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Annual  
**2003**  
Report



P H I L I P P I N E   N U C L E A R   R E S E A R C H   I N S T I T U T E



## ABOUT US

The Philippine Nuclear Research Institute (PNRI), formerly the Philippine Atomic Energy Commission, has been the center of nuclear science and technology activities in the country since 1958. The PNRI is mandated to develop and regulate the safe and peaceful uses of nuclear science and technology in the Philippines.

## OUR MISSION

"We contribute to the improvement of the quality of Filipino life through the highest standards of nuclear research and development, specialized nuclear services, nuclear technology transfer and effective and efficient implementation of nuclear safety practices and regulations."

## OUR VISION

The PNRI is an institution of excellence in nuclear science and technology propelled by a dynamic and committed workforce in the mainstream of national development.



PHILIPPINE NUCLEAR RESEARCH INSTITUTE

P N R I



## Annual 2003 Report



## MESSAGE

This year has been another challenging but fruitful year for PNRI as the Institute strived to make use of its limited financial resources to harness the unique capability and advantage of nuclear science and technology in support of national development goals.

The 2003 PNRI Annual Report attests to the significant accomplishments in our research, service and nuclear regulatory activities which focused on the fulfillment of our collective mission to contribute to an improved quality of life for the Filipino people. We initiated and continued to undertake projects and deliver services so that our target end-users could access and benefit from the peaceful applications of the powerful atom.

Through our information, education and advocacy program, various sectors have expressed their willingness to use nuclear and radiation technology and isotope techniques. Survey results of the advocacy program indicated the willingness of the food manufacturing sector in six regions in Mindanao to apply food irradiation technology. Several water districts in Visayas and in Mindanao signified interest in applying isotope techniques to solve groundwater management problems in their areas. The pilot -plant for the semi-commercial production of polyvinyl pyrrolidone (PVP) – carrageenan hydrogels for burn, wound and bed sore is now being constructed at the PNRI with financial assistance under the DOST Technology Incubation for Commercialization Program.

The effective implementation of its nuclear regulatory mandate has always been one of the priority areas of concern of the PNRI. The Institute enhanced its efforts to strengthen the nuclear regulatory infrastructure by updating regulations, continuing further training of regulators and involving actively the stakeholders through dialogues, conferences and seminars. These efforts kept in view the worldwide concern for the security and safety of nuclear and radioactive materials. The PNRI availed of assistance under the Radiological Threat Reduction program of the U.S. Department of Energy to upgrade the security of radioactive materials and facilities in the country.

These strides would not have been possible without the full commitment of the PNRI staff, the support of the DOST and the cooperation of our local and foreign partners in nuclear science and technology development. I extend my sincere appreciation and gratitude to them.

ALUMANDA M. DELA ROSA, PhD

Director





# nuclear research



## FOOD AND AGRICULTURE

The PNRI uses gamma radiation from cobalt-60 to develop new crop varieties with improved characteristics.

### Mutation Breeding

**Rice.** PNRI's Agricultural Research Group continued to develop mutant rice selections with desirable characteristics using gamma radiation. This year, 66 promising mutant lines were obtained from the different crosses of radiation-induced Denorado rice mutant with Azucena and IR8. These were planted for further purification and selection of desirable mutants. The Group also worked on the seed multiplication of the original Denorado rice variety and its mutant to have a stock of seeds that can be provided to



*PNRI has developed improved crop varieties of rice using gamma radiation.*

farmers. The Denorado mutant has short, stiff and strong straws. It matures very early and has about seven strong tillers which is ideal for the development of a new plant type capable of yielding 25 - 30 percent more. Good mutant lines were also obtained from the tissue-cultured Fortuna rice variety irradiated at a dose of 30 Gy. The Fortuna mutant lines were transplanted in the field for further studies.

**Mungbean.** The PNRI has an on-going study on determining the general performance and adaptability to Philippine conditions of 18 high-yielding mutant mungbean varieties from eight countries participating in an International Atomic Energy Agency coordinated research project. This year, the PNRI identified mungbean varieties that had yields of more than one ton per hectare. These were the KPS 2 variety from Thailand (1.27 tons per hectare); 2917A from China (1.23 tons per hectare); and PSB Mg-1 and PAEC 3 from the Philippines (1.15 tons per hectare). Nine varieties, on the other hand, had yields below one ton/hectare. These low yielding genotypes can be used either as parent materials in cross-breeding or as sources of genes for resistance to certain diseases and other traits not found in high-yielding mutant cultivars. They can be utilized also as genetic stock to increase the genetic diversity of PNRI's mutant germplasm collections.

