

## ANNUAL REPORT FOR YEAR 2012

The Institute of Nuclear Science and Technology is a unit within the College of Architecture and Engineering. It offers training in nuclear technology and energy studies. In particular it offers training in radiation science and renewable energy. The recent interest in nuclear electricity by the government has greatly improved the Institute's profile.

### **Programmes offered.**

The Institute offers a Master of Science in Nuclear Science. It also offers a Diploma in Radiation Protection and a Certificates courses in Applied Radiation Protection and Renewable Energy.

### **Enrolment**

In the 2011/12 academic year, the Kenya Government through the Ministry of Energy sponsored 15 students to pursue studies in MSc (Nuclear Science). In addition the university sponsored one student while eight (8) students paid for themselves and as such we had a class of 24 students. In the 2012/13, the government once again sponsored 15 students for the programme; 13 took up the sponsorship while two declined having been sponsored by other organisations for other degree course. Two students were sponsored by the University and two by the Ministry of Health bringing the total no. To 17 students.

### **International Links and Collaborations**

In the year 2012, the University on behalf of the Institute signed memorandum with the following institutions:

- a) Department of Chemistry, Faculty of Science Gothenburg University, Sweden
- b) University of McMaster, Ontario, Canada.
- c) The International Finance Cooperation
- d) The International Centre for Research in Agroforestry (ICRAF)
- e) The United Nations Environment Programme
- f) The Kenya Nuclear Electricity Board

Through the collaboration with Gothenburg, two of their staff members, Prof Johan Boman and Prof Annemarie Wagner were facilitated to visit the Institute. During their visits they delivered lectures in X-ray Fluorescence (XRF) and Total Reflection X-ray. In addition, through the same collaboration Prof. Johan Boman has assisted in the MSc supervision of one of our MSc. Students; Kivaya. Mr. Vincent Waita Kivaya has now finished his thesis project titled, ***Black Carbon, Trace Elements and Particulate Matter Levels in the ambient air of the Jomo Kenyatta International Airport-Nairobi.*** Through this same collaboration, Mr. Mwaniki who recently successfully defended his MSc. Thesis has been awarded Ph.D scholarship in the University of Gothenburg under the supervision of Prof. Johan Boman.

### **Publications**

In the year 2012, Institute Staff published the following articles.

- 1) Authors. **David M. Maina**, Lydia W. Njenga, John M. Onyari and Benjamin N. Kyalo.  
Date of Publication: July 2012

Title: Trace Element Concentrations in Some Traditional Diets Consumed in Selected.

Publisher: Journal of Environmental Protection 2012, 3, 617-623

- 2) Authors: Bendibbie Munyao Mulwa, **David Muchori Maina**, and Jayanti Pushotami Patel.

Date of Publication: Dec 2012

Title: Multielemental Analysis of Limestone and Soil Samples of Kitui South (Kenya) Limestone Deposits.

Publisher: International Journal of Fundamental Physical Sciences, Vol 2, No.4 pp 48 – 51.

- 3) Authors: Ngugi M. Piero, Njagi M. Joan, Kibiti M. Cromwell, Maina D., Ngeranwa J. N. Joseph, Njagi N. M. Eliud, Njue M. Wilson, and Gatjumbi K. Peter.

Date of Publication: 2012

Title: Trace Elements Content of Selected Kenyan Antidiabetic Plants.

Publisher: International Journal of Current Pharmaceutical Research, Vol 4, Issue 3, 2012

- 4) Authors: Njagi JM, Piero MN, Ngeranwa JJN, Njagi ENH, Kibitican, Njue WM, Maina D and Gathumbi PK.

Date of Publication: 2012

Title: Assessment of Antidiabetic Potential of Ficus Sycomorus on Alloxan induced Diabetic Mice

Publisher: International Journal of Diabetic Research 2012, 1(4), 47-51.

- 5) Authors: Njagi JM, Ngugi M P, Kibiti CM, Ngeranwa NJ, Njagi ENM, Njue MW, Maina D, and Gathumbi PK.

#### **Date of Publication: 2012**

Title: Hypoglycemic Effects of Caesalpinia Volkensii on Alloxan induced Diabetic Mice.

Publisher: Asian Journal of Pharmaceutical and Clinical Research. Vol. 5 Supp 2, 2012.

#### **Consultancies.**

During the 2012 year, the Institute staff continued to work on a consultancy.

This consultancy was awarded to the Institute in ..... 2011 and expected to finish in June 2012.

The Institute has a consultancy with the International Finance Cooperation to analyse imported LED torches at the Lighting laboratory at the Institute.

Mr. James Cheselemi Wafula, a staff of the Institute was awarded a consultancy, “Improved sanitation, hygiene, health environmental conditions and giving standards through Improved access to infrastructure including street lighting” in June 2012. The consultancy was funded by UN-Habitat and to be carried out in Puntland.

