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Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf

# Soils Newsletter

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*Water (sheet) erosion.*

## A. To Our Readers

Significant changes will take place in the Section in 2004 in regard to staffing. All professional posts will become vacant between the end of January and the end of August 2004. I would like to take this opportunity to highlight the contributions of **Mr. Felipe Zapata** who will retire from the Agency at the end of January 2004 after almost 25 years of professional service.

Felipe joined the Agency on 1979-03-30 as a Professional Officer (P-3) based at the Seibersdorf Laboratories. He was promoted to the P-4 post of Head of the Soil Science Unit on 1984-01-01, where he was responsible for overseeing implementation of the research and training activities conducted by that Unit in support of the FAO/IAEA Programme. In the same year the State University of Ghent, Belgium, awarded him the degree of Doctor in Agricultural Sciences with high distinction. At Seibersdorf, Felipe led an internationally recognized team that developed many of the concepts and procedures for the use of the stable isotope $^{15}N$ to estimate legume biological nitrogen fixation. More than 50 scientific papers were published in international journals on the results of this major research endeavour. The isotope methodologies were introduced with great success into technical co-operation projects to select superior legume genotypes and Rhizobial inoculants and to identify improved agronomic practices, bringing economic benefits to farmers through savings of manufactured fertilizers and reduction in the potential for environmental pollution.

In January 1996, Felipe transferred to a vacant P-4 position in the Soil and Water Management & Crop Nutrition Section at HQ to enable him to devote more time to co-ordination of research activities within the Regular Programme and to implement Technical Co-operation Projects. Through his Regional TC Project for Latin America (ARCAL XXII) he successfully promoted the concept of integrated soil, water and nutrient management for sustainable increases in crop production. The

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publications from this TC Project included a special issue of the journal *Terra*, two books on biological nitrogen fixation, a manual on the soil moisture neutron probe in English, French and Spanish, and three bulletins on the management of water, nitrogen fertilizers and phosphate rocks.

Equally successful have been his Co-ordinated Research Projects (CRPs) on "Phosphate Rocks" and "Soil Erosion". These CRPs have provided the methodologies that have enabled practices to be identified to make rational use of local nutrient sources and to arrest soil degradation. The CRP on Phosphate Rocks has resulted in the publication of one TECDOC, a special issue of the journal *Fertilizer Research*, a special issue of the journal *Nutrient Cycling in Agroecosystems*, a database on phosphate rocks, an interactive computer-based decision support system and an FAO/IAEA Bulletin on direct application of phosphate rocks. The CRP on Soil Erosion has resulted in the publication of one TECDOC, a special issue of the journal *Acta Geologica Hispanica,* a special issue of the journal *Soil and Tillage Research* and a handbook (Kluwer Academic Publishers) for the assessment of soil erosion and sedimentation using environmental radionuclides. The latter publication received the Departmental Award for the best book published in 2002 in acknowledgement of an outstanding achievement related to the generation and dissemination of technical information in the Department of Nuclear Sciences and Applications.

The Agency recognized his dedicated work and professionalism through a Merit Award in October 1998 and through a rare Merit Promotion to P-5 in July 2002. His fluency in several languages (English, Spanish, French, Flemish, German) has been a tremendous asset, which enhanced considerably his effectiveness in TC and Regular Programme activities. I am sure that his many friends and colleagues in the Agency and in the Member States will join with me in wishing Felipe a long, happy and productive retirement. We are going to miss him in the Section.

With my very best wishes for the holiday season and the New Year.

Phillip Chalk
Head, Soil and Water Management
& Crop Nutrition Section

# B. STAFF

## 1. IAEA Headquarters, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria, Telephone (43-1) 2600 + ext, Fax (43-1) 2600 7, e-mail: Official.Mail@iaea.org

| | |
|---|---|
| James D. DARGIE | Director |

**Soil and Water Management & Crop Nutrition Section**

| | |
|---|---|
| Phillip M. CHALK, Head of the Section | Soil Fertility, Plant Nutrition |
| Felipe ZAPATA, Technical Officer | Soil Fertility, Plant Nutrition, Agronomy |
| Gamini KEERTHISINGHE, Technical Officer | Soil Fertility, Plant Nutrition |
| | |
| Ruth ROSSI | Secretary |
| Rosario LEON DE MUELLNER | Secretary |

## 2. FAO/IAEA Agriculture and Biotechnology Laboratory, A-2444, Seibersdorf, Austria, Telephone (43-1) 26002891, Fax (43-1) 2600 28 222

| | |
|---|---|
| Chris J. RIGNEY | Head, FAO/IAEA Agriculture and Biotechnology Laboratory |

**Soil Science Unit**

| | |
|---|---|
| Gudni HARDARSON, Head of the Unit | Soil Microbiology, Plant Nutrition |
| Lee K. HENG (Soil Scientist) | Soil Physics |
| Rebecca HOOD-NOWOTNY (Soil Scientist) | Plant Nutrition |
| Martina AIGNER | Senior Laboratory Technician (50%) |
| Leopold MAYR | Senior Laboratory Technician |
| José Luis ARRILLAGA | Laboratory Technician |
| Stefan BOROVITS | " " |
| Gerhard ECKHARDT | " " |
| Maria HEILING | " " (50%) |
| Christine FICKER | Laboratory Attendant |
| | |
| Elisabeth SWOBODA | Secretary |

## 3. Staff Changes

**Ms. Judith Carrillo de Fischer** left the Section on 31 August after a period of 7 months as a temporary Secretary. We thank her for her contribution to the work of the Section and wish her all the best for her new assignment in the Agency.

**Ms. Rosario Leon de Muellner** transferred to the Section from the Animal Production and Health Section on 1 September to fill the vacant G-4 Secretarial post. Rosario brings a wealth of experience that will serve the Section well during the next two years when retirements and staff turnover will occur.

**Mr. Steve Evett,** USDA-ARS, Southern Plains Area, College Station, Texas, USA, left the Soil Science Unit on 31 July 2003 after a 4-month sabbatical. Steve was a key lecturer in the Interregional Training Course on Soil Water held at Seibersdorf during July 2003. We thank Steve for his many contributions to the work of the sub-programme and look forward to further collaboration in the area of increasing water use efficiency.

# C. FUTURE EVENTS

***RESEARCH CO-ORDINATION MEETINGS (RCMs) OF FAO/IAEA CO-ORDINATED RESEARCH PROJECTS (CRPs)***

⇒ **First RCM of CRP on "Selection for Greater Agronomic Water Use Efficiency in Wheat and Rice Using Carbon Isotope Discrimination" (D1.20.08), Vienna, Austria**

Seven research contractors from Algeria, China, India (2), Morocco, Pakistan and Yemen; two technical contractors from Australia and Mexico and two agreement holders from the Philippines (IRRI) and USA are expected to attend this meeting. The main purpose of this first co-ordination meeting will be to review the experimental plans of the participants and establish work plans, methodologies and protocols in accordance with the specific objectives of the CRP. To facilitate this process all participants will be requested to present a report highlighting their on-going work related to the project and specific activities planned for the CRP. The meeting is scheduled for the 2nd quarter of 2004 and the exact dates will be announced later.

⇒ **Second RCM of CRP on "Assess the Effectiveness of Soil Conservation Measures for Sustainable Watershed Management Using Fallout Radionuclides" (D1-50.08), 04-08 October 2004, Istanbul, Turkey**

Twelve research contractors, one technical contractor and seven agreement holders, are expected to participate. Ms. Sevilay Haciyakupoglu, Istanbul Technical University, is the local organizer. The participants will present the major results of their research since the commencement of the project in May 2003. Experimental protocols will be developed and adjustments made to the work plan, if necessary.

⇒ **Fourth RCM of CRP on "Development of Management Practices for Sustainable Crop Production Systems on Tropical Acid Soils Through the Use of Nuclear and Related Techniques" (D1-50.06), 15-19 November 2004, Vienna, Austria**

Eight research contractors from Brazil (2), Benin, Burkina Faso, Cuba, Mexico, Nigeria, Venezuela, one technical contractor from Germany and three agreement holders from Kenya (TSBF), Nigeria (IITA) and USA (IFDC) will participate in the fourth and final RCM. The results obtained throughout the implementation of the project (1999-2004) will be reviewed and discussed and the main achievements will be evaluated in accordance with the project objectives.

*IAEA GUEST MEETING*

⇒ **1st Joint European Stable Isotope Users Group Meeting (JESIUM), 30 August-3 September 2004, Vienna, Austria**

It is hoped the meeting will bring together as many national stable isotope groups as possible. To date these include:

Stable Isotope Network Austria (SINA)
Stable Isotope Mass Spectrometers Users Group (SIMSUG), UK
Arbeitsgemeinschaft Stabile Isotope (ASI)/German Association for Stable Isotope Research (GASIR)
Societe Française des Isotopes Stables (SFIS), French Stable Isotope Society
Benelux IRMS Users Group

Please note we would be happy to include other national groups.

Stable isotope methodologies over the past few years have become a crucial research tool in a wide range of scientific fields. The purpose of the meeting is to bring together a wide range of stable isotope scientists from all over Europe, to encourage communication across disciplines and country boundaries. The meeting will provide an opportunity to discuss theoretical and methodological difficulties and to exchange techniques and ideas, a chance to discuss our successes and our failures.

