

INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND NUCLEAR SCIENCES (ICENS)

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PhD Lond – Director General

THE CENTRE

The year's work focused mainly on agricultural and health consequences of trace elements in the Soil ► Food ► Human chain. This involved studies on elemental composition of Jamaican foods, soil-food elemental transfers and trace elements in humans. Work is also underway on various peaceful uses of the atom, including the investigation of the feasibility of nuclear power to contribute to Jamaica's midterm energy needs.



Population exposures to cadmium have been determined for a selected population in central Jamaica and the possible effects of this exposure on human mortality and morbidity are being examined. Although cadmium is generally considered one of the most toxic of the trace metals, its effects on mortality and morbidity in Jamaica are not first order. However cadmium levels in export foods are strictly regulated so there is the possibility of socio-economic consequences.

Investigations continued on the influence of trace elements on diseases of high incidence in Jamaica e.g. cancer, diabetes, hypertension and renal disease, These are being supported by collaborations with the UWI Health Centre, the Faculty of Basic Medical Sciences, the Ministry of Health, and the Ministry of Agriculture.

New collaborations are being developed with: (1) the Police Forensic Laboratory to assist with examinations of "sudden death" cases that might be caused by heavy metal poisoning and the application of geochemistry to forensic investigations; (2) the British Geological Survey in investigations of the bioavailability of cadmium in Jamaican

soils and its transfers to plants; and (3) Brunel University on the application of x-ray diffraction and transmission electron microscopy to heavy metals in Jamaican soils.

For the second year, ICENS was invited to participate in a programme of Proficiency Testing organized by the Hong Kong Government Laboratory in collaboration with the Hong Kong Accreditation Service, under the auspices of the Asia-Pacific Laboratory Accreditation Cooperation. 102 participating laboratories (two from Jamaica) carried out measurements of cadmium and lead concentrations in a sample of plant material used as a herbal medicine. ICENS' performance was excellent, with the results for both elements well within the acceptable range in contrast to the 21% and 14% of participating labs that produced either “questionable” or “unacceptable” results respectively for lead and cadmium.

Shortly before the 2007 Christmas season, ICENS and the Bureau of Standards Jamaica carried out a pilot programme screening 84 items of children's toys for lead content. A Memorandum of Understanding for collaboration between ICENS and the BSJ was drafted.

The main problems during the year have been the maintenance of the atomic absorption spectrometer and the identification of staff with expertise and experience not presently available in Jamaica.

Public Awareness

Staff participated in raising public awareness with newspaper articles, radio and television programmes on environmental pollution, lead hazards for children and aspects of nuclear energy. Community sensitization programmes were carried out in communities considered to be at risk from cadmium and lead. One such event was the Lead Safe Health Day conducted as part of a project funded by CHASE in February 2008. The first National report on Chemicals in the Jamaican Environment was widely circulated. The report focuses on effects of lead on children in Jamaica and provides information and recommendations to mitigate and control the problem. Exposure to lead continues to attract worldwide attention and childhood lead poisoning has recently been correlated with violence in adults in several countries.

Research and Development

Specialised Instrumentation

Aspects of the work have been delayed by problems with equipment malfunctions which are being slowly resolved. Our 12 year old Perkin-Elmer Atomic Absorption Spectrometer is being nursed to extend its useful life while funds are being sought for a newer instrument. The SLOWPOKE reactor continues to be a work horse of the analytical work; The Total Reflection X-ray Fluorescence system put into full service will assist in ongoing work on foods and plants, and a new programme aimed at understanding the trace element contents in human blood, urine and some tissues of normal and diseased persons has begun.

Radioactivity

Discussions are nearing completion for the formation of a partnership of reactor facilities in Jamaica (ICENS), Mexico (JNIN), Columbia (INGEOMINAS), and Austria (ATOMINSTITUTE), with the assistance of the IAEA. The “Caribbean Reactor Coalition” is expected to advance the usage of research reactors in the Caribbean region, and open up shared access to scientific and experimental research, training, and irradiation services available at the centres, to countries without research reactors. ICENS is to be designated “Neutron Activation Analysis” Centre within the coalition.

Work continues in collaboration with Instituto Nacional de Investigaciones Nucleares (ININ) of Mexico and the UWI Department of Geography and Geology looking at radon concentrations in the Above Rocks area covering two major lithologies.

Food, Nutrition and Health

Work continues on:

- the concentrations and distributions of elements in Jamaican soils and foods;
- productivity of Jamaican soils;
- dietary patterns and consequent elemental intakes from food;
- cadmium concentrations and renal function biomarkers in urine.

Lead Contamination

Much progress has been made in generally reducing the blood lead levels of children but there remain a number of children and adults, who were once severely lead poisoned, and who keep turning up with blood lead levels in or near to the emergency range. This emphasizes the need for long-term continuing medical follow-up of lead poisoned children. A programme on lead concentrations in donated blood is underway to estimate the potential risk to children who receive transfusions.

ICENS' Databases

ICENS maintains what is now probably the Caribbean's largest geochemical databank on over 14,500 samples of soils, stream sediments, rocks, surface- and ground-water, air particulates and food; human and animal tissues, urine and blood. There are presently over 200,000 analytical data records, and more than 45,000 text, maps, photographs and satellite imagery records. The databases provide standard database, document, photo and multi-media content that, with GPS and GIS, allow spatial assessments; interpretations, correlations and predictions.

Objectives for 2008 - 2009

Research and development activities will continue in environmental geochemistry, agriculture, the environment, health, food and nutrition, elemental composition of Jamaican foods, essential element deficiencies in crops, trace elements in the human body, soil-food elemental transfer processes and the socio-economic and health consequences thereof. The main focus for the year will be the work on cadmium and its potential effects on public health.

