

# PakAtom

Newsletter of the Pakistan Atomic Energy Commission

November-December, 2002

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### **PAEC working on saline land project for socio-economic development**

Socio-economic conditions of the masses could be improved by helping them to cultivate saline and water-logged wastelands of the country. It will discourage migration of rural population to urban centers by creation of jobs and generating economic activity at their native places. This was stated by Chairman Pakistan Atomic Energy Commission, Mr. Parvez Butt during his visit to BioSaline Agriculture Research Station at Pacca Anna about 53 kilometers from Faisalabad.

He said, out of twenty million hectares of country's lands, seven million hectares are afflicted by salinity and water logging. This malice has massively reduced our agriculture output potential forcing the local population to migrate for livelihood. The traditional methods employed for elimination of salinity and water logging involve pumping out gigantic mass of underground water followed by sweet water treatment which apart from being unaffordable and expensive take many many years to yield results. PAEC through application of nuclear techniques, has evolved and identified crops, trees and shrubs, which are, salt tolerant, accept the brackish water and can be grown in saline lands. He said that as such these plants have economic worth and could be used for the redressal of poverty by creating new job opportunities.

Mr. Parvez Butt informed that this technology is internationally acclaimed and Pakistan has transferred the same to many countries badly affected by salinity and water logging under the aegis of International Atomic Energy Agency.

In view of the demonstrated utility of these techniques, Government of Pakistan has sanctioned Rs. 178 million for the project under which 25,000 acres of saline lands in all four Provinces are being brought into cultivation, he disclosed.

Replying to a question, he said that since these projects promise direct, basic and substantial benefits to the economy of the country, therefore, we are encouraged to approach the multinational funding agencies, who based upon the success of these efforts, have pledged to donate sufficient funds for this mega enterprise in the coming few years. "Such investments will have multifarious benefits in the form of aesthetic improvement or these wastelands, job creations, stopping the population migration to unbearably burdened urban centers and reduction of poverty through enhancement of agriculture related output", he added.

Persistent sowing of these salt tolerant crops result in reclamation of saline lands into normal land over the years and that will be the stage where PAEC's research based high yield crops will magnify the benefits of these land reclamation efforts. "PAEC is set to play its dynamic role in poverty alleviation and socio-economic development by working on this project", he said.

Chairman PAEC said this project has a potential of Rs. 200 billion in the future as according to some estimates the economy of the country suffers this loss annually on account of decrease in farm production on soils effected by salinity. Appreciating the excellent work done by the NIAB scientists, he hoped that they would expedite their efforts by extending the benefits of this technology at the grass root level.

He said that PAEC has forty year experience in the field of nuclear power generation and now we are working to set up two more nuclear power plants to meet our future requirements. He said that Karachi Nuclear Power Plant was established about thirty years ago. PAEC is working to extend its life for another 10-12 years.

He further said that three more nuclear medical centers would also be set up in various part of the country to provide this state of art treatment for the ailing humanity.

After the Pacca Anna Model Project visit, Dr. M. Mohsin Iqbal, Director, Nuclear Institute for Agriculture and Biology (NIAB) briefed the visitors about research activities being carried out in various sectors of agriculture development by the scientists of NIAB. Mr. Anwar Ali Member Technical and Dr. Kauser Abdulla Malik, Member (Biosciences) PAEC also accompanied the Chairman during this visit. The visitors planted saplings of Eucalyptus at the research station.

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## **Orientation and Training Courses at NIAB**

## Saline Agriculture Farmers Participatory Development Project (SAFPDP)

An orientation-cum-training course on Saline Agriculture Farmers Participatory Development Project (SAFPDP) was held at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad.

Explaining the genesis of Farmers Participatory Saline Agriculture Development Project, Dr. Kauser Abdulla Malik, Member (Biosciences/Admin), PAEC, termed it a major structural shift to link research institutes with community mobilizing NGOs for technology transfer to the end users. PAEC has evolved a reliable technology for the economical use of the saline lands and demonstrated its efficacy.

The project has been launched in collaboration with National Rural Support Program (NRSP) to take this technology to the end users. This NGO would give lectures and methodologies to the field staff that will ensure direct involvement of farmers. The Project has been submitted to various donor agencies including IAEA, UNDP, WB and ADB etc. Their response is very encouraging and the Government will also give full support for this mega project.

Two sites in Punjab and one each in Sindh, Balochistan and NWFP have been selected for this purpose. The three basic parameters for the selection of these sites are (i) where predominantly the area is salt affected, (ii) underground water is brackish and (iii) community is living around this area. These sites have 5000-8000 acres of saline land with at least 5 to 10 villages. There will be ten persons for each site including Site Facilitators Agronomists/Soil Scientist, Social Mobilizer and Field Assistants to have direct links with the farmers and disseminate PAEC saline agriculture technologies to the farmers.

For the successful implementation of the project, new practices, new thinking and new forms of community engagement will be required. It will be a transformational change, developing new system through investment in human and social capital. Other technologies developed by different research organisations like pest control, water conservation, variety selection, etc., will also be made available for the welfare and uplift of the farming community, specially the small farmers who form the major chunk of the rural economy. "Social Baseline Surveys defining site analysers, education, land holdings, income and health situation have already been completed and documented, and that it will be our benchmark and help us to assess the improvement in mid-term review of this project."

