INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND NUCLEAR SCIENCES (ICENS)

Charles Grant MSc, *University of Surrey*
Director General

The 2017/18 period saw ICENS fulfilling major portions of its mandate and mission to be a centre of excellence through its scientific research and the application of nuclear and other advanced technologies towards national and regional developmental needs. To this end ICENS played a major role in the development of the Country Programme Framework (CPF) which articulates the strategic structure for the programme of cooperation between the Government of Jamaica and the International Atomic Energy Agency (IAEA). It is focused on key areas of high priority in line with the national development Framework as well as the mandate of the IAEA namely: Legislative Framework and Regulatory Infrastructure for Radiation and Nuclear Safety and Security; Human Resource Development; Food and Agriculture; Human Health and Nutrition; Management of Water Resources; Environmental Protection;

Radiation Technology and Energy Planning and Industry. ICENS is also assisting Antigua and Barbuda, The Bahamas, Belize and The Common Wealth of Dominica to develop similar documents for their Country Programme Frameworks.

IAEA NATIONAL PROJECTS

The International Centre for Environmental and Nuclear Sciences (ICENS) was involved in one national project during the reporting period: "Upgrading the Research Reactor Infrastructure at the University of the West Indies Slowpoke, Facility JM-1 - JAM1001". The project, under the guidance of the Director General, provides continued support of socio-economic development of Jamaica through research utilizing nuclear sciences in environmental geochemistry, particularly its relation to health, the safety of Jamaican foodstuffs, environmental protection and the development of natural and human resources. Total IAEA budget allocated for this project to refurbish the Nuclear Analytical Laboratory to date is €810,000.00.

IAEA REGIONAL PROJECTS

In his capacity as the Jamaican representative to the Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL), the Director General has purview over 14 projects for the country. Additionally he serves as the regional project lead for:

RLA9081: "Strengthening Cradle-to-Grave Control of Radioactive Source"; this project serves to protect the people and the environment from potential adverse effects of ionizing radiation while enabling and fostering the safe and secure use of radioactive sources to promote sustainable socioeconomic development. Total IAEA budget allocated for this regional project to date is €777,416.22.

The Director General also serves as project counterpart for the following projects:

RLA1012: Developing a Capacity Building Programme to Ensure Sustainable Operation of Nuclear Research Reactors through Personnel Training (ARCAL CLI). The aim of the project is to strengthen the application of the peaceful uses of nuclear technology in participating Member States in Latin America and the Caribbean by supporting targeted human resources development and selected strategic initiatives, including resource mobilization required to increase the socioeconomic impact of the programmes in the region. Local project coordinator is Mr. Haile Dennis. Total IAEA budget allocated for this regional project to date is €590,624.93.

RLA0059: Strengthening Regional Cooperation (ARCAL CLXII). The aim of the project is to enhance regional cooperation by establishing mechanisms aimed at strengthening technical cooperation among developing countries and the regional programming for Latin America and the Caribbean, through ensuring the quality of the ARCAL programme, and promoting communication and partnerships in the region. Total IAEA budget allocated for this regional project to date is €190,575.00.

IAEA INTERREGIONAL PROJECTS

The Director General serves as the project lead for the:"INT0093: Applying Nuclear Science and Technology in Small Island Developing States (SIDS) in Support of the Sustainable Development Goals and the SAMOA Pathway". Countries include: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominican Republic, Fiji, Guyana, Haiti, Jamaica, Marshall Islands, Mauritius, Palau, Papua New Guinea, Seychelles, Trinidad and Tobago and Vanuatu. This interregional project aims at supporting the human and institutional capacity of SIDS in key areas, such as human health, nutrition, food, agriculture, water management, marine environment, as well as safety and security through knowledge and experience-sharing among SIDS. This entails enhancing capabilities in selected interregional resource centres and promoting the cooperation among SIDS. Establishing cooperation among SIDS fulfils the Sustainable

Development Goal (SDG) 17, as global partnerships for sustainable development are being created. The interregional project has operationalized the document "Rationale for an inter-regional project 2018–2021 for Small Island Developing States" as a complement to the existing IAEA Technical Cooperation national, regional and interregional programmes. Total IAEA budget allocated for this regional project to date is €828,806.25.

IAEA COORDINATED RESEARCH PROJECTS

The International Centre for Environmental and Nuclear Sciences (ICENS) was involved in three coordinated research projects during the reporting period.

The first research coordination meeting for the coordinated research project F11021, "Enhancing Nuclear Analytical Techniques to Meet the Needs of Forensic Science" was held in Vienna from November 13–17, 2017. ICENS is involved in the working group related to food fraud and potentially counterfeit pharmaceuticals. Inter-comparison work between international labs has commenced. Mr. Johann Antoine is the principal investigator for this CRP.