**Meeting themes:**

- **Health and nutrition. Past and present**
  Convenors: Peter Schadewaldt, Olav Rooyackers
  Keynote speaker: Tasmin O'Connell

- **Isotope ecology**
  Convenors: Annette Gieseman, Pascal Boeckx
  Keynote speaker: Phil Ineson

- **Isotope physiology**
  Convenors: Richard Robins, Wolfgang Wanek
  Keynote speaker: Jeleh Ghashghaie

- **Hydrology and earth science**
  Convenors: Manfred Groening, Christoph Spötl
  Keynote topic: Beagle 2 Project. Mission to Mars.

- **Stable isotopes in the atmosphere and biospheric exchange**
  Convenors: Francesca Cotrufo, Andreas Richter
  Keynote speaker: Nina Buchmann

- **Methodology**
  Convenors: Christophe R. Quetel, Tom Preston
  Keynote speaker: Willi Brand

- **A stable future!**
  Convenors: Roland Bol, Rebecca Hood
  Keynote speaker: Tom Conrads

The emphasis will be on practicalities. There will be a session dedicated to the presentation of interesting practical techniques. This will take place in the laboratory and shall have a number of stations where people can demonstrate their techniques either in real time, with video or with a computer. The best device, which has made the work a lot easier, or novel approach presented will receive a prize. Young scientists in particular are encouraged to present their work and a prize will be awarded for the best presentation to someone under 35 years of age.

More details can be found out at: http://chemsrv0.pph.univie.ac.at/JESIUM/
For enquires contact: jesium.oekologie@univie.ac.at
For the Scientific Committee please contact: Dr. Rebecca Hood-Nowotny (R.Hood-Novotny@iaea.org)

***NON-FAO/IAEA MEETINGS***

⇒ **7th International Symposium on Inorganic Nitrogen Assimilation in Plants: From the Genome to the Agro-Ecosystem, 23-27 June 2004, Wageningen, The Netherlands**

Information on this symposium, including the registration form can be found at: http://www.enaag.org

⇒ **13th International Soil Conservation Conference, 4-9 July 2004, Brisbane, Australia**

Information on this conference can be found at http://ww.icms.com.au/isco2004

⇒ **4th International Crop Science Congress, 26 September-1 October 2004, Brisbane, Australia**

Information on this congress can be found at http://www.cropscience2004.com

⇒ **3rd International Nitrogen Conference, 12-16 October, Nanjing, China**

Information on this congress can be found at http://www.issas.ac.cn/n2004

⇒ **XIV International Congress on Nitrogen Fixation, 28 October-1 November 2004, Beijing, China**

Information on this congress, which was originally planned for 1-6 November 2003, and then postponed, can be found at http://www.n2fix.com

*TECHNICAL CO-OPERATION PROJECTS (TCPs)*

⇒ **FAO/IAEA Regional TC Project for Africa "Combating Desertification in the Sahel" (RAF/5/048)**

Implementation of this regional TC project commenced in 2001. The overall objective is to sustainably intensify food production in the rainfed agriculture of Sahelian countries, in order to enhance food security while combating desertification. The specific objective is to develop, pilot-test and promote the adoption of improved and integrated soil, water and nutrient management technologies in cropping systems through the use of nuclear and related techniques. The short-term goal is to improve the productivity of the agricultural systems, while the long-term goal is to restore and maintain the soil fertility to effectively combat dry-land degradation. The target area is the West African Sahel and includes Burkina Faso, Mali, Niger and Senegal.

The first project co-ordination meeting was held in Ouagadougou, Burkina Faso from 18-21 February 2001. The specific focus of the initial phase (2001-2002) of the project activities has been to strengthen the national capacities and to establish a network of field trials to generate specific technologies for improved and integrated crop, soil, water and nutrient management in millet-based cropping systems. The second phase of the project has been approved for implementation during the biennium 2003-2004 and the focus will be on the continuation of the field trials and the pilot testing of promising technologies in farmers' fields to promote their adoption. Detailed work plans were developed at the Second Co-ordination Meeting of project co-ordinators held 07-09 April 2003 in Niamey, Niger.

- **Regional Training Workshop on "The Use of Nuclear and Related Techniques in Studies to Intensify Sustainable Agricultural Production while Combating Desertification in the Sahel", 14-18 June 2004, Seibersdorf, Austria**

The training workshop will be organized at the IAEA Laboratories in Seibersdorf. It is anticipated that representatives from the four countries participating in the project (Burkina Faso, Mali, Niger and Senegal) will attend this training event. The main purpose of the workshop will be to provide relevant information and develop a better understanding of the principles and practical aspects of the use of nuclear techniques that are being used in the project for developing technologies to intensify agricultural production while combating desertification in the Sahel.

⇒ **FAO/IAEA Regional TCP for East Asia and the Pacific (RCA) on "Restoration of Soil Fertility and Sustenance of Agricultural Productivity" (RAS/5/039)**

In East Asia and the Pacific region extensive land degradation and the conversion of agricultural land into other uses (urbanization, infrastructure and industrial development) are factors contributing to reduced agricultural productivity. The principal land degradation processes are nutrient depletion, acidification, salinization, pollution, and soil erosion. The effects of human-induced degradation are exacerbated by inappropriate land use, soil and water mismanagement and inadequate farming practices. For instance, excessive and continued use of agrochemicals in some areas may greatly affect both water and soil quality

over the long term. Enhancing sustainable food production will require the combined use of the following strategies: a) agricultural intensification on the best arable land, b) rational utilization of marginal lands, and c) prevention and restoration of soil degradation.

The overall objective of this project is to develop improved soil, water, nutrient and crop management practices while counteracting predominant soil degradation processes in order to increase and sustain crop productivity. Two complementary approaches are utilized to achieve this main objective. Part 1 of this project deals with the restoration of soil fertility, and implementation commenced during the 2001-2002 cycle (refer to past events). The specific objective of Part 2 of this project is to measure soil erosion/sedimentation and associated pesticide contamination. For this purpose, the fallout radionuclide $^{137}$Cs and related techniques are utilized to measure erosion/sedimentation rates and to define soil redistribution patterns in the landscape. Pesticides are being extensively used to maintain agricultural production over the long term. It is often found that eroded soil particles are a carrier for pesticides that may become toxic to aquatic plants and animals. Conventional and radiotracer techniques are applied to assess potential pesticide contamination levels in soil, water and crops. This part of the project started with the project formulation meeting held in February 2002, Beijing, China and will be implemented through 2004. The mid-term project review meeting was recently held in Jakarta, Indonesia, 17-23 October 2003.

- **Regional Training Course on "Exchanging Experiences in the Use of the $^{137}$Cs Technique in Soil Erosion/Sedimentation Studies", 5-9 July 2004, Kuala Lumpur, Malaysia**

The training course, which belongs to Part 2 of the project, will be organized under the auspices of the Malaysian Institute of Nuclear Technology (MINT). The local organizer will be Dr. Zainudin Othman, MINT. It is anticipated that representatives from the seven countries participating in the project (China, Malaysia, Indonesia, Pakistan, Philippines, Sri Lanka and Viet Nam) will attend the course. The main purpose of this training course will be to discuss and refine all aspects of the $^{137}$Cs technique for measuring soil erosion/sedimentation in the landscape. The participants will present case studies in the application of the $^{137}$Cs technique in their own countries of the region.

- **Final Project Evaluation Meeting of Part 1 "Integrated Nutrient, Crop and Water Management Practices for Increased Crop Production", 6-10 September 2004, Bangkok, Thailand**

The main purpose of this meeting will be to review the overall achievements of Part 1 of the project. It is anticipated that all counterparts from countries in the project (Bangladesh, China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam) will attend this meeting. All participants will be requested to present a report highlighting the major achievements of the project and these will be critically evaluated in line with the specific objectives. The local organizer of the meeting is Ms. Jaria Prasatsrisupab, Nuclear Research in Agriculture, Department of Agriculture, Bangkok and the meeting will be held at the Kasetsart University-Home, Bangkok.

# D. PAST EVENTS

***RESEARCH CO-ORDINATION MEETINGS (RCMs) OF FAO/IAEA CO-ORDINATED RESEARCH PROJECTS (CRPs)***

⇒ **Third RCM of CRP on "Development of Management Practices for Sustainable Crop Production Systems on Tropical Acid Soils Through the Use of Nuclear and Related Techniques", 18-22 August 2004, Ouagadougou, Burkina Faso**

The Third RCM was held under the auspices of the "Institut de l' Environnement et de Recherche Agricole" (INERA) at the Hotel Splendide. Six of the eight research contract holders, two research agreement holders, representatives of two agreement holders, and a technical contract holder attended the meeting. The local organizer was Mr. Vincent Bado.