Identification and employment of senior staff is also being undertaken in an effort to build and strengthen ICENS capacity and to help build collaborations with local and international institutions.

Teaching

ICENS does not offer formal teaching except for a few topics mainly for Applied Chemistry undergraduate and graduate students on Neutron Activation Analysis and X-ray Fluorescence techniques. Two younger members of staff are registered for MPhil degrees based on their on the job research in ICENS.

ICENS again collaborated with the University of Michigan by providing summer research experience for two undergraduates as part of its Minority Health International Research Training programme. As usual the Centre accommodated many tours of the facility by students from diverse educational institutions locally and regionally.

Staff Training

Staff training was facilitated by:

- visits of experts from the British Geological Survey, the Canadian Geological Survey and the Department of Health Sciences, University of Michigan, funded mainly by the Caribbean Development Bank;
- training in Environmental Radioactivity Analysis and Measurement Techniques in Tokyo, Japan funded by the Japan International Cooperation Agency (JICA).
- workshops/training sessions/seminars held in various institutions regionally and extra-regionally including Lima, Peru, the Comisión Chilena de Energía Nuclear (CCHEN) in Santiago, Chile, and Vienna, Austria, funded by the International Atomic Energy Agency; and
- a scientific visit to University of Texas at El Paso.

PAPERS PRESENTED

- **Lalor, G.:** “The work of ICENS”, COMSATS 11th Coordinating Council Meeting; Beijing, China, June 24-26, 2008.
- **Rattray, R.:** “Environmental Geochemistry and Health in Jamaica”, Ninth Annual Science Symposium, Northern Caribbean University, Mandeville, April 1-5, 2008.
- **Grant, C.N.:** “Human Resource Development and Nuclear knowledge Management”, International Atomic Energy Agency Regional Workshop, Lima, Peru, March 10 - 14, 2008.
- **Antoine, J.A.:** “Jamaican Application of the Code of Conduct on the Safety of Research Reactors”, Regional Meeting on the Code of Conduct on the Safety of Research Reactors, Comisión

Chilena de Energía Nuclear (CCHEN), Santiago, Chile, December 10- 14, 2007.

- Wright, P., Lalor, G., Rattray, V., and Hanson, R.: “Health Consequences of Exposure to Diet Sourced Environmental Cadmium in Central Jamaica”, 8th Conference of ISTERH; IXth Conference of Nordic Trace Element Society (NTES); VIth Conference of the Hellenic Trace Element Society (HTES), Heraklion, Crete, Greece, October 21-25, 2007.

PUBLICATIONS

- * Robert G. Garrett, Anthony R.D. Porter, Patricia A. Hunt and **Gerald C. Lalor**. “The presence of anomalous trace element levels in present day Jamaican soils and the geochemistry of Late-Miocene or Pliocene phosphorites”. *Applied Geochemistry* 23, 4 (2008) 822-834.
- * Garrett, Robert **G. Lalor, Gerald C., Preston, John, Vutchkov, M.K.** “Variation in geochemical background levels for Jamaican soils”. *Geochemistry: Exploration, Environment, Analysis*, 8, 2, (2008) 149-156.
- * **Gay-Ann DaCosta, Gerald Lalor, Mitko Vutchkov**, Nicole Wynter and Delroy Anderson “Contributions to Cadmium in Jamaican Soils from Phosphate Fertilizer” *Jamaican Journal of Science and Technology* 16 and 17, (2005-2006) 18-25.
- * Leslie Hoo-Fung, Gerald Lalor and Robin Rattray. “Effect of Cooking and Extraction with Simulated Gastric Juice on the Cadmium Content of Selected Foods”. *Jamaican Journal of Science and Technology* 16 and 17, (2005-2006) 26-29.

INCOME GENERATION

The major research grants were:

Organisation of American States (OAS).

2008-2012: “Institutional Strengthening for Promoting Best Practices in Science and Technology for the Caribbean States” – US\$400,000.

International Atomic Energy Agency (IAEA)

2007 - 2008: “The Application of Nuclear Techniques to Food Safety and Health in Jamaica” – US\$150,000.

2007 - 2010: “Nutritional Status and Exposure to Toxic Elements of Jamaican Children” – US\$134,030.

PUBLIC SERVICE

Professor Gerald Lalor

- Honorary Chairman, Gleaner Company
- Director, Blue Cross/Blue Shield; Insurance Company of the West Indies
- Board of Governors, ICWI Group Foundation
- Member, Third World Academy of Sciences (TWAS)
- Member, The Royal Society of Chemistry
- Member, New York Academy of Sciences
- Member of Editorial Boards: Environmental Geochemistry & Health; Jamaica Journal of Science & Technology; The Science of the Total Environment

Dr. Robin Rattray

- Member, Air and Water Quality Subcommittees, National Environment and Planning Agency
- Recording Secretary/Vice President, Laboratories Association of Jamaica
- Director, Lions Club of Mona.

Dr. Gladstone Taylor

- Member, Executive Council, Inter-American Institute for Global Change Research.

Mr. John Preston

- Member, Land Information Council of Jamaica
- Member, Telecommunications Appeals Tribunal.

Mrs. Joan Thomas

- Member, Radiation Protection Advisory Committee of Jamaica.
- Member, Inner Wheel Club of Kingston.

Ms. Leslie Hoo Fung

- Member, Standards Development Committee, Bureau of Standards Jamaica

Ms Kemeaka Duncan

- Regional Secretary, Caribbean Association of Medical Technologists
- Member, Advisory Committee for Medical Technology UTECH.