The coordinated research project T33001 "Options and Technologies for Managing the Back End of Research Reactor Fuel Cycle" received the final tranche of funding of €4,000. The CRP successfully ended in February 2018. Mr. Haile Dennis was the principal investigator for this CRP.

The coordinated research project J02006, "Enhancing the Effectiveness of Nuclear Security at Research Reactor and Associated Facilities" received funding during the period of €5,000. ICENS is part of task 1 of the CRP, "The assessment of tools used for the evaluation of Physical Protection systems (PPS) for Research Reactor Facilities." These evaluation tools will be used to evaluate PPS at ICENS by December 2018. ICENS is also the lead facility for task 5 of the CRP which is the development of installation and test procedures as well as acceptance criteria for intrusion detection devices. The document is now in draft. Mr. Ronmccrea Cushnie is the principal investigator for this CRP.

HAZARDOUS LABORATORY WASTE AD-HOC COMMITTEE (HALWAC)

The Hazardous Laboratory Waste Clean-Up Ad-Hoc Committee (HALWAC) was constituted in early 2017 by the National Commission on Science and Technology (NCST) under the auspices of the Ministry of Science, Energy and Technology (MSET). The Committee was mandated to provide recommendations for collection, treatment and disposal of chemical waste and obsolete equipment in Government labs and provide recommendations to avoid recurrence of the present issues. HALWAC is chaired by the Director General of ICENS, Mr. Charles Grant; Ms. Leslie Hoo Fung sits on the Committee as a technical adviser, and also provides training.

Following on the initial inventory activities, Ms. Hoo Fung (ICENS) and Dr. Roy Porter (UWI Department of Chemistry) compiled a protocol for characterization of unknown chemicals for distribution to the participant institutions. ICENS has facilitated training and paid internships to a number of students from the University of the West Indies to assist with project activities, including inventory; compilation of a database of hazardous chemical and laboratory waste and MSDS/SDS; and qualitative characterization of unknown chemicals. In particular, several UWI students taking the course CHEM 3402 (Chemical Industries) were placed in internships in 2018 to assist with HALWAC activities.

The Committee conducted a pilot disposal exercise, under an agreement with the Caribbean Cement Company for the incineration of non-halogenated liquid organic wastes, with assistance from ICENS, the UWI Department of Chemistry, and the National Environment and Planning Agency. As part of this disposal exercise, safety training was provided to more than 30 persons from participant organizations.

The Committee has also developed a framework for the adoption of best practices for management and disposal of hazardous chemicals and laboratory waste, and has provided resource materials and guidance for disposal of some types of municipal and chemical waste.

ICENS AIR QUALITY PROGRAMME

The International Centre for Environmental and Nuclear Sciences joined the regional project RLA7023-Assessing Atmospheric Aerosol Components in Urban Areas to Improve Air Pollution and Climate Change Management (ARCAL). Apart from Jamaica, countries participating in the project include, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Panama, Paraguay, Peru and Uruguay. The project is under ARCAL, the Regional Cooperation Agreement for the promotion of nuclear science and technology in Latin America and the Caribbean, a technical cooperation programme of the International Atomic Energy Agency (IAEA). The first research coordination meeting was held in Buenos Aires, from March 20–23, 2018. Jamaica joined the project after it was possible to participate in the meeting but still sent a presentation and will be participating in the Regional Training Course on Method Validation and Quality Assurance of Airborne Particulate Matter Analysis using Nuclear Analytical Techniques to be held from October 18th to 26th, 2018 in San Jose, Costa Rica.

TOXIC SITES IDENTIFICATION PROGRAM (TSIP)/ PURE EARTH

Pure Earth is an organization that partners with various entities to address pollution problems in developing countries. Pure Earth offered TSIP training at ICENS from October 18–19, 2017 to members of staff, as well as students and staff members of the Department of Physics at the University of the West Indies, Mona and Government personnel from the Ministry of Science, Energy and Technology (MSET) and the National Environmental Protection Agency (NEPA). The training course gave participants practical knowledge on the aims of the program including initial site screening protocols, measuring instruments, as well as hands-on experience working with the organizations' database. A practical exercise was carried out during the training course at Mona Commons, a site that had been previously identified as having significantly elevated levels of lead in the soils, to consolidate the information provided in the course. The investigative team included Ms Jhenelle Williams

(ICENS), Mr Andre Gordon (Physics, UWI) and Professor Mitko Voutchkov (Physics, UWI) as the Team Leader and set out to conduct investigations on fifteen (15) sites which included the aforementioned Mona Commons, Frasers Content, Rae Town Fishing Village and a scrap metal facility. The project concluded in April 2018 and the database was populated with site observations and measurements obtained via the portable Niton x-ray fluorescence analyzer.

