INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND NUCLEAR SCIENCES (ICENS)

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HIGHLIGHTS OF THE WORK OF THE CENTRE

irtually every large item of equipment at ICENS has required major attention during the year. The SLOWPOKE reactor has had to be re-shimmed to restore the nominal reactivity, and for the first time the adjustment was done in house by our Chief Reactor Operator, who in preparation for such a situation had observed several shimmings performed by AECL in Canada, assisted by an overseas technician funded by the IAEA. This will allow for the continued operation of the reactor in its present



configuration until after 2015 and, as a detailed ICENS re-shimming manual is being prepared, it is expected that if necessary future normal re-shimmings will also be performed in house. However, there is some progress on the promised exchange of the present high enrichment uranium core for a low enrichment core and hopefully this will occur during the next 5 years. Several gamma ray detectors have been sent away for repairs and should be back in use within a couple of months. All these repairs were funded by the IAEA.

The (now obsolete but still potentially valuable) graphite furnace atomic absorption spectrometer continues to defeat our efforts and the advice of the manufacturer, on repairs. However, an inductively coupled plasma optical emission spectrometer, provided by a grant from the CHASE fund, was installed in June 2009. This significantly enhances our data generation capabilities.

Laboratory downtime was compensated to some extent by intensive training programmes. For example in the nuclear analytical laboratory

alone, training amounted to 7 man months, in areas such as total reflection XRF, reactor operations, and interdiction of weapons of mass destruction. An immediate outcome of this is that the long disused total reflection x-ray fluorescence spectrometer is now fully operational and performing well.

Mr. Johann Antoine completed his training and has been successful in the examinations for SLOWPOKE Reactor Operator Grade 1.

The 'ICENS Newsletter' has been launched by members of staff to provide a new medium for internal communications and interaction with the public.

Radiation Monitoring/Personnel Dosimetry

The ICENS radiation monitoring service now covers over 1000 users in Jamaica, Barbados, the Cayman Islands and the Turks and Caicos islands. The Port Authority, now a very large user of radiation-based detection equipment, became a client and consequently two members of ICENS' staff received training hosted by Nuclear Security Administration (NNSA)/Department of Energy at the Hazardous Material Management and Emergency Response Training and Education Center in Richland, WA. This training included the detection of radiological and nuclear material in containers slated for export, as part of the US effort to protect their country from terrorists.

Collaborations

Collaboration was re-established between the BGS and ICENS and some joint work has commenced. New collaborations are developing with the Caribbean Agriculture Research and Development Institute (CARDI), the Ministry of Agriculture, and the Centre for Excellence in Agriculture. These are particularly important in ensuring good fits with national plans and priorities and in data interpretation. ICENS is a member of the newly formed Government of Jamaica Heavy Metals Task Force. Their present focus is on lead and this introduces another channel to present information on findings that may require government intervention.

ISO Accreditation

As a step towards accreditation to the international standard ISO17025, ICENS' labs have been assessed by Dr Elizabeth Zeiller, a German Quality Auditor. Three members of staff have been trained in

the relevant preparation of analytical documentation, quality assurance, quality control requirements and in other relevant matters. Two of these staff members have been invited to be trainers in the national ISO 17205 programme and have received further relevant intensive training.

RESEARCH AND DEVELOPMENT IN PROGRESS

The major research focus for the year has been on extending geochemical data on soils and understanding elemental transfers from soils to food and humans. The main objectives of this work are to:

- Improve food security and nutrition
- Contribute to agricultural land use and productivity
- Assist in environmental protection
- Help ensure that the quality of Jamaican foods meets international health standards.

Geochemical Studies

This is the basic background study. Detailed soil composition data are now available for St. Elizabeth and Manchester and areas of Clarendon and St Ann obtained at a sample density of 1 in 4 km2. In some regions even greater sample densities have been obtained. These data are attracting new applications and queries e.g. forensic investigations (studies of the beach sand theft) and possible chemical risks due to the dredging of offshore sediments.

Food and Nutrition

ICENS continues to produce data on the elemental composition of Jamaican foods. The levels of cadmium, which is almost universally regarded as a very toxic substance, remain of concern. The human intake is significant, but evidence for its contribution to mortality or morbidity in Jamaica remains slight. Mercury is also receiving special attention as international interest in mercury is approaching one of its periodic peaks and we are finding fairly high levels in some local salt water fish.

The collaboration with CARDI on the elemental uptake of varieties of sweet potato is producing interesting results and, similar uptake studies

have begun with the Ministry of Agriculture on 20 of their priority crops.

These data also contribute to an IAEA project entitled "Nutritional Status and Exposure to Toxic Elements of Jamaican Children".

Public Health

Much of ICENS' work has implicit public health applications. The areas of present concern are:

Lead Contamination

Earlier mitigation efforts in the Kintyre area, a previous lead "hot spot", have to a large extent withstood the severe rains experienced in recent years. Of continuing concern however are:

- the lingering number of children and adults, who were once severely lead poisoned and still continue to exhibit lead levels much above acceptable standards despite many efforts by ICENS staff.
- the significant number of children with blood lead levels above the internationally accepted levels but below levels considered medical emergencies;
- adult occupational exposures.

ICENS' work on lead has received favourable comment in a recent issue of Bulletin, a publication of the International Atomic Energy Agency http://www.iaea.org/NewsCenter/Multimedia/PhotoEassays/Lead_pollution/.

Cadmium toxicity

Surprisingly, the extremely high levels of cadmium in some Jamaican soils reflected in some foods and in humans, appear to produce no obvious health effects on the population except for an increase in concentrations of a small protein in urine with increased cadmium intake. Based on the present worldview, this requires clarification.