- The research contractors presented the results obtained during the reporting period, highlighting the progress made within the main areas of research, i.e. identification of adapted genotypes, amelioration of acidity and infertility and development of improved soil management practices for sustainable crop production in tropical acid soils. The results obtained so far were thoroughly discussed after each presentation.
- To complement the presentations on the savannahs of West Africa, two local scientists participating in the IAEA regional TC project RAF/5/048 "Combating desertification in the Sahel" were invited to deliver lectures on the assessment of land degradation in Burkina Faso and the role of trees in the savannahs of Burkina Faso.
- A field visit was made to the INERA experimental station at Saria and the villages of Saria, Nandiala and Manega. A long-term experimental field for the improvement and maintenance of the soil fertility under several crop rotations was visited and the results obtained so far were explained by Mr. Moussa Bonzi. Farmer's fields were also visited and the constraints and potential improvements were discussed. The field visit provided an insight on the main biophysical and socio-economic constraints for the sustainable development of the savannahs of the West Africa region, and the approaches/strategies being followed to overcome obstacles at both research and small-scale farm levels.
- The presentations by the agreement holders (or their representatives) focused on identification and characterization of aluminium-resistant and P-efficient plant genotypes, and soil, crop and nutrient management practices to ameliorate acidity and infertility of tropical acid soils. The technical contractor reported on studies carried out using isotopic techniques to measure P acquisition from different pools by genotypes of rice, soybean and cowpea that are reported to differ in P-efficiency, with the aim of identifying P-efficiency mechanisms.
- Mr. Zapata reviewed the logical framework of the project, the main topics of investigation, target cropping systems and the expected outputs of the project. Moreover, he made an overall assessment of the progress made in implementation of the activities of the CRP in accordance with the objectives of the meeting.
- At a later stage of the meeting, participants divided in three working groups (savannahs of Africa, savannahs of Latin America and supportive research) to review and identify activities for completion of their individual work plans. Updated work

plans were presented and recommendations for completion of the CRP were formulated.

- Final issues for completion of the updated CRP, including the preparation of final reports and manuscripts for the CRP publication were discussed. Finally, conclusions and recommendations were drafted, presented and adopted. Prof. Hamidou Boly, Director General of INERA, formally closed the meeting.

The RCM enabled a comprehensive review of work done so far and an assessment of the individual progress made by each contractor. It was found that studies conducted by most contractors focus on amelioration of acidity and infertility of tropical acid soils.

The integrated approach to crop, and soil, water and nutrient management (SWNM) in predominant cropping systems of the savannahs of Africa and Latin America has been adopted. Complementary studies for further integration were discussed and agreed to. A report of the meeting is available at:
http://www.iaea.org/programmes/nafa/d1/crp/3rcm-burkinafaso.pdf

⇒ **Second RCM of CRP on "Integrated Soil, Water and Nutrient Management for Sustainable Rice-Wheat Cropping Systems in Asia", 08-12 September 2003, Nanjing, China**

The second RCM was held at the Nanjing Agricultural University (NAU) with Prof. Qirong Shen as the local organizer. All participants in the CRP, including seven research contract holders from Bangladesh (1), India (2), Nepal (1), Pakistan (1) and China (2), a technical contract holder (Australia), a representative of a technical contract holder (IRRI, Philippines), and two agreement holders (CSIRO-Australia; CIMMYT-India) attended the RCM. The meeting was officially opened by Prof. Dr. Guanghong Zhou, Vice-president, NAU.

A total of four technical sessions were scheduled during the first two days of the RCM, during which three invited speakers and each contract/agreement holder gave a 45-minute presentation on their research endeavours. Chairpersons gave an oral summation of the proceedings of each technical session at the end of the second day.

An excursion to Yancheng, Jiangsu Province, to see the field experimental plots of Prof. Qirong Shen, was scheduled on the third day of the RCM.

On the fourth day, the scientific secretary made a presentation on CRP management issues, and outlined the requirements for the mid-term review of the CRP. The participants then proceeded to discuss issues in plenary and to formulate the conclusions and recommendations of the second RCM. In addition, the scientific secretary, in collaboration with the participants, drafted the CRP Progress Report, for the mid-term review. All activities were completed on the final day according to the planned schedule.

The participants agreed to recommend that the third RCM be convened in Dhaka, Bangladesh, February/March 2005, to be held back-to-back with the 12$^{th}$ Meeting of the Regional Technical Co-ordination Committee of the Rice-Wheat Consortium of the Indo-Gangetic Plain.

The report of the meeting, including the draft CRP Progress Report, is available at http://www.iaea.org/programmes/nafa/d1/crp/2rcm-china.pdf

## *CONSULTANTS' MEETINGS*

⇒ **FAO/IAEA Consultants' Meeting on "Integrated Soil, Water and Nutrient Management in Conservation Agriculture", 16-18 August 2003, Iguaçu Falls, Parana, Brazil**

The Consultants' Meeting (CM) was organized in close consultation with the Land and Water Development Division (AGL) of FAO. Five consultants from Australia, Brazil, India, Kenya, and the USA, and two IAEA staff (Ms. R. Hood-Nowotny, SSU Seibersdorf and Mr. P. Chalk, Scientific Secretary) participated in the CM.

The CM immediately followed the Second World Congress on Conservation Agriculture (WCCA), held at the same venue (Rafain Palace Hotel, Foz de Iguaçu), August 11-15, 2003. The two IAEA staff and three of the Consultants also participated in the 2nd WCCA. The WCCA set the scene for the CM, reviewing worldwide adoption and impact of CA practices, case studies, farmer experiences in all regions, socio-economic and political factors, barriers to adoption, and organisations/institutions involved in CA research and development activities. The WCCA attracted approximately 1000 participants from all regions, including stakeholders from Government, NARS, international donors (GTZ, CIRAD, World Bank, IICA), inter-governmental organizations (FAO, IAEA), the CGIAR (CIMMYT, IRRI), NGOs, farmers and manufacturers of direct-drill equipment. Several Divisions of FAO (including the Joint FAO/IAEA Division) provided financial support to the 2nd WCCA, which was organized by the Brazilian Federation of No-till Farmers (FEBRAPDP). The Scientific Secretary is grateful to the Federation for organizing a Meeting Room and facilities for the CM.

The objectives of the CM were:

(i) To review current knowledge concerning the optimal management of external inputs and natural resources under conservation agriculture (CA) practices
(ii) To define research priorities in conservation agriculture
(iii) To define the role of nuclear techniques in research in conservation agriculture
(iv) To draft a Project Document for an FAO/IAEA Co-ordinated Research Project (CRP) in Conservation Agriculture (2005 - 2009).

The scientific secretary opened the CM and provided an overview of the activities within the Soil and Water Management & Crop Nutrition (SWMCN) Sub-programme. The consultants and the IAEA staff member made presentations. The consultants from Australia and the USA each made two presentations.

The consultants provided overviews of past and current work on zero- vs. conventional tillage, in particular carbon and nutrient (N and P) dynamics, water balance and soil physical properties. The consultants identified research priorities within CA and the role of nuclear techniques in research on CA. Conclusions and recommendations were formulated, and a

proposal for a new Co-ordinated Research Project (CRP) on CA was drafted. Thus, the objectives of the CM were fully achieved.

The report of the meeting, including the draft project document, is available at http://www.iaea.org/programmes/nafa/d1/crp/integr-soil-bra03.pdf The new CRP was approved by the IAEA Research Contracts Sub-committee on 22 October 2003 and is advertised in this Newsletter.

### ⇒ FAO/IAEA Consultants' Meeting on "Decision Support Systems for Utilization of Phosphate Rocks and Organic Nutrient Sources", 25-27 August 2003, Vienna, Austria

A series of follow-up activities of the Phosphate CRP were initiated in 2001 and continued during the IAEA Programme of Work and Budget (PWB) 2002-2003. These activities include **the development of a Decision Support System for Phosphate Rock Use (PR-DSS) and the construction of a website for Direct Application of Phosphate Rocks (DAPR).** The work plan to start the development of the PR-DSS was drawn up during F. Zapata's visit to IFDC Headquarters in November 2001 whereas the latter was originally a pilot-IT project from the Joint FAO/IAEA Division that implemented FAO Java/XML standards. Both activities are programmed during the next IAEA PWB 2004-2005. Furthermore, it is also programmed to start similar activities with **Organic Nutrient Sources** during the next biennium 2004-2005.

To streamline the implementation of the programmed activities related to the use of phosphate rocks (and to ensure an orderly and smooth transition to the new staff) as well as to plan the activities on the use of organic nutrient sources (**ONS**), a Consultants' Meeting was convened with the following objectives: a) to review the overall development and technical aspects of the PR tasks (**PR-DSS and DAPR website**), b) to assess progress made and plan the way ahead including requirements of resources, c) to develop a work plan for the development of the activities related to the use of organic nutrient sources, and d) to discuss other programmatic issues of common interest.

Four scientists, Mr. Larry Hammond (IFDC, USA), Mr. Nteranya Sanginga (TSBF/CIAT, Kenya), Mr. Georg Cadisch (Wye College, UK) and Mr. Roberto Giaccio (Univ. Rome, Italy) were invited as consultants. In addition, Mr. R. Roy, from AGL, FAO, Ms. Gaby Voigt (IAEA, Seibersdorf) and FAO/IAEA staff members attended the meeting. Mr. F. Zapata was the scientific secretary of the meeting.

The consultants, together with the FAO/IAEA staff involved in this development work (Ian Ferris, Lee Heng and Felipe Zapata), reviewed the work done so far on the development of the PR-DSS and the interactive web-based DAPR resource as well as the available information on the use of Organic Resources (OR). A session on development of Environmental Decision Support Systems was also held. The participants identified a series of elements/issues needing discussion. Thereafter, the panel developed independent proposals for further development of the PR-DSS including distance learning tools and initiating the development of the OR-DSS. The overall aim of this work would be to disseminate the results obtained from PR and OR research conducted by the Joint FAO/IAEA Programme and other institutions by providing practical recommendations and guidelines to a wide audience comprised of policy and decision makers, the scientific community, higher level extension workers, NGOs and other

stakeholders involved in sustainable agricultural development at the local, national, regional and international levels.