Dr. Mohsin Iqbal, Director NIAB, highlighted the contribution of NIAB in developing new technology to use salt affected lands instead of employing costly technologies for the rehabilitation of saline lands. Dr. Zahoor Aslam presented the methodology of this training course.

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## Application of Nuclear and Other Advanced Techniques in Agricultural and Biological Research

The 30th Annual training course on Application of Nuclear and Other Advanced Techniques in Agricultural and Biological Research was held from 14 -25 October, 2002. The objective was to share the latest knowledge on application of radiation and nuclear techniques with peer scientists and researchers for development of agriculture and biological disciplines in the country.

The course, attended by 29 participants from various organisations comprised lectures, and hands-on practical, on topics such as Basics of radioactivity, radiation and radio-isotopes; Application of radiation and isotopic tracers in Mutation Breeding, Soil and Fertilizers research, Insect pest control, Waste-land utilization, and the analytical techniques like Separation techniques, Chromatography, Spectroscopy, Radioimmunoassay, Enzyme linked immunosorbent assay, Autoradiography, etc.

Majority of the faculty members were the serving and retired senior scientists of NIAB. Some specialized lectures were delivered by scientists of INMOL and NIFA, Peshawar.

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## Safety Measures in the use of Radiation in Agriculture and Biology

The 9th Annual Training Course on Safety Measures in the use of Radiation in Agriculture and Biology was held at NIAB, Faisalabad, from 16 -20 December, 2002. The objective was to impart knowledge on atomic radiation and isotopes and their safe handling in the work places.

Attended by thirty participants, the resource persons included Dr. M. Mohsin Iqbal, Mr. S.D. Orfi, Dr. Altaf Hussain, Mr. Javaid Akhtar, Mr. R. A. Wahed and Mrs. Nasim Khaild from NIAB, Dr. Javed Irfanullah from PINUM, Dr. Amna from PNRA and Mr. Muhammad Salim from NARC, Islamabad.

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## Introducing Quality Management Systems in PAEC Organisations

Implementation of quality assurance measures according to specified criteria is one of the mandatory requirements for the design, construction and operation of nuclear power plants imposed by the respective nuclear regulatory authorities of the nations using nuclear reactors for generating electricity on a commercial scale. An Overall Quality Assurance Programme (OQAP) is required to be established by the organization planning to construct a Nuclear Power Plant (NPP) in advance of commencement of construction work.

The Overall Quality Assurance Programme should provide guidelines to all the lower tier subcontractors for developing constituent QA programmes according to the respective scope of work. This programme includes the scope of activities to be covered by the constituent QA programmes, applicable codes and

standards to be followed and interfaces to be established between different subcontractors for implementation of activities relating to safety. PAEC management established a QA Division in the CHASNUPP project organization in November 1989, i.e. two years ahead of the signing of the contract with China for the construction of a 300 MWe nuclear power plant at Chashma. The QA Division was entrusted with the challenging task of developing an overall infrastructure of QA for the project. Before the signing of contract, this Division was involved in the pre-project studies in identifying clear roles of different project participants for activities involving safety, since the construction of a nuclear power station involves many complex activities which can be classified as safety related. With the start of contract negotiations, the Division was actively involved in negotiations with the Main Contractor/Prime Subcontractors for the planning and implementation of the detailed QA activities during project implementation. The broad principles for QA for the CHASNUPP project including scope of activities and PAEC's right of independent QA verifications were included in one of the articles of the main contract. With the signing of this contract, the QA Division was upgraded to QA Department, and reorganized to cater for the QA activities during project implementation. An Overall QA Programme (OQAP) was developed by the QA Department and was reviewed by the national nuclear regulatory authority. It was then distributed to the main contractor and prime subcontractors. Constituent QA programmes were developed by the subcontractors involved in safety related activities

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### **Utilisation of CHASNUPP'S Construction Experience**

***By developing and implementing a comprehensive quality management system for the CHASNUPP project, involving all essential elements of quality assurance such as QA surveillance, QA Audits, review of quality plans and review of constituent quality assurance programmes, PAEC has gained valuable experience in the field of quality assurance. This experience will now be utilized in introducing quality management systems at other PAEC establishments. Keeping this in view, a Directorate of Quality Assurance has been established at PAEC Headquarters.***

