

## INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND NUCLEAR SCIENCES (ICENS)

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Lond – Director General

### WORK OF THE CENTRE

During the year, ICENS carried out extensive collaborative activities on cadmium in Jamaica with: the Department of Sociology, Psychology and Social Work, the Health Centre, the Faculty of Medical Sciences the Caribbean Food and Nutrition Institute, the Ministry of Agriculture, the Ministry of Health, the Rural Agricultural Development Agency, Rural and Physical Planning Agency, Research and Development Institution (CARDI), and Federal University of Mato Grosso, Brazil. Much progress has been made and detailed data are becoming available on the transfer of potentially toxic elements from soil through food to people; exposures from diet and possible mitigation steps that might be employed. There is now evidence of incipient renal damage in some cases.



Staff skills were increased by work with consultants, overseas training and scientific visits; sponsored mainly by the Caribbean Development Bank, the International Atomic Energy Agency and International Development Research Centre.

Efforts were made to increase public awareness in science and technology by staff participation in radio programmes on trace elements, environmental pollution, lead hazards in Jamaican children and aspects of nuclear energy.

A prime concern during the year has been nuclear security and the replacement of the present highly enriched uranium core of the SLOWPOKE reactor with one of lower enrichment. Officials from the US Department of Energy and Sandia National Laboratory visited ICENS on two occasions. They have provided enhanced security for the Centre and agreed to fund the core replacement hopefully in 2008.

A distinguished gathering headed by the Governor General, His Excellency Professor Kenneth Hall and the past Governor General, His Excellency Sir Howard Cooke, attended a ceremony to commemorate the naming of the building housing ICENS as the “Gerald Lalor Building”.

### **Research and Development**

ICENS continued the exploration of themes that affect health, food intake, small farming vulnerability, crop contents and land use that provide data and interpretations likely to contribute in the solution of important national problems. The main examples are:

#### **The soil ► food ► human ► health chain**

Food composition studies are underway: this year the concentrations of 37 elements in some food crops and meats were measured and the uptake of some 40 elements in agricultural products and the concentrations of these in the soils on which the crops are grown, were examined. These data are useful for nutrition, public health and to help meet the food regulations of importing countries.

Cadmium is the element of greatest concern at present. Significant quantities have been identified in foods grown in certain locations and studies of cadmium and a small protein in urine provide evidence of incipient renal tubular disease in some members of the population.

#### **Lead**

Lead poisoning in Jamaica is now largely caused by contamination from the smelting of lead from old automobile batteries. Some locations of the smelters in Kingston and St. Andrew, provided by the Ministry of Health, yielded a number of soil samples with extremely high concentrations of lead. Three hundred and twenty-two (322) children attending basic schools in the neighbourhoods were examined and eight (8) were found to have significantly elevated blood lead levels. Two of these, who unfortunately keep turning up in studies in this part of Kingston, were again referred to the Bustamante Hospital for Children for emergency treatment. Remedial measures were taken for the other six children.

### **Radioactivity in the Jamaican Environment**

Relatively high levels of radioactivity occur naturally in the Jamaican environment in rocks and also in bauxites which contain significant levels of uranium and thorium. An examination of the occurrences of radioactivity is underway in collaboration with Mexico. The radioactive gas radon, known to induce lung cancers, has been observed in four public access caves in northern Manchester that show radon levels above the 1000 Bq/m<sup>3</sup> accepted as the work place limit. Further data will be obtained to enable examinations of risk analyses.

### **ICENS' Databases**

ICENS continued to expand its database which now contains well over 250,000 analytical data entries on over 15,000 samples of soils, rocks, surface and ground water, stream sediments, air particulates, food, blood, urine, animal and human kidney and liver tissues, geographically referenced information on topography, climate, vegetation, land use, geology, and mineral deposits.

The data are complimented by the satellite imagery, including one metre resolution IKONOS satellite images for the entire island. Google Earth, with some Jamaican data overlays and visual links between the various data sets, is used for spatial viewing. Computer interfaces are being improved to allow remote access by collaborators and other authorised users.

### **Specific Objectives for 2007 - 2008**

The main objectives for 2007 – 2008 are to:

- a) Identify and employ new senior staff.
- b) Extend research and development projects in:
  - i. Environmental Geochemistry and Geochemical Mapping of Jamaica including natural radioactivity;
  - ii. The elemental composition of Jamaican foods;
  - iii. Soil-food elemental transfer processes and the socio-economic and health consequences thereof;
  - iv. Land utilization and crop selection;
  - v. Trace elements in the human body;
  - vi. Essential element deficiencies in agricultural crops;

- vii. Peaceful uses of the atom, including possibilities for utilization of nuclear energy in small states.
- c) Upgrade staff skills.
- d) Strengthen collaborations with local, regional and international institutions and with eminent individuals in related fields.
- e) Increase public awareness in science and technology.
- f) Produce two national reports on chemicals in the Jamaican environment.
- g) Expand and strengthen the ICENS databases and information systems to increase the availability of research data to stakeholders.
- h) Complete the formal framework for the transformation of the Centre for Nuclear Sciences into the International Centre for Environmental and Nuclear Sciences.