Further studies were also undertaken on the mungbean variety PSB Mg-1 previously exposed to 100 to 800 Gy gamma radiation. Results showed that mungbean seeds treated with 100 Gy were the earliest to flower while seeds treated with 200 Gy had the highest yield value of 0.91 tons per hectare.

**Peanuts.** The effects of different doses of gamma radiation on the NSIC Pn-8 peanut variety were studied. Data on several parameters such as plant height, seed yield and plant maturity are being gathered.

**Cashew and Mangosteen.** This year, PNRI agricultural researchers started a project on developing improved varieties of important high value crops like cashew and mangosteen through gamma irradiation. The objectives of the mutation breeding studies on these tropical fruit trees are to increase the yields of fruits and nuts and to induce mutations for earliness to flower and non-seasonal fruit crops. Two varieties of cashew (Makiling and a variety collected from Guimaras) and a mangosteen variety from Davao were selected for mutation induction and tissue culture studies. Research on the radiosensitivity of cashew and mangosteen to varying doses of gamma radiation was also undertaken.



*A flowering branch of a mangosteen tree*

**Soybean.** The screening of drought tolerant mutants from eight types of irradiated soybean varieties from Vietnam and the Philippines is presently being done by PNRI in collaboration with the Bulacan State College of Agriculture, a government-run agricultural college located about 170 km from Metro Manila. This project is being carried out as part of the multilateral research program of the Forum for Nuclear Cooperation in Asia (FNCA).

# & development

PNRI's research and development programs are focused on the safe and peaceful uses of nuclear techniques, materials and processes to contribute to the government's efforts in increasing agricultural and industrial productivity as well as ensuring health security and safeguarding the environment.

**Ornamentals.** PNRI agricultural researchers continued the multiplication of the dwarf mutant of Kamuning or Orange Jasmine (*Murraya paniculata*) and chlorophyll mutant of the Green Corn plant (*Dracaena sanderiana*) under greenhouse conditions for commercial purposes. The *Murraya* and *Dracaena* mutants had been registered in 2002 as *Murraya* 'Ibarra Santos' and *Dracaena* 'Marea', respectively, with the National Seed Industry Council of the Department of Agriculture as improved varieties.



The PNRI-developed *Murraya* "Ibarra Santos" registered at the National Seed Industry Council (NSIC)

In *Dracaena godseffiana* var *surcolosa*, 16 pots (with two to five plants per pot) exhibited yellowish coloration with reduced leaf area. In chrysanthemum, a total of 17 plants irradiated at 10 Gy and seven plants from those exposed to 20 Gy bore flowers earlier than the unirradiated ones. In *Cordyline* chlorophyll mutants, 100 plants were propagated and 18 of these plants were sold to members of the

Philippine Orchid Society. PNRI also continued its research studies using gamma irradiation, coupled with tissue culture technique, to improve the characteristics of cutflower ornamentals like orchids and chrysanthemum.

In September, an open lecture on Mutation Breeding of Ornamentals was conducted for ornamental plant growers as part of the Forum for Nuclear Cooperation in Asia Workshop on Mutation Breeding. The biggest ornamental business enterprise in Davao, Mindanao submitted tissue cultured samples of orchids for irradiation at PNRI -- indicating an interesting feedback on the open lecture.

## Molecular Techniques in Aid of the Mutation Breeding Program

The PNRI Health Physics Research Group isolated DNA materials from leaves of irradiated cashew trees grown in an experimental farm at Ramon Magsaysay Technological University in San Marcelino, Zambales. Information on these DNA materials will be included in the computer database of DNA markers and graphic description of radiation-induced stable plant mutants developed by the PNRI's Agricultural Research Group. The PNRI-developed database, which now contains information on rice and ornamental mutants, can serve as (1) resource material for plant growers and commercial

plant breeders and exporters, (2) catalogue for selection of desired plant varieties intended for mass propagation, and (3) supporting document in the registration of variants with the Department of Agriculture.

## Food Irradiation

PNRI biomedical researchers tested the efficacy of varying doses of gamma radiation in extending the storage life of "Carabao" mangoes and Solo papayas and in improving the hygienic quality of dehydrated products like powdered "miso".