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according to their scope of work as spelled out in OQAP. These constituent QA programmes were subjected to a systematic review by PAEC's QA Department. Violations and omissions from the Nuclear Safety Standards were identified during these reviews and subsequent revisions of these QA programmes were developed for implementation. With the start of construction of CHASNUPP, and during the project implementation, PAEC's QA Department, supported by experts from other PAEC establishments, conducted extensive independent QA verifications through comprehensive programmes of QA audits and surveillance for design and construction activities in China and at the construction site. More than five thousand control points were participated by PAEC teams as part of the PAEC's QA Surveillance Programme during civil works, equipment manufacturing in China, installation, commissioning and pre-service inspections. In addition, thirty three QA audits were conducted by PAEC audit teams in China and at the construction site. All QA activities conducted by PAEC were implemented systematically through PAEC's QA manual, which was developed according to the requirements of the International Atomic Energy Agency's (IAEA's) approved Nuclear Safety Standards on QA. PAEC's overall QA programme was actively supported by foreign QA experts from the IAEA in the form of periodic reviews. During the implementation of CHASNUPP Project, six expert missions on QA visited CHASNUPP and conducted extensive in-depth reviews of PAEC's QA manual. The recommendations of these missions were judiciously followed to update PAEC's QA programme and procedures. In addition, PAEC's QA programme was continuously monitored by the national nuclear regulatory body through a systematic programme of Regulatory Inspections throughout the project implementation phase. By developing and implementing a comprehensive quality management system for the CHASNUPP project, involving all essential elements of quality assurance such as QA surveillance, QA Audits, review of quality plans and review of constituent quality assurance programmes, PAEC has gained valuable experience in the field of quality assurance. This experience will now be utilized in introducing quality management systems at other PAEC establishments. Keeping this in view, a Directorate of Quality Assurance has been established at PAEC Headquarters. Presently this Directorate is systematically monitoring the Quality Management Systems of the two operating nuclear power stations, i.e. KANUPP and CHASNUPP, to upgrade them as per latest QA requirements and Pakistan Nuclear Regulatory Authority (PNRA) regulations. Active planning is also under way to spread QA awareness in PAEC through a series of short seminars for the middle management and a QA certification course for engineers and scientists working in nuclear related projects. The Directorate of Quality Assurance is also planning to develop a comprehensive QA management system model for future nuclear power projects with more emphasis on quality control measures by PAEC personnel during the construction phase to ensure in-built quality for these projects.

*(Contributed by Engr. Mohammad Azim, Chief Engineer/Director, Directorate of Quality Assurance, PAEC)*

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## **Technological development to bridge gap between North and South**

Technological development is the only way to bridge gap between North and South and we must engage in science-based solution of problems with own efforts and with the cooperation of the North. This was stated by Mr. Parvez Butt, Chairman Pakistan Atomic Energy Commission, while addressing a meeting on CERN Data-Grid and its Application- Providing an opportunity of Learning for Scientists from Developing Countries. This meeting was organized by the Commission on Science and Technology for Sustainable Development in the South (CaMSA TS), at its headquarters in Islamabad on 4 November, 2002

The meeting, attended by scientists from various organisations, diplomats and research scholars, was arranged with a view to introduce the opportunities and potential for collaboration among scientists from the North and the South

Mentioning the poor condition of science and its application, Chairman PAEC declared that while the world is getting united through science-based connectivity, it is also getting more and more divided as in the South people do not have a shelter and enough to eat while the North lives in comfort.

"We, in the South do not know what is happening a kilometer away and the North is spending trillions to know as to what happened at and before the beginning of this universe", an allusion which he made to the exotic experiments being made by CERN in connection with discovering the origin of the universe. He deplored the attitude of remaining in isolation and suggested that more and higher level of cooperation with the North can equalize the differences in quality of life, which exists now.

He urged the South to apply all efforts for engaging into a culture of science and technology, and the North to be more sharing with their desolate counterpart in South. Only technological development in the South can bridge this yawning and alarming gap. Eulogizing the emerging cooperation between institutions in the world, he cited CERN as a perfect example of international cooperation.

Talking about the genesis of PAEC technological journey, he said if PAEC had not set up its research laboratories and had not put up a research nuclear reactor forty years before, it would not have been in a position to extend a meaningful technical assistance to the high-tech program of CERN.

Mr. Butt divulged that apart from in-kind technical assistance, which PAEC is providing to CERN as a member of the international scientific community, it has also provided such services on competitive commercial basis, the value of which stands at US \$ 2 million. This symbolized the export potential of PAEC in the fields of design, manufacturing and technical services to the world scientific community. Mr. Parvez Butt proposed that we should aim for value-added products apart from working on conventional processes.

Dr. Luciano Maiani, Director General, CERN, Geneva, while addressing the guests via video conferencing, introduced them to CERN and how the organization was shifting from an European orientation to a global orientation and therefore welcoming collaboration with partners like COMSATS so that opportunities could be created for future generations. He also answered several questions of the guests at the meeting regarding CERN and its projects.

Dr. Blechschmidt, from CERN, emphasized the need for international scientific collaboration as the means to sustained economic development and stability. Dr. John Ellis, a renowned theoretical physicist from CERN, explained the physics program at CERN, while Dr. Hafeez Hoorani of National Centre for Physics (NCP), Quaid-e-Azam University, introduced the CERN-COMSATS-NCP- PAEC project.

Dr. Hameed Ahmed Khan, Executive Director, COMSATS said that COMSATS is actively planning its role in the socio-economic uplift of developing countries using science and technology as the agent for sustainable development. He said that this activity is based on the concept of sharing of intellectual and computational resources worldwide. One of the greatest advantages to be gained through this initiative would be the video-conferencing, which will enable lectures originating at CERN to be participated by scientists here.