Elemental constituents of human tissues

Methodologies are being developed for a significant expansion of previous work on the concentrations and distributions of elements in humans as functions of: age, gender, geographic distribution, and where it is relevant, health status. The methodology for blood has been worked out and some data are being examined.

Nuclear Energy for Jamaica

The first report of a prefeasibility study on the applicability of nuclear power for Jamaica is being prepared. It seems clear that manageable reactors of suitable size will be available and desk studies are focussing on costs, availability and potential time-windows of opportunity in the island projections for capital expenditures for electricity plants for example, as well as the preliminary steps that would have to be taken to introduce one or more of these small nuclear power plants.

Database and Information Systems Development

In addition to ICENS' in house developments there are 2 main initiatives:

Digital Repository to Support a Data Sharing Platform for Jamaican Public Sector Agencies

In collaboration with the Environmental Division in the Office of the Prime Minister, the National Solid Waste Management Authority, and the Chemistry Department of the UWI, work has begun on the creation of a pilot environmental data sharing repository. ICENS is developing a flexible information storage and access framework that does not add any burden to the primary data collection mandate of institutions and which will provide efficient access to an of digital resources across a diverse set of users and applications. ICENS will host the pilot network and provide technical assistance in its development.

Institutional Strengthening for Promoting Best Practices in Science and Technology for the Caribbean States.

This project is supported by the OAS to develop an appropriate database and information delivery system linking Jamaica, Barbados, and Trinidad and Tobago, to be used to interpret and apply S&T information for socio-economic development. A pilot has been launched to help determine the main kind of S&T information that is required by decision and policy makers, the present sources of such information, and any gaps that exist in the information presently available.

Participation in IAEA Regional Programmes

ICENS joined the participants in two initiatives, namely:

Supporting the introduction of Nuclear Energy (ARCAL XCV).

A project to strengthen national and regional infrastructures in Latin America and the Caribbean for the planning and development of nuclear power programmes.

Supporting a Sustainable Increase in the Use of Research Reactors in the Latin American and Caribbean Region through Networking, Exchange of Experience, Knowledge Preservation and Training of Human Resources (ARCAL CXIX).

This project will provide training and the modernisation of some facilities. Based on a memorandum of understanding between Colombia, Jamaica, Mexico, Austria and the IAEA to combine efforts to promote the use of research reactors, the Caribbean Research Reactor Coalition has been formed to provide irradiation services and products and nuclear related education and training to scientific, educational, Government and commercial entities in the Caribbean and Central America.

PAPERS PRESENTED

- Grant, C.N., The Jamaican Slowpoke-2 Research Reactor: Neutron Activation Analysis in Environmental and Health Studies, 10th annual conference on Research Reactor Fuel Management (RRFM), European Nuclear Society (ENS). 22-25 March 2009.
- Grant, C.N. "Caribbean Research Reactor Coalition, CRRC" First Project Coordination Meeting on Supporting a Sustainable Increase in the use of Research Reactors in the Latin American and Caribbean Region Through Networking, Exchange of Experiences, Knowledge reservation and Training of Human Resources, Bariloche, Argentina, 2-6 March 2009.
- Wright, P. Beta-2 Microglobulinuria in a Jamaican population exposed to cadmium through Diet. First Conference on "Practical Applications of Medical Geology", British Geological Survey (BGS), March, 2009.

- Preston, J. Aspects of the Operation of the ICENS SLOWPOKE-II Research Reactor, and Decommissioning Plans. IAEA Regional Workshop on "Decommissioning of Facilities Using Radioactive Material", Ezeiza, Argentina, 27-31 October 2008.
- Rattray, R. "The Roadmap to Accreditation in 20 Milestones" and "Laboratory Quality Improvement the Role of Proficiency Testing". The Trinidad and Tobago Bureau of Standards, 3-6 September 2008.
- Rattray, R. Improvement of Analytical Quality Through Proficiency Testing and Certification of Matrix Reference Materials using Nuclear and Related Techniques. First Coordinating Meeting of IAEA project RLA 012, Lima, Peru, 1-4 July 2008.

PUBLICATIONS

- * J Nriagu, M Boughanen, A Linder, A Howe, C Grant, R Rattray, M Vutchkov and G Lalor. Levels of As, Cd, Pb, Cu, Se and Zn in bovine kidneys and livers in Jamaica, Ecotoxicol. Environmental Safety. 72(2), 564-571, 2009.
- * C. Grant, G.C. Lalor, J. Preston. The Jamaican Slowpoke-2 Research Reactor: Neutron Activation Analysis in Environmental and Health Studies, 13th Transactions of the international Topical Meeting on Research Reactor Fuel Management, Vienna Austria, March 2009, ISBN 978-92-95064-07-2.
- * C. Grant, G.C., Lalor, J. Preston. The Jamaican Slowpoke HEU-LEU core conversion, Return of Research Reactor Spent Fuel to the Country of Origin: Requirements for Technical and Administrative Preparations and National Experiences, IAEA-TECDOC-1593, 2008, ISBN 978-92-0-105508-8.

PUBLIC SERVICE

Professor Gerald Lalor

- Honorary Chairman, Gleaner Company;
- Director of: 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); The Royal Society of Chemistry; the American Chemical Society; the New York Academy of Sciences; The American Association for the Advancement of Science; Council of the Institute of Jamaica.
- Member of Editorial Boards of: Jamaica Journal of Science & Technology; The Science of the Total Environment; Revista Latino-Americano Quimica.

Dr. Robin Rattray

- Chairman, Codex Sub-Committee on Methods of Sampling and Analysis, Bureau of Standards Jamaica
- Member, Air and Water Quality Subcommittees, National Environment and Planning Agency
- Recording Secretary, 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