The report of the consultants' meeting is available at:
http://www.iaea.org/programmes/nafa/d1/crp/phosphate-rock-vienna03.pdf

Further development of the DAPR Website:
http://www.iswam.iaea.org/jeeves/srv/en/dapr.home
and the field validation (calibration) work of the PR-DSS in selected agro-ecological zones and cropping systems will be implemented under the IAEA PWB 2004-2005.

***NON-FAO/IAEA MEETINGS***

⇒ **Joint Workshop on the "FNCA Biofertilizer Project and the JSPS Co-operative Multilateral Project", 20-24 October, 2003, Hanoi and Ho Chi Minh City, Viet Nam**

Developing countries use more than 53 million metric tonnes of N fertilizers annually worth more than 16 billion US $ 88% of this fertilizer is used in Asia with China and India consuming 22 and 10 million metric tonnes, respectively. Studies using $^{15}N$ labelled fertilizer have shown that, unless fertilizer application is managed properly, only 30-40 % of the applied N is taken up by crops and the rest is immobilised and lost to the atmosphere and groundwater. With the objective to reduce the economical burden of N fertilizer use and furthermore to reduce environmental pollution, scientists in the East Asia region have formed networks to find and promote alternatives technologies for crop production. Two of these networks, FNCA Biofertilizer Project and JSPS Co-operative Multilateral Project, have worked on biofertilizer in the East Asia region for several years with the objective to establish biofertilizer production in the participating countries and to promote their use.

The Joint Workshop on the FNCA Biofertilizer Project and the JSPS Co-operative Multilateral Project was sponsored by FNCA and JSPS (Ministry of Science, Technology and Environment and Ministry of Education, Culture, Sports, Science and Technology, Japan) and was locally organised by the Viet Nam Atomic Energy Commission, Viet Nam Agriculture Science Institute and Cantho University.

The group of scientist working with FNCA have completed several years of research work to test and promote biofertilizer production and use in the East Asia region. This group will now need assistance in the use of nuclear technology ($^{15}N$) for the quantification of biological nitrogen fixation and radiation for the sterilization of inoculant carrier to complete the work. Mr. G. Hardarson participated in the Meeting and made a presentation on completed and on-going FAO/IAEA Projects in this area.

⇒ **IFAD/FAO mission on collaboration with "United Nations Convention to Combat Desertification's Global Mechanism, International Fund for Agricultural Development", 21-22 October 2003, Rome, Italy**

Mr. Christophe Ivetot, Concepts and Planning Section, Division of Programme Co-ordination, IAEA Technical Co-operation Programme and Mr. Felipe Zapata undertook a mission to hold consultations with representatives of the United Nations Convention to Combat Desertification Global Mechanism (UNCCD-GM), the International Fund for Agricultural Development (IFAD) and the Food and Agriculture Organization of the United Nations (FAO). Specific objectives were: a) to present IAEA (TC/NA) activities that contribute to UNCCD/IFAD's objectives of combating desertification; and b) to identify with relevant staff of UNCCD/IFAD/FAO potential areas and modalities of co-operation and to agree on follow-up activities.

The mission was arranged as a follow-up activity to the 4th Accessible Information Development Activities (AiDA) Open meeting, OECD, Paris, 12-13 June 2003, where representatives of the UNCCD-GM and IFAD demonstrated interest in IAEA activities. A few days after the meeting in Paris, the UNCCD-GM invited the IAEA to present, in Rome, its activities in the areas of combating desertification, utilization of saline lands and carbon sequestration to representatives of UNCCD-GM, IFAD and FAO.

The UNCCD-GM was established under the authority of the Conference of the Parties (COP) of the UNCCD in September 1997. Its mandate is "to increase the effectiveness and efficiency of existing financial mechanisms to promote actions leading to the mobilization and channeling of substantial financial resources, including the transfer of technology, on a grant basis, and/or on concessional or other terms, to affected developing country parties". In fact, the GM acts as a hub for a dynamic network of partners, committed to focusing their energies, resources and knowledge on combating desertification. The GM not only mobilizes financial resources, but also channels their flow, thereby guaranteeing increased financial effectiveness and efficiency and ensuring a holistic and equitable approach to resource distribution. IFAD was selected to house the GM.

The GM acts as a partnership builder that actively works on the interface between resources needed and resources available, between supply and demand, with the task of mobilizing substantial resources for combating desertification and drought. The GM recognizes that desertification is a cross-sectoral issue and therefore, it deals with resources concerning the development process itself, particularly rural development, agricultural development, poverty eradication and sustainable development. In response to the multi-sectoral dimensions of the UNCCD, the GM acts as a broker and as a catalyst that not only draws on but also adds value to the interventions of other development parties.

A Facilitation Committee (FC) was established in September 1997 based on collaborative institutional arrangements between IFAD, the United Nations Development Programme (UNDP) and the World Bank in support of the Global Mechanism. The FC provides support and advice to the GM and allows for collaborative institutional arrangements between the GM and those institutions having relevant technical and financial expertise to the UNCCD.

The objectives of the mission were achieved. Potential avenues for further collaboration were identified. Follow-up communications with the GM should lead to elaboration and signature

of a Memorandum of Understanding and identification of concrete and co-ordinated activities. Further communications with IFAD should clarify how IAEA could benefit from the IFAD grant programme. Scientific back-up to FAO's projects in the field of combating desertification should be examined in the light of the IAEA mid-term programme priorities.

The meeting provided a good forum to publicize the activities of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (AGE) related to land degradation, in particular combating desertification, the main thrust area of the UNCCD-GM.

***TRAINING COURSE***

⇒ **FAO/IAEA Interregional Training Course on "The Use of Nuclear and Related Techniques to Increase Water Use Efficiency in Rainfed and Irrigated Agriculture", 1-29 July 2003, Seibersdorf, Austria**

The Soil Science Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf, organized the Interregional Training Course. The objective of the course was to give scientists from developing countries a sound working knowledge of strategies, approaches and applications of nuclear and related techniques to monitor soil water status and improve the use of water resources, particularly in arid and semi-arid areas for increased and sustainable agricultural productivity.

A total of nineteen participants attended this training course, including an observer and three scientists from developing countries already at Seibersdorf receiving practical training in soil water measurement under the IAEA Technical Co-operation fellowship programme.

*Interregional FAO/IAEA Training Course, Participants and staff*

*Participants in the Training Course:*

Mr. Samson Bekele, Ethiopia
Mr. Daniel Asare, Ghana
Mr. Joseph Miriti, Kenya
Mr. Lav Bhushan India
Mr. Haithem Al-Adaileh, Jordan
Ms. Gulmira Sariyeva, Kazakhstan
Mr. Abdul Rahman Shyful Azizi, Malaysia
Mr. Fayyaz Hussain, Pakistan
Mr. Jalal Al Attar, Syria
Mr. M. Onur Özbas, Turkey
Mr. Bruno J.R. Alves, Brazil
Ms. Clover La Guerre, Jamaica
Ms. Mariana León Lárraga, Venezuela
Ms. Vesna Zupanc, Slovenia
Mr. Matej Knapic, Slovenia

*Fellows who attended the Training Course:*

Mr. Onesimus Semalulu, Uganda
Mr. Richard Max Kpange, Sierra Leone
Mr. Augustine Bundu Rashid-Noah, Sierra Leone

*Observer:*

Mr. Seung Oh Hur, Korea

The course programme can be found at:
http://www.iaea.org/programmes/nafa/d1/intc/seib-jul03-programme.pdf

## *TECHNICAL CO-OPERATION PROJECTS (TCPs)*

### ⇒ FAO/IAEA Regional TCP for Europe on "Fertigation for Improved Crop Production and Environmental Protection" (RER/5/011)

The objectives of the project are to increase water-use efficiency, improve crop production and reduce environmental damage through fertigation, using nuclear techniques to monitor fertilizer and water dynamics. Nine countries are participating in the project: Bulgaria, Cyprus, Former Yugoslav Republic of Macedonia, Greece, Hungary, Romania, Slovenia, Turkey, and Serbia and Montenegro.

- **Final Co-ordination Meeting, 22-25 September 2003, Busteni, Romania**

Ms. Lee Heng organized and conducted the final meeting that was attended by the national counterparts. Mr. Mihail Dumitru from the Research Institute for Soil Science and Agrochemistry in Bucharest was the local organizer.

In general, the group observed higher crop yields and a considerable increase in the efficiency of water and fertilizer use with fertigation compared with conventional practices, while reducing the risk of nitrate leaching to groundwater. The study also helped to establish the scientific basis for fertigation and drip-irrigation scheduling for a range of soils, crops and environments in the participating countries. The results also highlighted the need for policy and decision makers to formulate strategies to assist farmers to adopt best management practices.

⇒ **FAO/IAEA Regional TCP for East Asia and the Pacific (RCA) on "Restoration of Soil Fertility and Sustenance of Agricultural Productivity" (RAS/5/039)**

- **Mid-Term Project Review Meeting of Part 2 "Measuring Soil Erosion/Sedimentation and Associated Pesticide Contamination", 13-17 October 2003, Jakarta, Indonesia**

The meeting was held under the auspices of the "Centre for Research and Development of Isotope and Radiation Technology" (CRDIRT), National Nuclear Energy Agency (BATAN), Indonesia. All national counterparts of the Member States participating in this project (China, Indonesia, Malaysia, Pakistan, Philippines Sri Lanka and Viet Nam), three local staff, Mr. R. Loughran (Australia), invited IAEA expert, and Mr. F. Zapata (IAEA technical officer) attended the meeting, which was held at the Jakarta Hilton International Hotel. The local organizer was Mr. Zainal Abidin, the national counterpart from Indonesia.

