
* Incident and Trafficking Database (ITDB) Point of Contact, established at ICENS
* Until the Radiation safety Authority (RSA) is fully established in law, and appoints a nuclear security committee (NSC), ICENS is the counterpart for the Integrated Nuclear Security Support Plan (INSSP)
* IAEA Radiation Safety information management System (RASIMS) national coordinator
* IAEA Nuclear Security Information Management System (NUSIMS) national coordinator

**5. Conclusion**

The impending legal framework to support Jamaica’s nuclear and other radiological materials safety and security infrastructures will significantly enhance and strengthen the need of TSOs in Jamaica. To date (2014), Jamaica has not been exposed to any nuclear or other radioactive material accidents, which have occurred in other developing states with immature or non-existent legal and regulatory frameworks. The relevant stakeholders (Jamaica: Defense and Constabulary Forces, Customs, Solid Waste, Maritime Authority, Health Authority, Fire Brigade and the RSA) are aware of the importance of a nuclear and other radioactive material safety and security culture as evident from their interest in lobbying for implementing legislation and other international instruments such as the Code of conduct on the Safety and Security of Radioactive Sources, Convention On The Physical Protection Of Nuclear Material and non-binding instruments such as the INSSP. The ICENS as TSOs in Jamaica has adhered to international best practices and guidelines which have contributed significantly in supporting the enhancement of nuclear and radiation safety and security. ICENS will continue to contribute to the national cause as legislative and regulatory infrastructures become installed, and after, extend our technical support as required by our regulators and the regional and international community. As a Centre for excellence the ICENS is a model institution for collaboration in small developing states with limited personnel and infrastructure.

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