CERN, the European Organization for Nuclear Research, is one of the largest laboratories in the world and is the inventor of the World Wide Web and Internet Highway. The most important project with CERN today is the Large Hadron Collider (LHC), in which 10,000 physicists and engineers are involved to make it fully operational by the year 2007. The project will allow a huge amount of data to be processed annually to solve current computational problems. COMSATS is helping to develop the needed software for the main data-hub, at Geneva, to share data with its nodes worldwide, of which COMSATS is one node. The project will open up areas such as higher learning, easier access to the state-of-the-art technology and specialised skills.

## **Chinese delegation assesses possible local participation in the construction of NPPs**

After successful operation of 300 MWe Chashma Nuclear Power Plant (C-1) for about two years, PAEC has decided to set up a second unit (C-2) at the same location. Subject to sufficient potential and capabilities of domestic manufacturing industry the Chinese suppliers of C-1 agreed in principle to increase the local contribution in C-2 as much as possible.

Scientific & Engineering Services Directorate (SES) arranged a visit of Chinese delegation to local industries for evaluation and assessment of mechanical and electrical components and construction material manufacturers.

The first delegation surveyed six manufacturers in Islamabad, eight in Lahore, and twelve in Karachi, engaged in mechanical equipment fabrication like pressure vessels, ordinary process vessels, heat exchangers, industrial boilers, textile machines, hoisting facilities, pumps, air conditioners, steel structures, etc., and ten manufacturers engaged in electrical component fabrication like trans- formers, switch gears, and cables, etc.

The second delegation surveyed a number of construction material manufacturers in and around Islamabad, Chashma, Lahore and Karachi. The delegation visited twenty five companies, including seven of material sup- ply, eleven of construction and erection, three of test and calibration and four of man- power supply and equipment renting.

It was concluded that local industry has obtained the manufacturing capability in several aspects which can be utilized in the construction of C-2 Project, like non-nuclear class vessels and heat exchangers, non-nuclear class pumps & non-1 E class low voltage motors, cables and low/medium voltage electrical cubicles, immersed type step down transformers non-nuclear class air conditioners, hoisting facilities, steel structures, etc.

Both Chinese and PAEC officials were of the view that the local companies have improved the capabilities significantly as compared with those during the construction of C-1 in terms of quality, manpower qualification, equipment, tools, etc.

A common understanding was reached that local companies can be involved in C-2 Project with greater utilisation of manpower and quality material. More qualified local contractors can be involved in construction and certain steel tanks and civil work pre-cast elements can be prefabricated locally.

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### **Pak Diff-1000: Indigenously designed and fabricated X-ray Diffractometer at PINSTECH**

X-ray diffractometer is an essential tool used for the characterization of materials including metals, semi-metals, alloys, minerals, clays, ores, organic and inorganic compounds. It has wide range of applications in almost all the disciplines of science and technology, for example, in crystallography, mineralogy, medicine, environment and materials testing. It plays a vital role in the development of several industries such as steel, chemical and pharmaceutical, dye and paint, glass and cement industries. It is also a useful tool for universities, industries and scientific organisations engaged in research and development on better materials.

PINSTECH has indigenously designed and fabricated a new automatic and computer controlled X-ray diffractometer system (PakDiff-1000). At present, only a few countries (USA, UK, Japan, Holland, France, Germany and Russia, etc.) are manufacturing and marketing these instruments. The significant feature of the project is designing and fabrication cost. The expenditure incurred on fabrication of the hardware parts of the diffractometer and the related software was one million rupees. If these were imported, it would have a cost more than six million rupees. The attainment of the technology and the establishment of local expertise in Pakistan is another important feature of the project. This is another step forward towards enhancing PAEC's role in the promotion of scientific research and development in Pakistan.

The fabrication of such a high-tech analytical system is an excellent effort, made by M. Akhtar, Principal Scientific Officer., NPD, PINSTECH. Apart from X-ray generator, all other parts, more than four hundred in number, such as goniometer, shielding enclosure with fail-safe mechanism, data acquisition system and control electronics, were designed and fabricated at PINSTECH.

Dr. Masud Ahmad, Member Physical Sciences, PAEC, visited the X-ray Diffraction Laboratory and inaugurated the newly fabricated system named PakDiff-1000. He examined various parts of the system and appreciated the precision and quality of the fabrication

The model PakDiff-1000 X-ray diffraction system is suited to materials characterisation and advanced materials studies in research organisations, industries and universities. The modular design of its horizontal wide-angle goniometer allows simple selection of an efficient diffraction system for specific needs. The operation and maintenance is much easy due to modular design and automated operation. The control electronics is specifically designed for fully automating the X-ray diffractometer system for saving the operation time and data acquisition. The data measured on PakDiff-1000 is comparable to the data available in literature. After achieving this capability, PAEC not only fulfills its own needs but can also supply these systems on commercial basis.