The main activities carried out at the meeting were:

- Mr. Pramudita Anggraita, Deputy Director General of the National Nuclear Energy Agency (BATAN), who explained the mandate and role of BATAN in the sustainable development of Indonesia, formally opened the meeting. Ms. Renaningsih Setjo, Head of the Center for Research and Development of Isotope and Radiation Technologies (CRDIRT), provided opening remarks to the participants. On behalf of the IAEA, Mr. Felipe Zapata welcomed the participants and thanked the host country and BATAN for the local organization of the meeting.
- At the start of the meeting, Mr. Zapata made an overview of the background and implementation of Part II of the TCP, and presented the objectives, programme and expected outputs of the meeting. This was followed by a general discussion by the participants.
- The national counterparts of the participating countries presented their progress reports with regard to the implementation of the project regional activities highlighting the progress made on the application of the Cs-137 technique to measure soil erosion/sedimentation. The results obtained so far, technical problems and limitations encountered were thoroughly discussed after each presentation.
- To complement the presentations of the participants, Mr. Loughran, IAEA expert, made a presentation on the nationwide study entitled "A survey of soil erosion in Australia using Caesium-137" and Mr. Zapata, IAEA Technical Officer, reported on recent studies on land degradation, in particular soil erosion and developments on the use of environmental radionuclides to assess the effectiveness on soil conservation technologies. The recently published "Handbook for the Assessment of Soil Erosion and Sedimentation using

Environmental Radionuclides" was distributed to all participants.

- A field trip was made to one of the study areas in Ciawi, Bogor, West Java, Indonesia. Two sites in cultivated lands with different land use were visited. Aspects related to field sampling design, and sample collection were discussed in situ. It was observed that the profile distribution of Cs-137 is drastically modified by local cultivation methods and some conservation structures implemented in the study area. The visit provided an insight on the main biophysical and land use/management factors affecting soil erosion/sedimentation in the study area. Approaches/strategies followed for field sampling and measurement of low Cs-137 input levels in tropical (near Equator) areas were discussed in detail.
- Mr. Yong Li, national counterpart from China, made a presentation on a project proposal submitted for the 2005 - 2006 biennium "Development of sustainable land use and management strategies for controlling soil erosion and improving soil quality" and Mr. Zapata made presentations on IAEA future directions of the activities in soil erosion/sedimentation.
- Each national counterpart reviewed his/her work plans and identified activities for completion of the regional project. The updated work plans have been incorporated in the report of the meeting.
- Messrs. Loughran and Zapata revised the progress reports submitted by the participants and following a list of criteria/indicators made an assessment of the progress made by each country. Moreover, they made an overall assessment of the progress made in implementation of the activities of the TCP in accordance with the objectives of the meeting. This evaluation was discussed during the meeting and is included in the report of the meeting.
- The participants reviewed the logical framework of the regional project, and the regional components of the project. The revised versions are included in the report of the meeting.
- Guidelines for completion of the TCP, including the preparation of publications (scientific and technical) were presented by Mr. Zapata and discussed by the participants. Finally, conclusions and recommendations were drafted, presented and adopted.
- Mr. Yong Li (CPR) spoke on behalf of the participants thanking the host country and the IAEA for making the arrangements for the meeting. Mr. Zapata made closing remarks summarizing the work done during the meeting and recommended to follow the guidelines provided for further implementation of the project. On behalf of the host country, Mr. Zainal Abidin, the local organizer, formally closed the meeting.

A report of the meeting including conclusions and recommendations is available at:
http://www.iaea.org/programmes/nafa/d1/mid-term.html

- **Regional Training Workshop on "Promising Fertilizer and Crop Residue Management Practices for Sustainable Crop Production in Rice-Based Cropping Systems", 20-24 November 2003, Hanoi, Viet Nam**

In support of Part 1 of the regional project, this training activity was organized with support from the National Institute for Soils and Fertilizers (NISF), Hanoi, and the Viet Nam Atomic Energy Commission (VAEC). Thirteen participants from nine countries (Bangladesh,

China, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam) attended the Training Workshop. The Chief local organizer was Mr. Pham Quang Ha, local counterpart of the regional project. Mr. Bui Huy Hien, Director of the NISF, acted as the Course Director of the workshop. The Technical Officer, Mr. Gamini Keerthsinghe, conducted the training with the support of Mr. Pham Quang Ha. The main purpose of this workshop was to provide information on the use of nuclear and related techniques for assessing the effectiveness of various fertilizer and residue management practices that are being investigated in the project for identifying promising technologies for sustaining crop production in rice-based cropping systems. The following main topics were covered:

- Nitrogen transformations in wetland rice soils and their effects on efficiency of nitrogen fertilizers
- $^{15}N$ studies for obtaining information on the fate of nitrogen inputs
- Importance of crop residue management practices for rice-based cropping systems
- Inclusion of legumes to rice-based cropping systems for increasing overall crop productivity
- Promising zero till and low till practices for rice-wheat cropping systems
- Transfer of promising technologies to the end-users

The training workshop highlighted the importance of using isotopes to obtain a better understanding of the complex nutrient transformation processes occurring in wetland rice soils and quantitative information on the fate and efficiency of applied fertilizers to crops. This information is needed to identify improved fertilizer management practices. The lectures provided an overview of current research on nitrogen use efficiency under varying soil, crop, fertilizer and water management practices in rice-based cropping systems, and utilization of available information for identification of technologies best suited to the local conditions to minimize losses and increase crop production. The workshop was also an ideal forum for the participants to exchange views and share skills and experience acquired in implementation of the project.

# E. STATUS OF CO-ORDINATED RESEARCH PROJECTS

⇒ **Integrated Soil, Water and Nutrient Management for Sustainable Rice-Wheat Cropping Systems in Asia**
Project Officer: P.M. Chalk

This CRP commenced on 1 October 2001 with an anticipated duration of five years. The overall objective is to improve the productivity and sustainability of rice-wheat cropping systems through increased efficiency of water and nutrient use. The specific research objective is to modify existing water and nutrient management systems, and improve soil management in both traditional and emerging (raised beds, non-puddled soil, direct seeding) tillage systems, for sustainable intensification of cereal production. Seven research contracts were awarded: Md. Akhter Khan (Bangladesh), Qirong Shen (China), Jiarong Pan (China), Yadvinder Singh (India), Manbir Sachdev (India), Ram Munankarmy (Nepal) and Fayyaz

Hussain (Pakistan). Two technical contracts were awarded: J.K. Ladha (Philippines) and G. Blair (Australia). There are presently two agreement holders: E. Humphreys (CSIRO-Australia) and R. Gupta (CIMMYT-India). The first RCM and training workshop was held 4-8 March 2002, in Vienna and Seibersdorf, Austria. The second RCM was held 08-12 September 2003, in Nanjing, China, and the third RCM is planned for Dhaka, Bangladesh, in February 2005. The CRP was reviewed after the 2nd RCM and has been approved for five years.

⇒ **Selection for Greater Agronomic Water-use Efficiency in Wheat and Rice using Carbon Isotope Discrimination**
Project Officer: G. Keerthisinghe

This CRP commenced on 1 November 2003 with an anticipated duration of five years. The overall objective is to contribute to increasing the agronomic water-use efficiency (AWUE) of wheat and rice production where AWUE is defined as grain yield/total water use including both transpiration and evaporation. The specific objectives are: (a) to evaluate different strategies for using carbon isotope discrimination as a selection tool for identifying higher yielding genotypes of (i) wheat in water-limited rain-fed stored soil moisture cropping systems, (ii) wheat in irrigated cropping systems, and (iii) rice in irrigated cropping systems; (b) to develop within (a) sets of elite isomorphic lines varying in carbon isotope discrimination for use in (c); (c) using a set of these isomorphic breeding lines evaluated in contrasting cropping environments, assist national programme scientists to determine the most effective breeding strategies for application of carbon isotope discrimination in their environments.

Seven research contractors from Algeria, China, India (2), Morocco, Pakistan and Yemen; two technical contractors from Australia and Mexico and two agreement holders from the Philippines (IRRI) and USA have been selected for this CRP. Details can be obtained at: http://www.iaea.org/programmes/nafa/d1/crp/list-part-d12008.pdf
The first RCM will be held in the second quarter of 2004, in Vienna.

⇒ **The Use of Nuclear and Related Techniques in the Management of Nutrients and Water in Rainfed Arid and Semi-arid Areas for Increasing Crop Production**
Project Officers: G. Keerthisinghe and L. Heng

The implementation of this CRP was completed in 2002. The manuscripts sent by the contract and agreement holders for inclusion in an IAEA-TECDOC are currently being collated and edited. It is anticipated that the TECDOC will be published in the first quarter of 2004.

⇒ **Use of Nuclear Techniques for Developing Integrated Nutrient and Water Management Practices for Agroforestry Systems**
Project Officer: G. Keerthisinghe

Participating in this CRP are nine contract holders: K. Aihou (Benin), B. Zhang (China), C. Ovalle Molina (Chile), C. Cervantes (Costa Rica), J.M. Ndufa (Kenya), Z. Rahman (Malaysia), S. Nissanka (Sri Lanka), P. Ebanyat (Uganda) and R. Chintu (Zambia); and five

agreement holders: M. Adams (Australia), S. Recous (France), L. Verchot (ICRAF-Kenya), N. Sanginga (TSBF-CIAT, Kenya) and M. Smith (UK). Participants have established links with CGIAR centres (IITA, ICRAF), international funding institutes (IFS, DFID, USAID) and a range of national institutes for effective implementation of the project activities. Through these linkages they have been able to obtain considerable financial and human resources in addition to the inputs from the Agency. The experimental work is progressing well in line with the main objectives and the project is well positioned for significant contributions in understanding the role of trees in agricultural systems and in contributing to the development of improved agroforestry systems. It is encouraging to note that the contract holders are actively involved in dissemination of information emanating from this project to end-users through presentations at national and international meetings and publications in scientific journals. The third RCM was held in Colombo, Sri Lanka in June 2003 and the fourth and final RCM will be held in 2005.