### **Number of Staff**

The Institute has the following staff members

Senior Lecturer	2
Lecturer	1
Administrator	1
Principal Technologist	1
Chief Technologist	1
Technologist	4
Secretaries (Grade A)	2
Messenger	1

### **Conferences**

The Institute staff and students attended conferences presented papers as follows:

- 1) Challenges facing young scientists in Kenya Birir, J. K, Gatari, M. J. and Maina D. M.
- 2) 1st EPS Conference Physics for Development Palais des Academies, 11-12 October 2012, Brussels. Janet Mutheu Mwanja, Wilson Macharia Kairu, Stephen Owuor Tollah, Wycliffe Nyariki, Edwin Agoi Kisame, John Birir.
- 3) Joint EPD-SIF International School on Energy 2012. Course I – “New Strategies for Energy Generation Conversion & Storage” 30th July to 4th August 2012. Villa Monastero – Varenna, Lake Como, Italy. Janet Mutheu Mwanja, Wilson Macharia Kairu, Stephen Owuor Tollah.
- 4) Nuclear Electricity and Capacity Development, Kenya Option for sustainability and economic development.
- 5) Research in basic and applied physics versus society: Observations in developing countries Agoi E. K. , Gatari M. J. and Maina D. M.
- 6) Education system challenges in Kenya: Option for basic and applied physics development. Mwanja J. M., Gatari M. J. and Maina D. M.
- 7) Physics and Society: Observations in Kenya and Recommendations. Kairu W., Gatari M. J., and Maina D. M.
- 8) Science, Technology and Development. The role of low cost instrumentation for research and education. Nyariki W. O, Gatari M. J. and Maina D. M.

### **MSc. Theses**

In 2012 two MSc. students successfully defended their theses:

A Radioecological Study of the Artisanal Gold Mining Areas of Kakamega, Western Kenya  
by **Makobe Alexander**

Assessment of Radiation Exposure levels Associated with Gold Mining in Sakwa Wagusu Area, Bondo District-Kenya.  
By **Willis O. Aguku**

Welded Joints Flaw Analysis on Jua Kula Fabricated Products using Radiography and Visual Testing Methods

By **Stephen Mwangi Karanja**

Determination of Elemental Concentrations in Edible Seaweeds from the Kenyan Coast Using X-Ray Fluorescent Technique

By **Chesori Chebosion Raphael**

Synthesis, Structural and Phase Characterisation of proton conducting Oxides.

By **Gaita Samuel Mwaniki**

Dose Conversion Factors for a Target Close to Semi-Infinite Source of Gamma Radiation.

By **Michael Rotich**

Air Quality Study in Nairobi Metropolitan Area: Application of Energy Dispersive X-Ray Fluorescence and Chemical Mass Balance Model.

By **Ngenoh Kipruto Jeremiah**

Local structure of proton conducting Y-doped  $AZrO_3$  (A=Ba, Sr, Ca) Perovskites investigated with vibrational spectroscopy

By **Caroline Wanjiru Mburu**

Trace Element analysis in Infant Food from Selected Rural-Urban using INAA and TRXF Techniques.

By **Pamella Kilavi Kageliza**

Black Carbon, Trace Elements and Particulate Matter Levels in the ambient air of the Jomo Kenyatta International Airport-Nairobi.

By **Vincent Waita Kivaya**

- 1) Trace and Rare Earth Elements in Soils from Selected Regions in Kenya
- 2) Chemometric Analysis of Trace Elements for Characterization of Soil Minerals in Mui Basin
- 3) Investigation of Welding Quality in the Kenyan Jua Kali Enterprises
- 4) Radiation Health Hazard risk assessment in Soil Samples associated with coal deposits prior to mining, Mui Basin
- 5) Development of an Instrument Solar Charger for Use in the field Measurements in Remote area.
- 6) Environmental Radiation Monitoring using Liquid Scintillation Counter and Thermoluminescent Dosimeter in Kitui County
- 7) Building an Infrared Spectral Library for Predicting Civil and Agricultural Engineering Soil Properties.
- 8) Development of recycled plastic composite with steel Reinforcement: Alternative Material for Construction of Wind turbines.
- 9) Determination of heavy mineral Content, Characterization and their distributions along river Tiva, Kitui County
- 10) Survival of cancer patients in Kenya; A population based Study

11) Assessment of Radiological hazards associated with indoor Norm Dose rate and radon exposures in households within Nairobi.

#### Research Activities

The Institute is carrying out research in several areas related to radiation science and energy studies. These studies can be broadly classified into:

- 1) Environmental radiation measurements
- 2) Trace element determination in various matrix
- 3) Environmental pollution studies – air measurement
- 4) Non destructive evaluation
- 5) Renewable energy.

The following is an expanded list of these research activities:

Environmental radiation Measurements