### **Teaching**

Although some members of the Academic staff participate in teaching programmes, ICENS does not offer formal teaching except for a few topics mainly for Applied Chemistry undergraduate and graduate students on using Neutron Activation Analysis and X-ray Fluorescence techniques.

### **Training**

Various staff members attended workshops/training sessions/ seminars held in various institutions regionally and extra-regionally including ININ in Mexico, Pan American meeting on Strengthening Implementation and International Instruments for enhanced Nuclear Radiological Security, Quito, Ecuador, IAEA in Austria, the Geological Survey of Canada (GSC), Ottawa, and the Caribbean Regional Workshop on Research Reactors, Lima, Peru; Ecole Polytechnique, Montreal, Canada.

Mr. John Preston visited with the Geological Survey of Canada in Ottawa, Canada to observe their techniques of data management, dissemination, client and public access.

## **PAPERS PRESENTED**

G.C. Lalor

- “Toxic Elements in the Jamaican Environment”, 10th Meeting of COMSATS Coordinating Council, Cairo, Egypt, June 2007.
- “Computers past and future” Jamaica Computer Society Conference, Montego Bay, October 2006.

C.N. Grant

- “Small Reactor Neutron Activation Analysis in Environmental and Health Studies”, IAEA Technical Meeting on Utilization of Small & Medium Research Reactors, Vienna, Austria, May 2007.
- “Safety and Security of the SLOWPOKE II reactor at ICENS Jamaica”, IAEA Technical Meeting on Safety and Security of Research Reactors under project and supply agreement, in Vienna, Austria, March 2007.
- “Nuclear Power for Small States”, 19th Annual Conference on Science and Technology, Kingston, November 2006.
- “The Jamaican SLOWPOKE HEU-LEU Core Conversion”, IAEA Technical Meeting on National Experiences on Return of Research Reactor Spent Fuel to the Country of Origin, Vienna, Austria, August September 2006.
- “Operations and Radiation Safety of the SLOWPOKE-II Reactor in Jamaica”, Latin America and Caribbean Regional Workshop on Research Reactors, Lima, Peru, August 2006.

Mitko Voutchkov

- “Lead and Cadmium in Jamaica”, 11th World Congress on Public Health: Panel on An Ecosystem Approach to Environmental Pollution and Public Health in Rural Areas Research to Policy Linkages, Rio de Janeiro, Brazil, August 2006.

## **PUBLICATIONS**

### **Referred Journal Articles**

*WIMJ* = *West Indian Medical Journal*

- \* G. Lalor, M. Vutchkov, and S. Bryan “Blood lead levels of Jamaican children island-wide”. *Science of the Total Environment* 374, (2006): 235-241.
- \* G. Lalor, M. Vutchkov, and S. Bryan. “Acute Lead Poisoning Associated with Backyard Lead Smelting in Jamaica”. *WIMJ* 55, 6 (2006): 394-398.

### **Technical Report**

- \* C. Grant, G. C. Lalor and J. Preston, the Jamaican SLOWPOKE HEU-LEU Core Conversion, IAEA TECDOC, 2007.

## **INCOME GENERATION**

The major research grants were:

### **IDRC**

2004 – 2007. Ecohealth Consequences of Heavy metals in Jamaica. (CAD)\$480,000.

### **IAEA**

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

### **CHASE Fund**

2006 – 2007 “The Health implications and interventions in communities associated with lead acid battery smelting and recycling”. J\$4 Million.

## **PUBLIC SERVICE**

Professor Gerald Lalor

- Honorary Chairman, Gleaner Company

- Director, Blue Cross/Blue Shield; Insurance Company of the West Indies, Board of Governors of the ICWI Group Foundation
- Member, Third World Academy of Sciences (TWAS); Commission on Science and Technology for Sustainable Development in the South (COMSATS); National Commission for Science and Technology (NCST); Technical Committee of the Scientific Research Council. The Royal Society of Chemistry; the New York Academy of Sciences; the American Chemical Society
- Member, Editorial Boards: Environmental Geochemistry & Health; Jamaica Journal of Science & Technology; The Science of the Total Environment; Revista Latino-Americano Quimica.

Dr. Robin Rattray

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

Dr. Mitko Vutchkov

- Member, Product Research & Development Committee, Scientific Research Council
- Council Member of the Jamaican Society of Scientists and Technologists (JSST)

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

Mr. Charles Grant

- Member, organizing Committee for The Faculty of Pure and Applied Sciences 8th Research Conference.

### **STUDENT MATTERS**

Due to limited funds the usual summer training programme mounted by the Centre for undergraduate students was severely curtailed, but the Chemistry Department's Work Study Programme was accommodated as usual.

ICENS again collaborated with the University of Michigan (UMICH) by taking part in its Minority Health in Research Training programme. Three UMICH undergraduate students spent June - July 2006 at ICENS and participated in its research activities.