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### **28th International Nathiagali Summer College on Physics and Contemporary Needs,**

*(Nathiagali, 30th June - 12th July, 2003)*

International Nathiagali Summer Colleges on Physics and Contemporary Needs (INSC) have been organized every year since 1976. mostly at the scenic hill resorts near Islamabad. Pakistan. The idea of holding these Colleges came from the distinguished Nobel Laureate. Professor Abdus Salam who

emphasized the vital need of communication, as well as for transferring and sharing scientific knowledge, among the scientific community of the Third World. The primary aim of these Colleges is to break the isolation of the scientists in the developing countries by enabling them to come in contact with their colleagues from the Third World and to interact with an international lecturing faculty. The scientific activities of INSC aim at a broad coverage of topics at the frontiers of knowledge in physics and allied sciences. One or two subjects of current interest and their applications for technological development, with special reference to needs of the developing world are highlighted by a renowned international faculty every year. About two hundred scientists from a large number of developing nations benefit from this scientific discourse. During the last twenty seven years, about 470 eminent scientists including six Nobel Laureates shared their knowledge and experience with nearly 5200 scientists from over seventy developing countries. The Colleges have resulted in collaboration between the scientists of the region and interaction with those from advanced countries. Many workshops/seminars and joint research projects spawned as a direct follow-up activity of the College. The proceedings of these colleges have appeared as eleven volumes of Physics and Contemporary Needs.

Over the years, Pakistan Atomic Energy Commission has regularly organized this scientific activity. From the 26th College, the scientific programme of the College is being looked after by the National Center for Physics, Quaid-i-Azam University, Islamabad. The regular sponsors of the College include the Abdus Salam International Center for Theoretical Physics (ASICTP), Trieste, the US National Science Foundation, the European Laboratory for Particle Physics (CERN) and some local and regional organizations.

### **Scientific Programme**

The scientific programme of the College has been divided into two activities: (i) Safety of High Technology Systems, and (ii) Condensed Matter Physics

During the first week (30 June -5 July, 2003), focus of attention will be on Safety of High Technology Systems. Technology plays a crucial role in the development of mankind. The technological advancements invariably introduce their own hazards. Technological systems of the present day carry their own natural companion of disaster. "Safety Culture" needs to be imbedded in human mind with full vigor in order to preclude occurrence of any such incident and mitigate consequence if at all such an untoward scenario starts to develop. Harvesting big economic advantage without compromising the safety is the main goal. A series of lectures/presentations will be held for technology managers emphasizing following areas relevant to safety, but not limited to these. (i) Safety Culture, (ii) Reliability and Safety Assessment, (iii) Human Factors Expert Systems.

During the second week (7-12 July, 2003), the College will focus on some key developments in Condensed Matter Physics in recent times. Unprecedented developments in experimental techniques, computation and computer technology have made it possible to comprehend and control some of the physical and chemical properties of materials at the atomic scale. Each such step brings us closer to the challenging era of nanotechnology and related innovative technical application in other fields like biology, pharmaceuticals, and engineering. The emphasis will be on understanding phenomena such as nanotribology, computational condensed matter physics, quantum dots, quantum computing.

### **Venue**

These Colleges have traditionally been held at the scenic summer resorts of Nathiagali, near Islamabad, the capital of Pakistan. Lodged in the Sylvan slopes of lower Himalayan range, these hill resorts (2000-3000 meter high) are sheer slopes of colourful harmony, rolling fields and towering forested hills, pervading senses with a deep feeling of rediscovering nature. The cool and bracing climate, heavy with the scent of pines and ablaze in a riot of colours, provides an excellent blend of tranquil atmosphere conducive to learning and enjoying nature at its best. Some Colleges have also been held at Islamabad.

### **Registration**

The College is primarily intended for scientists actively engaged in teaching and research activities in developing countries.

## **Announcement**

### **INSC -2003**

#### **SCIENTIFIC PROGRAMME**

**Week -1 : 30 June -5 July, 2003**

**Safety of High Technology Systems**

- Safety of High Technology Systems
- Safety Culture
- Reliability and Safety Assessment, Human Factors
- Safe nuclear power for 21st Century

**Week -2 : 7 July -12 July, 2003**

**Condensed Matter Physics**

- Experiments on Surface and Nanostructure
- Thin film Magnetism and Superconductivity
- Magnetic Nanostructure & Heterostructures
- Photonic Materials, Wide Band Gap
- Computational Methods for Studies of Nanostructures

Advanced graduate students from Pakistan are also encouraged to attend. Participants must have an adequate knowledge of English which is the working language of the College. The boarding and lodging arrangements and the expenses in this regard are, in general, the responsibility of the Organizers. The travel costs are expected to be arranged by the participants. However, modest funds may be available to cover the expenses, either in full or in part, of a limited number of participants from the developing countries. Requests for participation, on the prescribed form (or photocopy) should reach the Scientific Secretary by 15th April, 2003. The selected candidates will be informed by 15th May, 2003. Advance applications can be sent by e-mail. The final selection, however, is subject to receipt of the formal application.

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**College Web site:**

**<http://summercollege.web.cern.ch/SummerCollege>**

## Investigation of Soil Erosion and Sedimentation Problems using

### Radioisotopes

Soil erosion and associated sedimentation are identified as major agricultural and environmental problems worldwide. Soil erosion causes not only on-site degradation of a non-renewable natural resource but also off-site problems such as downstream sediment deposition in fields, floodplains and water bodies.