⇒ **Development of Management Practices for Sustainable Crop Production Systems on Tropical Acid Soils through the Use of Nuclear and Related Techniques**
Project Officer: F. Zapata

This CRP commenced at the end of 1999 and the first RCM was held in Vienna in June 2000. Eight research contract holders: P. Houngnandan (Benin), S. Urquiaga (Brazil), T. Muraoka (Brazil), V. Bado (Burkina Faso), A. García (Cuba), J.J. Peña-Cabriales (Mexico), E. Iwuafor (Nigeria), and M. Lopez (Venezuela); and four agreement holders: W. Horst (Germany), S.H. Chien (IFDC-USA), B. Vanlauwe (TSBF-Kenya), and J. Diels (IITA, Nigeria), are currently participating in the project. The third RCM was held in Ouagadougou, Burkina Faso, 18-22 August 2003. For details on the meeting refer to the Past Events Section. The progress made in implementation of the CRP is satisfactory. Individual work plans were updated and issues for completion of the CRP were defined.

More research is needed to identify mechanisms of Al-resistance and P-efficiency, and methods to characterize/evaluate crop genotypes adapted to acid soil (Al toxicity and low P) conditions. Also, long-term field studies to assess the sustainability of improved agricultural production practices are required. In this respect, a series of recommendations were provided and are included in the report of the meeting that is available at:
http://www.iaea.org/programmes/nafa/d1/crp/3rcm.burkinafaso.pdf
The fourth and final RCM will be held in Vienna, Austria, 15-19 November 2004.

⇒ **Assess the Effectiveness of Soil Conservation Measures for Sustainable Watershed Management using Fallout Radionuclides**
Project Officer: F. Zapata

This CRP was approved in March 2002 and commenced this year with an anticipated duration of five years (2003-2007). This project will be implemented together with another from the Isotope Hydrology Section entitled "Isotope techniques for sediment sources characterization". The overall aim of these projects is to develop diagnostic tools for assessing soil erosion and sedimentation processes and effective soil conservation measures for sustainable watershed management. The specific research objectives are: i) to further develop fallout radionuclide (FRN) methodologies, with particular emphasis on the combined use of $^{137}Cs$, $^{210}Pb$ and $^{7}Be$ for measuring soil erosion over several spatial and time scales, ii) to

establish standardized protocols for the combined application of the above techniques, and iii) to utilise these techniques to assess the impact of short-term changes in land use practices and the effectiveness of specific soil conservation measures.

Thirteen research contract holders: A. Bujan (Argentina), O. Bacchi (Brazil), M.E. Trumper/ P. Schuller (Chile), Yong Li (China PR), Xinbao Zhang (China PR), K. Manjaiah (India), M. Benmansour (Morocco), M. Rafiq Sheikh (Pakistan), W. Froehlich (Poland), Nelu Popa (Romania), V. Golosov (Russia), S. Haciyakupoglu (Turkey), and Hai Son Phan (Viet Nam); one technical contractor: D.E. Walling (UK) and eight agreement holders: P. Wallbrink (Australia), A. Klik (Austria), C. Bernard (Canada), D. Lobb (Canada), J. Onda (Japan), H. Liniger (WOCAT-Switzerland), J. Ritchie (USA), T. Yang (USA), are currently participating in the project. The participants are representing multi-disciplinary and inter-institutional teams involved in soil erosion/sedimentation research. The individual studies cover a wide range of conditions (land use, environment, spatial scales) that should allow a robust testing of the potential of the FRNs to assess the efficiency of soil conservation practices. The first Research Co-ordination Meeting plus technical workshop was held in Vienna and Seibersdorf, Austria, 18-22 May 2003. The next RCM is scheduled for 4-8 October 2004, in Istanbul, Turkey.

Appropriate linkages have been established to institutions/associations working in soil and water conservation such as the World Overview of Conservation Approaches and Technologies (WOCAT) consortium, World Association of Soil and Water Conservation (WASWC), and the International Association of Hydrological Sciences (IAHS). The activities of this project are included in their Newsletters and corresponding websites.

# F. NEW FAO/IAEA CO-ORDINATED RESEARCH PROJECT

### 1. Title of the CRP:

Integrated Soil, Water and Nutrient Management for Conservation Agriculture

### 2. Background Situation Analysis (Rationale/Problem Definition)

Of the total area of land in the world presently under arable crops (1,360 Mha - FAO, 2002) at least 225 Mha are estimated to be severely to moderately degraded (Oldeman, 1994). In tropical and sub-tropical regions, owing to higher soil organic matter (SOM) decomposition rates due to high temperatures, and in many regions increased pressure on the land due to population growth, this problem is disproportionately severe and growing more rapidly than in temperate regions. For example, it is estimated that 25% of all degraded agricultural land is found in Africa.

With the development of effective wide spectrum herbicides in the USA during the 1960s, the first steps were made to eliminate soil tillage, and no-tillage crop production systems were developed and spread such that today 13% of all arable crop area (22.4 Mha) in the USA is under no-till (Derpsch, 2003). In the early 1970's, in response to severe erosion problems occurring in southern Brazil where the soil was tilled twice a year under continuous wheat/soybean cropping, progressive farmers started to experiment with no-till in this sub-

tropical region. Until the 1990s the spread of this system in Brazil was modest (~1 Mha in 1992), but in order to mitigate pest and disease problems most practitioners introduced more crops into the system with maize in summer and oats or green manures in winter. From trials with these systems in Brazil and elsewhere, the various management systems, which today are collectively known as Conservation Agriculture (CA), were developed.

CA depends essentially on three principal management practices: (a) Elimination or reduction of tillage; (b) year-round preservation of soil cover with crops or crop residues; and (c) crop rotations including where possible contrasting crops such as cereals in rotation with $N_2$-fixing legumes and/or Cruciferae. Today these systems occupy over a third of the cropped area of Brazil (17.4 Mha) and over half of that in Argentina (13 Mha) and worldwide amounts to ~70 Mha (Derpsch, 2003).

The benefits of the adoption of this system are unquestionable in terms of soil conservation, reduction of labour and/or fuel inputs, and other frequently observed advantages including improved soil fertility (physical and nutritional), better water infiltration, SOM accumulation, reduced soil compaction, higher CEC, better WHC, increased soil biodiversity, resilience to climate change and greenhouse gas mitigation, all of which interact in a complex way to increase agricultural productivity. There are very considerable potential benefits of CA, not only for increasing productivity and sustainability of agricultural production systems with significant off-farm environmental benefits, but also to enhance food security for millions of smallholders in the developing world.

The rapid adoption of this system in South America, the USA and Australia has outpaced the scientific understanding of the principles of CA, and major efforts are being made by FAO, CGIAR centres, NARS of many countries, NGOs and CA farmer associations/federations to expand the adoption of CA. However, there is a deficit in the scientific understanding of the impact of the introduction of CA on nutrient and water use efficiency, SOM dynamics, control of weeds and crop disease and the interactions between them. It is essential that this lack of basic information be addressed through research, in order to develop optimal CA management practices adapted to local needs and conditions. This will provide a sound scientific basis for expansion of CA into regions (Europe, Central America, Africa, Asia) where it is not currently widespread.

The Agency's involvement is justified in that:

a) Nuclear techniques are essential to obtain quantitative estimates of organic matter dynamics, water balance and nutrient flows in conservation agriculture systems. More specifically, the techniques that may be used include:

- $^{13}C$ and $^{15}N$ to quantify the stabilization and turnover of SOM
- $^{13}C$ and $^{15}N$ to quantify the fate of N and C in crop residues
- $^{15}N$ to quantify legume BNF inputs to crop rotations
- Neutron probe to profile soil water content
- Sealed source ($^{63}Ni$) to quantify $N_2O$ emissions by ECD
- $^{32}P$ to study the availability and sorption of P in P-fixing soils (laboratory studies)

b) The objectives of the proposed project fall within the scope of Agency Project E.1.02 "Development of soil management and conservation practices for sustainable crop production and environmental protection" and are in line with a Major Output of the FAO's Medium Term Plan

c) The research approaches envisaged are highly relevant to Member States of FAO and IAEA.

d) The proposed CRP will operate within the framework of regional networks of national research institutes working in conservation agriculture. The Agency has a strong track record in the conduct of co-ordinated research networks that have successfully brought together scientists from different disciplines in both developing and developed countries. The findings from this CRP could be further disseminated through national or Regional Technical Co-operation Projects.

e) The Seibersdorf Laboratory of IAEA has strong in-house capacity to support the CRP through training, quality assurance, analytical services, and strategic research capability.