INTERNATIONAL MEETINGS

ICENS was the host organization for the Regional training course on security in transportation of radioactive material at the Jamaica Pegasus Hotel, December 4–8, 2017. The course was intended to equip regulators and operators from seven participating countries (Jamaica, Dominica Republic, Mexico, Guatemala, Honduras, Costa Rica and Argentina) within the region with the necessary knowledge and tools to plan, implement and maintain an effective transport security program for radioactive materials. The course provided participants with an understanding of the need for security of nuclear material in transport and with information relevant to the development and implementation of national transport security requirements.

ICENS also hosted the second coordination meeting for the IAEA's regional project "Developing a Capacity Building Programme to Ensure Sustainable Operation of Nuclear Research Reactors through Personnel Training", January 22–26, 2018. The project aims to ensure the continued and safe operation of research reactors in the Latin American and Caribbean region through the development of mechanisms to facilitate nuclear knowledge transfer to young research reactor operating staff. The meeting was attended by IAEA representatives as well as experts from research reactor institutions in Jamaica, Argentina, Brazil, Czech Republic, Chile, Colombia, Mexico and Peru.

The Government of Jamaica, through ICENS as the lead organization, hosted the IAEA's Regional Training Course on the "Implementation of Safeguards in States with Small Quantities Protocol", May 14–18, 2018.

This training course further equipped experts who have responsibility for safeguarding nuclear material in their respective countries within the Caribbean region, with additional knowledge necessary to meet their countries' safeguards obligations to the IAEA. Expert lectures were also presented by staff of ICENS. The course was attended by 21 participants from Jamaica, the Bahamas, Bolivia, Costa Rica, Ecuador, Guatemala, Panama, Paraguay, Saint Kitts and Nevis and Saint Vincent and the Grenadines along with experts from the IAEA.

INTER-GOVERNMENTAL PANEL ON CLIMATE CHANGE, CARBON BIOGEOCHEMISTRY PROJECTS

Dr. Adrian Spence continued his work on the Intergovernmental Panel on Climate Change (IPCC) including an invitation to serve as a Lead Author for Chapter 7, Agriculture, Forestry and other Land Uses (AFOLU) of the IPCC Sixth Assessment Report (AR6). He also has completed the first order draft of, "Climate change and land: an IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security and greenhouse gas fluxes in terrestrial ecosystems". He has also attended the IPCC First Lead Author Meeting, Special Report on Climate Change and Land, Norwegian Environment Agency, in Oslo, Norway, October 16–20, 2017; the IPCC Expert Meeting on Assessing Climate Information for Regions (smr H545) at the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, May 16–18, 2018 and the IPCC Second Lead Author Meeting Special Report on Climate Change and Land. Ministry of the environment, Christchurch, New Zealand, March 26–30, 2018. He also serves as consultant scientist for the Agrobiodiversity, Indigenous Knowledge and Protected Area Management in the Rio Grande Valley, Jamaica and KwaZulu-Natal, South Africa Project and the World Bank's Program on Forests (PROFOR): Assessing ecosystem services provided by mangroves, Jamaica. Dr Spence also serves as technical advisor to the Resilient Islands by Design Project: Integrating Ecosystem- and community-based Approaches to Enhance Climate Change in the Caribbean project in Jamaica. Implementing partners: The Nature Conservancy (TNC)

and the International Federation of the Red Cross and Red Crescent Societies (IFRC). Funded by the International Climate Initiative (IKI) of the German Federal Ministry of the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

PAPERS PRESENTED

C.N. Grant, J.M.R. Antoine, "Utilisation of the Jamaica SLOWPOKE reactor in environmental and health studies". EnvIMEKO 17 – 7th IMEKO TC19 Symposium on Environmental Instrumentation and Measurements Aguascalientes, Mexico, August 3–4, 2017 (oral presentation).

J.M.R. Antoine, C.N. Grant, "Non-destructive determination of the 40K in Marijuana and the effective does to the body." EnvIMEKO 17 – 7th IMEKO TC19 Symposium on Environmental Instrumentation and Measurements Aguascalientes, Mexico, August 3–4, 2017 (oral presentation).

H.T. Dennis, C.N. Grant, T.A. Warner, G.C. Lalor, "Determination of Trace Elements in Blood by Total X-ray Fluorescence (TXRF) Analysis." EnvIMEKO 17 – 7th IMEKO TC19 Symposium on Environmental Instrumentation and Measurements Aguascalientes, Mexico, August 3–4, 2017 (poster presentation).