Pakistan is situated in arid and semi-arid zone and suffers from general shortage of water. High wear and tear takes place in the soil cover in the water shortage areas. Due to high intensity rains at hill slopes, high yields of soil sediment are generated. Magnitude of erosion-affected land in Pakistan has been estimated to be around 8 million hectares.

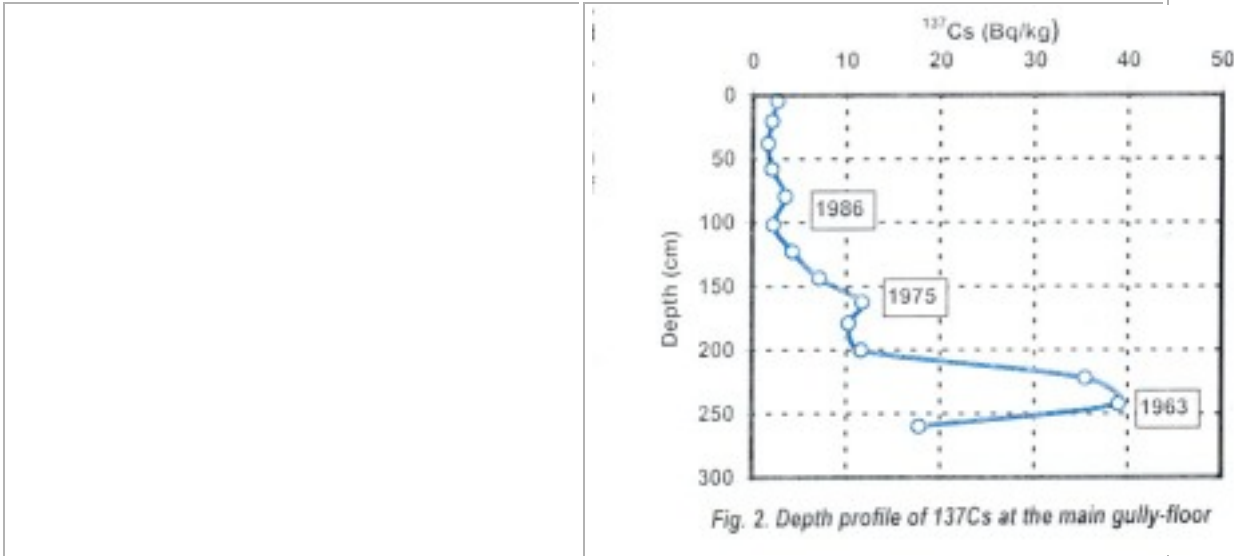
Using traditional techniques in Pothwar plateau soil loss of 3.0-4.5 tons/ha/yr has been observed in cropped fields. Many small dams constructed to store water for irrigation, hydroelectric power generation and water supply for cities are silting up much quickly than expected. Another problem associated with soil erosion is contamination of surface water and groundwater with agrochemicals. Sediment may carry chemicals such as herbicides and insecticides that may be toxic to aquatic plants and animals. Present levels of soil degradation, especially decline in soil fertility, is attributed primarily to a combination of soil erosion and nutrient mining as a consequence of poor land management practices. Thus development of innovative, practically feasible and appropriate technologies for monitoring of soil erosion and fertility degradation are urgently warranted in the interest of food security, poverty alleviation as well as resource base sustainability and environmental protection. Conventional methods used for erosion assessment are long term monitoring of experimental plots, field survey of erosion features and erosion modelling. All these methods are limited in their capacity to provide complete and timely data. Numerous field studies reported in literature have shown the potential of nuclear techniques for such studies.

Caesium-137 (<sup>137</sup>Cs), produced from nuclear testing in the atmosphere, has been widely used for tracing the movement soil and sediment particles within the landscape, to provide information on rates and patterns of soil erosion and re-deposition in agricultural regions, and on rates and patterns of sediment deposition on floodplains and in lakes/dam reservoirs. <sup>137</sup>Cs is useful for medium-term (during the last 50 years) measurement but some other natural fallout radionuclides like <sup>7</sup>Be and <sup>210</sup>Pb are potentially used to estimate short-term soil erosion and sedimentation rates in reservoirs. These

nuclear techniques in combination with chemical techniques are applied to identify the source areas of sediment generation.

Radiation and Isotope Application Division, PINSTECH has the measurement facilities and expertise for application of radioisotopes to study the erosion and sedimentation problems in the country. Using  $^{137}\text{Cs}$  as an indicator of soil erosion and sedimentation, the following studies were initiated.

- Study of soil erosion and sedimentation in Mangla Watershed, Missa Kassowal Area;
- Investigation of soil erosion in Rawal Watershed at Satrameel and sedimentation in Rawal Dam Reservoir; and
- Study of soil redistribution in cultivated slopes at Fateh Jang.