**3. Overall Objective**

To enhance the productivity and sustainability of farming systems through a better understanding of the principles and practice of conservation agriculture

**4. Specific Research Objective (Purpose)**

To quantify the individual and interactive effects of conservation tillage practices, residue management, crop rotations, nutrient and water inputs to increase soil organic matter, resource use efficiency, agricultural productivity and environmental quality

**5. Expected Research Outputs (Results)**

- Data on carbon, water and nutrient dynamics under conservation agriculture in diverse agroecosystems
- Means to extrapolate experimental findings across and between regions
- Enhanced capacity of NARS to conduct integrated soil, water and nutrient management studies with the aid of nuclear and related techniques
- Research findings communicated to the wider community.

**6. Action Plan (Activities)**

6.1 Consultants' Meeting (August 2003)

6.2 Presentation of Project Document to PCC (October 2003)

6.3 Advertisement of approved CRP (December 2003)

6.4 Research contract and agreement proposals received (February- July 2004), evaluated (August-September 2004) and approved by PCC (October 2004). Preference will be given to scientists already conducting research in conservation agriculture so that the planned activities in the CRP can be integrated into existing experiments. Experience in the use of nuclear techniques will be required. Contract proposals will be encouraged/solicited from NARS scientists in developing countries who are part of research networks or teams being supported by FAO, the CGIAR or other international funding agencies.

6.5 Research Contracts (10 @ US $ 8,000), and Agreements (4-5) awarded (Jan-Feb. 2005, R0). Research contracts and agreements renewed annually in February 2006 (R1), 2007 (R2), 2008 (R3) and 2009 (R4).

6.6 Research will be conducted on the impact of conservation agriculture practices on productivity and the dynamics and interactions between soil carbon, water and plant nutrients, particularly nitrogen and phosphorus.

6.7 Scientific Secretary of the CRP to attend the 3rd World Congress on CA (Kenya 2005) to keep abreast of latest developments.

6.8 RCMs: 1st (March 2005) with training workshop at Seibersdorf Laboratories; 2nd (Sept 2006); 3rd (March 2008); 4th (Sept 2009).

6.9 Publications (TECDOC or special journal issue) 2010.

**7. Call for Proposals**

Proposal forms for research contracts and agreements may be obtained at: http://www.iaea.org/programmes/ri/uc.html. They must be countersigned by the Director of the Institution and submitted to the Head, Research Contracts Administration Section, IAEA, PO Box 100, A-1400 Vienna, Austria. **Please note that they should be received before the deadline of 31 July 2004**. Further information on the Research Contracts Programme can be found at: http://crp-dev.iaea.org/.

# G. LABORATORY ACTIVITIES

***RESEARCH***

⇒ **"Management of Nutrients and Water in Rainfed Arid and Semi-arid Areas for Increasing Crop Production". A summary of the CRP datasets**
Project Officer: L. Heng

Rainfed agriculture plays an important role in world cereal production; it accounts for nearly 58% of total production and occupies more than 65% of the world's cereal areas. However, due to poor soil fertility, low and unpredictable rainfall and lack of integrated crop, soil, nutrient and water management practices, the productivity in the rainfed region is usually low, with an average yield of less than one metric ton per hectare.

A co-ordinated research project on "Management of Nutrients and Water in Rainfed Arid and Semi-arid Areas for Increasing Crop Production" was implemented between 1997 and 2002. Eleven contract holders from Argentina, China, India (2), Jordan, Kenya, Morocco, Niger, Pakistan, Senegal and Zimbabwe, and five agreement holders from Australia, France, TSBF-Kenya, ICARDA-Syria and ICRISAT-Zimbabwe participated in this project. The objective of the project was to explore, using isotopic techniques, the various options for utilizing organic manures and fertilizers, recycling of crop residues, inclusion of legumes into crop rotations and conservation of water that are sustainable and economical. Furthermore, the aim was to increase crop production through improved management of nutrients and water in rainfed arid and semi-arid areas. More detailed information regarding the project may be obtained at: http://www.iaea.org/programmes/nafa/d1/index.html.

A wide range of crops and cropping systems was studied, including wheat-maize systems on the loess plateau of China, sorghum-castor rotations in Andra Pradesh, India,

maize based cropping systems in the Machakos region of Kenya and in the Senegal Peanut Basin as well as wheat-vetch rotations in the Safi-Abda region in Morocco. The crops can be grouped as follow: wheat (China, India, Jordan, Morocco and Pakistan); maize (Argentina, China, Kenya, Senegal and Zimbabwe); barley (Jordan), sorghum (India); millet (Niger); cotton (Argentina); alfalfa (Argentina); castor (India); mustard (India); pigeon pea, chickpea and cowpea (India, Niger); peanut (Senegal), lentil (Jordan and Pakistan) and vetch (Morocco).

Datasets were collected in several of the participating countries, some with more than one experimental site.

*Water Use Efficiency (WUE)*

There are several definitions of WUE. In this study it was expressed as the ratio of water used to the quantity of grain produced. Water use efficiency (WUE) is often used as the benchmark for comparing the efficiency of rainfall use, i.e. the productivity of crops in water-limited environments.

The average rainfed wheat WUE of each participating country (Fig. 1) ranged from five to more than 15 kg/ha/mm. Values of less than 1 kg/ha/mm were observed in Jordan due to the very dry conditions. Globally, the WUE of wheat varies from 5 to 20 kg/ha/mm for well-managed, pest-free crops; our results are within this range.

As different plant species absorb $CO_2$ at different rates, WUE can be different between crops such as maize, sorghum and chickpeas. In general, WUE was found to be higher for the $C_4$ than the $C_3$ crops and increased with N applied.

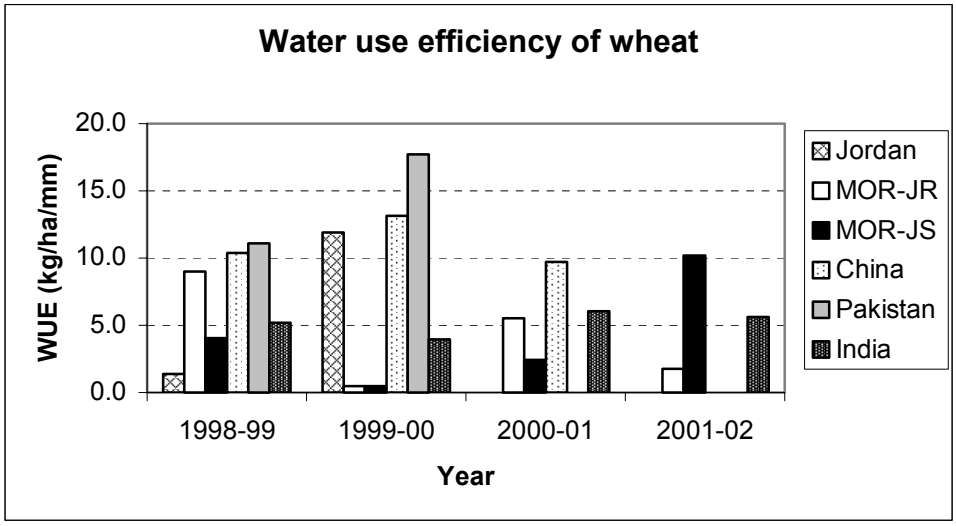


Fig. 1. Water use efficiency (WUE) of wheat crops

*Yield and Seasonal Rainfall*

Large variation in yield was recorded between seasons and treatments because of nitrogen level, amount and distribution of rainfall, and other environmental factors (Fig. 2). On average, wheat yields were higher than the 1.2 metric tons per rainfed hectare global average for developing countries. This was probably because many of the experiments were carried out on-station, which have better conditions compared with farmers' fields. Fig. 2 also

shows that wheat grain increased with increasing rainfall in the growing season. The same trend was observed for other crops.

The minimum amount of approximately 150 mm rainfall is required during the growing period to produce a wheat crop (Fig. 2). French and Schultz (1984) estimated that 110 mm in South Australia to be the minimum amount needed for wheat. However, they noted significant variation in this value, with 25 mm measured in Queensland and as high as 170 mm at high rainfall (>450mm) sites in South Australia, with soils having poor surface structure. They called this quantity the "Water Use for Zero Yield (WUZY)", which is essentially the amount of evaporation from the soil surface. The same authors gave an estimated potential yield for wheat per unit rainfall to be 20 kg grain/ha/mm, shown as a solid line in Fig. 2. Results from this CRP shows considerable scatter around the potential, with India and Pakistan having higher values and Jordan and Morocco lower than the average.

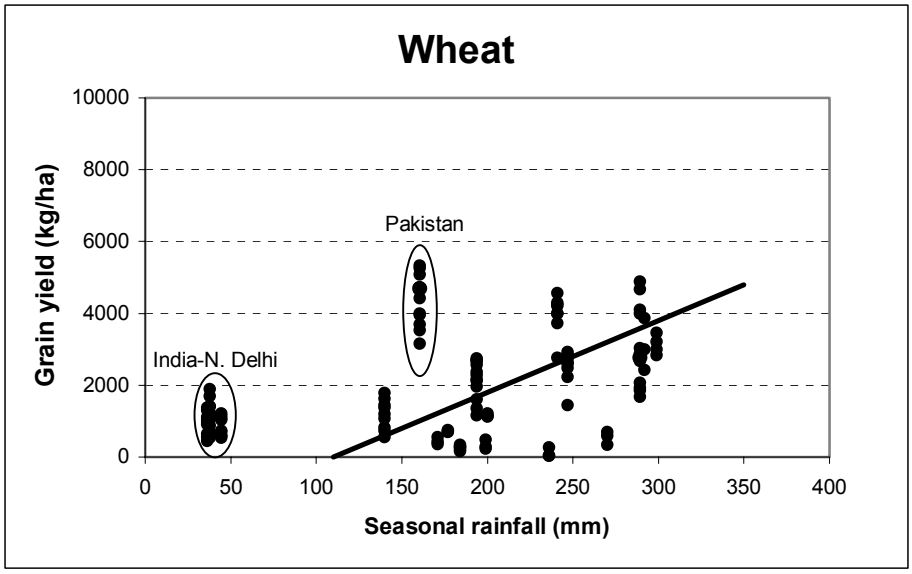


Fig. 2. Relationship between wheat grain yield and growing season rainfall
(The solid line is yield at 20 kg/ha/mm).