REFEREED JOURNAL ARTICLES

H.T. Dennis, C.N. Grant, J.A. Preston. "Radiation and criticality safety analyses for the highly-enriched uranium core removal from a research reactor." *Applied Radiation and Isotopes* 129 (2017) 152–155.

C.N. Grant, J.M.R. Antoine. "Instrumental neutron activation analysis in forensic science in Jamaica: The case of the Coral Springs beach theft." *Forensic Chemistry* 7 (2018) 88–93.

M. Guevara, et al., **A. Spence**, et al. "No silver bullet for digital soil mapping: country-specific soil organic carbon estimates across Latin America." *Soil* 4, (2018) 173–193; DOI: 10.5194/soil-4-173-2018.

INVITED LECTURES

- **A. Spence**. Soil organic carbon sequestration and its implication for climate change mitigation and adaptation. College of Agriculture, Science and Education, Portland, Jamaica, September 21, 2017.
- **J.M.R. Antoine**. Considerations for delivering analytical services of research reactors for forensic end users. 1st Research Coordiation Meeting on Enhancing Nuclear Analytical Techniques to Meet the needs of Forensic Sciences, November 13–17, 2017 Vienna, Austria.
- **C.N. Grant**. Introduction to Instrumental Neutron Activation Analysis and Radioisotope Production for Low Power Reactors, 20–24 November 2017, Agencia Boliviana de Energía Nuclear, La Paz, Bolivia.
- **C.N. Grant**. Strengthening the Capacities of Research Reactors for Safety and Utilization, 16–20 April, 2018 Ghana Atomic Energy Commission, Accra, Ghana.
- **A. Spence**. Climate change adaptation and Infrastructure planning and design. Development Bank of Jamaica, Kingston, April 26, 2018.
- **A. Spence**. Climate change and Jamaican agriculture: adaptation, mitigation and program design imperatives. Ministry of Industry, Commerce, Agriculture and Fisheries (MICAF). Kingston, May 30, 2018.
- **A. Spence**. Climate change and sustainable land management: implications for national food security. Agricultural Land Management Division, Ministry of Industry, Commerce, Agriculture and Fisheries (MICAF). Kingston, June 19, 2018.

PUBLIC SERVICE

Mr. Johann Antoine

– Chair, National Mirror Committee/ISO TC/93 Starch-including derivatives and by-products (Bureau of Standards Jamaica).

Mr. Charles Grant

- Member of National Bioethics Committee;
- ARCAL National Coordinator (Jamaica), and member of the ARCAL;
- Technical Coordination Board (OCTA which oversees all ARCAL Projects);
- Member, Ministry of Energy Committee on Nuclear Energy as an option for Jamaica;
- Member, NEPA/UNDP Committee for renewable wave energy technologies for the generation of electric power in small coastal communities in Jamaica;
- National Coordinator for Incident Reporting system for Research Reactors;
- National Coordinator, IAEA Radiation Safety Information Management System; (RASIMS);
- Chair, Hazardous Laboratory Waste Ad-Hoc Committee (Ministry of Science, Energy and Technology/ National Commission on Science and Technology).
- Member, National Bioethics Committee

Ms. Leslie Hoo Fung

- Chair, National Food Standards Committee/ ISO TC/34 Mirror Committee (Bureau of Standards Jamaica);
- Member, Codex Committee on Methods of Analysis and Sampling (Bureau of Standards Jamaica);
- Member/Technical Adviser, Hazardous Laboratory Waste Ad-Hoc Committee (Ministry of Science, Energy and Technology/ National Commission on Science and Technology);
- ISO/IEC 17025 Assessor (Jamaica National Agency for Accreditation);
- Member, Soil Health Technical Working Group (Ministry of Industry, Commerce, Agriculture and Fisheries, Jamaica);

– Member, Royal Society of Chemistry;

– Member, AOAC International;

– Member, Board of Studies, School of Science, Technology, Engineering & Mathematics (STEM), Excelsior Community College, Kingston, Jamaica.

Mrs. Sandra Hunter

– Fellow of the Institute of Chartered Accountants, Jamaica.

– Mr. John Preston

– Member, Land Information Council of Jamaica;

– Independent Member, GOJ Telecommunications Appeals Tribunal.

Dr. Adrian Spence

– Member of the Geochemical Society;

– Member of the American Chemical Society;

– Member of the Royal Society of Chemistry;

– Chemistry Ambassador and Co-Advisor, American Chemical Society (ACS) Student Chapter, UWI.