Brief results of "Hypothetical Hill-Slope- Streambed Soil Redistribution Model" in Mangla Watershed are presented which show the potential of  $^{137}\text{Cs}$  technique to investigate soil erosion from slopes and gully head, and sedimentation on gully floor/streambed. Depth profile of  $^{137}\text{Cs}$  inventory at the reference site is shown in Fig. 1. It shows that most of the  $^{137}\text{Cs}$  (88 %) activity is present in the top 10 cm of soil profile. Activity of  $^{137}\text{Cs}$  shows exponential behavior in the analysed depth profile. All the locations except the one near some trees have significant loss of  $^{137}\text{Cs}$  showing erosion as compared to the reference site.

Although, the location near the tree is at highest slope but its  $^{137}\text{Cs}$  is more than that of the reference site. The gain in  $^{137}\text{Cs}$  at the site indicates deposition and it obviously indicate the role of plants in soil conservation.

One of the depth profiles taken from the gully floor is shown in Fig. 2. The depth distribution represent the outlet from the gully and the peaks clearly indicate close association of the aggradation rate with the major world nuclear events. According to this graph there are three obvious  $^{137}\text{Cs}$  peaks: (i) The major one (39.5 Bq/kg) at 238 cm depth represents climax in the global nuclear activity during early 1960s, especially in 1963. (ii) The second peak (11.3 Bq/kg) at 165 cm depth relates to the high fallout during mid 1970s due to nuclear tests, and (iii) The third peak (3.24 Bq/kg) at 83 cm depth coincides with the Chernobyl accident in April 1986.

Thus, using the period and the depth of sediment deposition, the mean aggradation rate on the floor was 6.4 cm/yr. Further, the deposition rate before 1986 was 6.7 cm/yr and after 1986 it was 6.74 cm/yr.

Application of radioisotopes has great potential to investigate soil erosion and sedimentation in Pakistan.  $^{137}\text{Cs}$  and other radioisotopes like  $^{210}\text{Pb}$  and  $^7\text{Be}$  along with soil chemistry can be used to assess soil erosion and redistribution rates in the fields, to investigate soil fertility degradation in eroded fields under different conditions, to evaluate different soil and crop management practices for erosion control and soil fertility restoration for sustained agricultural production, to investigate pesticides residue, transport and relationship with soil loss, and to investigate sedimentation rates/patterns in the reservoirs and sediment source areas.

**(Contributed by Engr. ManzoorAhmad, S.P.E., RIAD, PINSTECH)**

## PINSTECH wins Islamic Development Bank Science Prize

Pakistan Institute of Nuclear Science and Technology (PINSTECH), the premier R&D institute of PAEC, has been honoured with Islamic Development Bank Prize for Science and Technology for outstanding contribution to the advancements in nuclear technology. Initiated by COMSTECH with the cooperation of Islamic Development Bank, the award carries a cash prize of US \$ 100,000.

The coveted prize was received by Dr. Abdul Ghaffar, Director General, PINSTECH at a ceremony held on 23 October, 2002 at Ouagadougou, Burkina Faso. Speaking on this occasion, IDB President H.E. Dr. Ahmad Muhammad Ali said that the objective of establishing this prize is the need for scientific and technological advancement to meet the challenges faced by Ummah. These awards aim at inducing productivity and innovation in national and regional economies of OIC member countries through strengthening scientific knowledge and research to help contribute to joint efforts of the governments, private sector and S&T community. In his acceptance speech, Dr. Ghaffar appreciated the efforts of IDB for encouraging and patronising the noble cause of scientific and technological advancement in the Muslim World.

PINSTECH can proudly claim to have the most advanced operational research facilities with wide ranging sophisticated equipment and highly qualified and skilled scientists and engineers in various fields. The major objectives envisaged by PAEC in the establishment of this Institute are

- Keeping pace with the ever-expanding frontiers of knowledge in the nuclear field through research that meets international norms and standards.
- Serving at the cutting edge of the PAEC's technological development for peaceful applications of nuclear energy.
- Producing radioisotopes and radiopharmaceuticals for catering to the needs of nuclear medical centers, industry and research establishments Undertaking limited production of sophisticated equipment and special nuclear materials.
- Promoting applications of radiation and isotope technology in various scientific and technological disciplines to support national programs Extending hi-tech support in the form of technical services to industry and other organisations.
- Providing appropriately trained manpower through training to the exacting and demanding standards of nuclear sciences.
- Working on important non-nuclear fields which are crucial for the development of science and a technology in the country.

As nuclear technology is essentially inter-disciplinary, the R&D efforts at PINSTECH are focused on nuclear technology and the allied fields of physical and chemical sciences through well defined and goal oriented projects, The major thrust of the programme is geared towards applications in the peaceful uses of atomic energy, In order to keep the programme well balanced and tuned to the needs of the future, basic research is also carried out.

Though much of facilities are dedicated to nuclear science and technology, PINSTECH has always cooperated with, and extended the benefits of its sophisticated technical facilities to other organizations and research and educational institutions. PINSTECH has rendered technical support to industry, armed forces, research institutes, medical and agricultural centers in such areas as radiation and isotope applications, radiation monitoring, mechanical testing and failure analysis, high precision chemical analysis, water resources research, lasers, electronics and computers, etc. The spin-offs of high-tech expertise from this Institute is playing an essential role in the socio-economic development in the country.