Reference
French, R.J. and Schultz, J.E. (1984). Water use efficiency of wheat in a Mediterranean-type environment. 1. The relation between yield, water use and climate. *Aust. J. Agr. Res.,* 35: 743-764.

## *TRAINING*

### ⇒ Fellowships

**Mr. Onesimus Semalulu** from Uganda (UGA/03010P) attended a two-month training in soil water including the interregional training course. He carried out a field experiment comparing the soil moisture content of mulched and bare plots using nuclear, capacitance and time domain reflectometry techniques under the supervision of Ms. Lee Heng.

**Mr. A. B. Rashid-Noah** (SIL/01004P) and **Mr. Richard Max Kpange** (SIL/02003P), both from Sierra Leone, came for a three and a half month fellowship. They also participated in the interregional training course. They carried out field experiments comparing traditional and drip methods of irrigation using nuclear and related techniques under the supervision of Ms. Lee Heng.

**Mr. A. Dumbuya** (SIL/02001P) was trained in the use of $^{15}N$ methodology to quantify biological nitrogen fixation. He conducted a greenhouse experiment to study early nodulation and nitrogen fixation in soybean cultivars. He also participated in the group training on total N and $^{15}N$ analyses.

⇒ **Group Training on total N and N-15 analyses by Optical Emission Spectrometry**

**Mr. T. Alam** (BGD/02037R) and **Mr. S. Faye** (SEN/02017R) received eight weeks isotope analytical training under the overall supervision of Mr. Leo Mayr from 23 October to 05 December 2003.

Sample preparation (plant material and soil) using the Kjeldahl method for total nitrogen determination, measurement of $^{14}N/^{15}N$ ratio using the NOI-7 emission spectrometer and quality assurance of the analysis were the main topics of the training. One week of troubleshooting of the OES system was also included in the programme.

***SUPPORTIVE SERVICES***

⇒ **Isotope Analyses**

The following isotope analyses were performed during the period January 2003 to November 2003:

- **Samples received**

| | | |
|---|---|---|
| CRP | 3,436 | 76.6% |
| TC | 165 | 3.7% |
| Seibersdorf | 882 | 19.7% |
| Total | 4,483 | 100.0% |

- **Requested analysis**

| | | |
|---|---|---|
| $^{15}$N enriched | 3,622 | 63.4% |
| $^{15}$N natural abundance | 230 | 4.0% |
| $^{13}$C natural abundance | 1,311 | 23.0% |
| $^{18}$O natural abundance | 546 | 9.6% |
| Total | 5,709 | 100.0% |

- **Measurements carried out**

| | | |
|---|---|---|
| $^{15}$N enriched level | 4,633 | 51.0% |
| $^{15}$N natural abundance | 946 | 10.4% |
| $^{13}$C natural abundance | 2,131 | 23.4% |
| $^{18}$O natural abundance | 1,378 | 15.2% |
| Total | 9,088 | 100.0% |

⇒ **External quality assurance**

The results of the 2003 proficiency tests will be reported in the Vol 27, No. 1 2004 Newsletter.

# H. PUBLICATIONS

**Chalk, P.M., Heng, L.K.** and **Moutonnet, P**. 2003. Nitrogen fertilization and its environmental impact. In: Fertilization in the Third Millenium – Fertilizer, Food Security and Environmental Protection. Keynote Lecture, Proceedings of the 12th International World Fertilizer Congress, Vol. 1. pp. 1 - 15. International Scientific Center of Fertilizers (CIEC) and The Chinese Academy of Sciences (CAS). ISBN 7-5381-3749-1.

**Chalk, P.** and **G**. **Hardarson** 2003. The role of legumes in sustainable farming systems. Powerpoint presentation and video clip. UN University International Course in Environment and Sustainable Development, 19th May-27th June 2003, Tokyo. CD ROM, L. Jansky (Ed.) ISBN 92-808-8021-7. UN University, Tokyo.

**Chalk, P., Keerthisinghe G., Zapata, F., Heng, L.** and **R. Hood-Nowotny** 2003. Integrated management of soil, water and nutrients in cropping systems to conserve natural resources and optimize external inputs. Powerpoint presentation and video clip. UN University International Course in Environment and Sustainable Development, 19th

May–27th June 2003, Tokyo. CD ROM, L. Jansky (Ed.) ISBN 92-808-8021-7. UN University, Tokyo.

Guidelines for the Use of Isotopes of Sulfur in Soil-Plant Studies. 2003 Training Course Series No. 20. IAEA, Vienna, Austria, 102 pp.

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**Hardarson, G**. and W.J. Broughton (Eds.) 2003b Maximising the Use of Biological Nitrogen Fixation in Agriculture. Special Issue, Plant and Soil, Vol. 252, No.1 186 pp.

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Karanja, N.K., K.A. Mwenda, J.R. Okalebo and **F. Zapata** 2003. Effects of phosphate rock fertilization and arbuscular mycorrhizae inoculation on the growth of agroforestry tree seedlings. *In*: S.S.S. Rajan and S.H. Chien (eds). Direct application of phosphate rock and related technology: latest developments and practical experiences. Proc. Int. Meeting, Kuala Lumpur, 16-20 July 2001. Special Publications IFDC-SP-37. Muscle Shoals, Alabama, USA, p. 353-366.

**Zapata, F**. and R.N. Roy (eds.) 2003. Use of Phosphate Rocks for Sustainable Agriculture. FAO Fertilizer and Plant Nutrition Bulletin No.13. FAO, Rome, Italy, 186 pp.

**Zapata, F.** 2003. FAO/IAEA research activities on direct application of phosphate rock for sustainable crop production. *In*: S.S.S. Rajan and S.H. Chien (eds) Direct application of phosphate rock and related technology: latest developments and practical experiences. Proc. Int. Meeting, Kuala Lumpur, 16-20 July 2001. Special Publications IFDC-SP-37. Muscle Shoals, Alabama, USA, p. 100-109.

Zaharah, A.R. and **F. Zapata** 2003. The use of $^{32}P$ isotope techniques to study soil P dynamics and to evaluate the agronomic effectiveness of phosphate fertilizers. *In*: S.S.S. Rajan and S.H. Chien (eds) Direct application of phosphate rock and related technology: latest developments and practical experiences. Proc. Int. Meeting, Kuala Lumpur, 16 - 20 July 2001. Special Publications IFDC-SP-37. Muscle Shoals, Alabama, USA, p. 225-235.

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# I. VACANCY ANNOUNCEMENT

## INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)

### SEEKS

### Head, Soil and Water Management & Crop Nutrition Section

**The IAEA,** an independent United Nations organization headquartered in Vienna, Austria, with 137 Member States and a staff of 2200, serving as the global focal point for international co-operation in the safe and peaceful use of nuclear energy, is seeking a Head for its Soil and Water Management & Crop Nutrition Section. **This individual will be responsible for providing leadership in formulating, guiding, monitoring and evaluating the performance of Projects aimed at assisting Member States to apply isotopes, radiation and other nuclear-based techniques in the strategic areas of crop, soil, water and nutrient management for productivity and sustainability, and for providing technical and managerial guidance to staff assigned to implement these activities**.

***Type and duration of appointment:*** Fixed term, 3 years

***Education and experience required:*** Ph. D with specialization in soil science or agronomy. At least 15 years' experience, supported by refereed publications, in the measurement of soil water, soil water fluxes, water balance and water use efficiency, and the management of the water resource in irrigated and dry land agro ecosystems, with a minimum of 2 years at the international level. Experience in managing human and financial resources.

***Knowledge, skills and abilities required.*** Sound knowledge of agriculture in developing countries. Communication skills. Fluency in English. Knowledge of French or Spanish desirable.

***Benefits****:* The IAEA offers a stimulating multicultural working environment in the beautiful and culturally rich city of Vienna, Austria, with easy access to Europe-wide attractions. The post offers: tax free remuneration; diplomatic status; rental subsidy; 6 weeks annual vacation; medical insurance coverage; a staff retirement plan; full coverage of removal expenses for staff member, family, and personal effects; additional allowance for installation expenses; assistance with finding housing and schools in Vienna; financial assistance with the education of dependent children; and paid travel to the home country for the staff member and family every other year.

**Applicants need to complete and submit a IAEA Personal History Form (PHF) before 9 February 2004**, quoting the vacancy notice no. 2003/094. Online application is encouraged at *http://www.iaea.org/About/Jobs*. If this is not possible, a PHF can be obtained from the above Internet address or by mail: Division of Personnel - International Atomic Energy Agency – Wagramer Strasse 5 - P.O. Box 100 - A-1400 Vienna, Austria.

INTERNATIONAL ATOMIC ENERGY AGENCY
***Our Goal****: to facilitate the safe contribution of nuclear technologies to peace, health and prosperity throughout the world, while ensuring that no technology or material under our oversight or provided with our assistance is used to further any military purpose.*



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