Collaboration has also been extended to different organisations and advanced laboratories in Europe, USA and Canada, IAEA and various international agencies. PINSTECH is offering services and specialized training under the IAEA- TC programme, It has the honour of being declared as the Regional Resource Center.

It is noteworthy that PINSTECH is a winner of various regional and international evaluations carried out on the basis of research facilities and output, PINSTECH has to its credit about 1100 research publications in scientific journals of international repute.

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## News Briefs

Mr. Parvez Butt, Chairman, PAEC, has been nominated as the Federal Member of the Executive Committee of Pakistan Engineering Council, for a period of two years.

Mr. Parvez Butt, Chairman, PAEC attended Meeting of the Governing Board of World Association of Nuclear Operators (WANO- Tokyo Centre) held in Tokyo, Japan on 2 October, 2002.

Dr. Kauser Abdulla Malik, Member (Biological Sciences/Administration), PAEC undertook mission as an IAEA Expert at Bangi, Kajang, Malaysia from 22 October to 5 November, 2002 in the field of Biofertilizer Technology, under Human Resource Development and Nuclear Technology Support

Mr. Manzoor Ahmad Chaudhry, PE, RIAD, PINSTECH, undertook assignment as an IAEA Expert at Kuala Lumpur, Malaysia from 23-27 September, 2002 in the field of Isotope Hydrology and Geochemistry for Geo- thermal Investigations, Project: Investigating Environment and Water Resources in Geo-thermal Areas.

Dr. Nasir Ahmad, CSO, PIEAS, undertook assignment as an IAEA Expert at Doha, Qatar from 5-17 October, 2002 in the field of Sustainable Radioactive and Radiation Measurement.

Dr M. Ishaq Sajjad, Chief Scientist/Head RIAD, undertook assignment as an IAEA expert to Manila, Philippines, from 25 November to 6 December, 2002, for the task: Mass Spectrometer Operation and Maintenance.

Mr. Miguel Domenech (Spain) and Dr. Barry Parsons (Canada) carried out assignment at Pakistan Nuclear Regulatory Authority, Islamabad from 14-31 October, 2002 for National Workshop on Review, Assessment, Inspection and Enforcement under Project -Strengthening of Nuclear Safety Regulatory Authority:

Mr Gunter Franz Tusel (Germany) and Mr. Mabrouk Methnani (Sweden) carried out Mission at Karachi Nuclear Power Complex (KNPC), Karachi from 23-27 September, 2002 for Task: Review of KANUPP Nuclear Desalination Project under Interregional Project: Design of Integrated Power and Desalination System.

Dr. Jin-Hong Lee, Chungnam National University, Daejeon, R.O. Korea carried out assignment at PINSTECH from 30 September -8 October, 2002 for Receptor Modelling under RCA Project -Isotopic and Related Techniques to Assess Air Pollution He also delivered lectures at Executive Management Seminar on Implication-of Environmental Pollution on Public Health.

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### **Foreign Trainees under IAEA Fellowship Award**

Mr. Ramon Clasagsag and Ms. Maria Victoria Olivar (Philippines) underwent one month training at PINSTECH, in the field of Ground Water Hydrology, during October, 2002.

Mr. Rene Montano Guitierrez (Bolivia) is undergoing 3 months training at INMOL, Islamabad in the field of Nuclear Medicine from 14 October, 2002.

Mr Mohammad Nejib Rajeb (Tunisia) paid one week scientific visit at NIAB/NIBGE, Faisalabad (including Biosaline Research Centre, Lahore, NIA, Tandojam and AWARSI, Lahore) in the field of Soil Science, Irrigation and Plant Nutrition from 22-26 October, 2002

Mr. P. Gamathi Ralalage Dharmaratne, Chairman, National Gem and Jewelry Authority, Sri Lanka paid visit to PINSTECH, Islamabad, PARAS, Lahore and Gem Institute, Peshawar, in the field of Radiation Processing from 28 October to 1 November,2002.

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### **PAEC Foundation Activities**

The 15th meeting of the Board of Governors, PAEC Foundation was held on October 29, 2002 which was presided over by Mr. .Parvez Butt, Chairman PAEC, and Chairman, Board of Governors, PAECF .The Managing Director, PAECF, Dr S. Mukhtar Ahmed, gave detailed review of the audited accounts, income generating schemes and welfare expenditure during the financial year 2001-2002.

The Foundation earned an income, of Rs. 26.73 million and the welfare expenditure amounted to Rs. 10.58 million. The, Board approved a welfare scheme to donate essential items for winter season (quilts, blankets and shawls) to the low-paid employees of PAEC. It envisages expenditure of Rs. 350,000/- to benefit 155 employees.

The Foundation has launched another welfare cum talent grooming scheme to provide full financial support to one child of a PAEC employee in BPS 1-16 and SPS 1-6 every year who is able to get admission in one of the quality and reputed residential institutions of the nation, from the academic year 2003- 2004. Necessary information is contained in Foundation's circular dated 06-11-2002.

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