Results of the irradiation studies were as follows: (1) shelf-life extension of two more days for samples of fresh mature green mangoes irradiated at 350 Gy. Tests done on the irradiated mangoes showed that the firmness, odor and flavor did not differ significantly with the unirradiated mangoes; (2) shelf-life extension of about three to four days for samples of fresh and mature green Solo papayas exposed to 500 Gy dose; (3) reduction of microbial content for dehydrated products irradiated with doses ranging from 3 to 9 kGy; (4) elimination of pathogenic organisms and shelf-life extension of up to six months for powdered and granulated "miso" irradiated at 6 kGy. Non-irradiated samples had only four weeks shelf-life extension at refrigerated temperature.



## The survey results of the advocacy program conducted in six regions in Mindanao indicated the willingness of various sectors to apply food irradiation technology.

### *Food Irradiation (cont'd)*

In addition to these research activities, the Biomedical Research Group spearheaded the conduct of an advocacy program on food irradiation in Regions 9, 10, 11, 12, Caraga and ARMM in Mindanao. The program included the conduct of seminars, press conferences, tri-media (radio, television and print) interviews and meetings/dialogues with various sectors in the regions. The survey results of the advocacy program conducted in six regions in Mindanao indicated the willingness of various sectors to apply food irradiation technology. A strong support from the academe, private sectors and food sectors were generated from this activity.

### **Quantification of Nitrogen in Inorganic Fertilizer and Nitrogen-Fixing Bacteria**

The PNRI Agricultural Research Group assessed the ability of Bio-N as an effective and cheap nitrogen-fixing inoculant for rice (PSB RC13 variety) and corn (Pioneer 30R49 variety) through the nitrogen-15 isotopic technique. Nitrogen-15 was also used to determine the best combination of Bio-N organic fertilizer and inorganic (or commercial) nitrogen fertilizer that will produce higher yield and better nitrogen fertilizer utilization in the plants. This project, which aims to minimize the use of inorganic fertilizers, is being carried out at the Bureau of Soils and Water Management Research Station in Dalwangan, Malaybalay City in Bukidnon.

The results of the studies showed that rice is more responsive to Bio-N application. The findings also indicated higher rice yield and more efficient nitrogen fertilizer utilization in rice treated with Bio-N and then grown in soil applied with one-half of the recommended rate of inorganic (commercial) nitrogen fertilizer. This could be a promising technology that will benefit farmers because it reduces the use of inorganic fertilizers by half, thereby reducing farm inputs. In corn, further experimentation is being undertaken at a degraded area in the province of Isabela. It is expected that the application of Bio-N would be most effective when used in soil with low fertility level.

### **Fertilizer-N Use Efficiency in Lowland Rice-Based Cropping System**

PNRI agricultural researchers continued to use the nitrogen-15 isotopic technique in determining the best combination of inorganic (commercial) and organic nitrogen fertilizer in lowland rice-based cropping system and in the management of crop residues in a PNRI experimental site in Talisay, Camarines Norte. The results of this study will be useful in assessing PNRI's previous studies/findings in two PNRI project sites at San Ildefonso in Bulacan and at Bucal in Calamba. The previous studies showed that inorganic fertilizer

could be substituted by 30 to 60 percent compost without reduction in yield of lowland rice (like the PSB RC-78 variety). Fertilizer nitrogen utilization was also noted to be high with combinations of compost and inorganic fertilizer than that of inorganic treatment alone.

This year, initial activities undertaken at the selected project site in Talisay included the following: (1) initial soil sampling for fertilizer recommendation, (2) planting in late July of PSB RC-14, a rice variety commonly grown in the area, and (3) soil sampling in September at the flowering stage and late October at maturity growth stage of rice. The soil samples collected are now being analyzed for total NPK and nitrogen-15 determination.

### **Conversion of Sugarcane Wastes Into Useful Products**

The PNRI continued to use gamma radiation and fermentation processes in its studies on converting agrowastes into useful products such as substrate for the production of edible mushroom (*Pleurotus sojur caju*), as biofertilizers or soil conditioners and as feed to ruminants. These studies are being undertaken in cooperation with the Sugar Regulatory Administration.

This year, the PNRI screened several agrowastes (such as sugarcane bagasse, rice straw, banana leaves, peanut shells and corn cobs) as substrates for growing the oyster mushroom (*Pleurotus Sojur caju*). As in the previous years, success on mushroom production was obtained on formulated sugarcane bagasse irradiated at 15 to 25 kGy. Good results were also obtained in the use of spent sugarcane bagasse (the substrates after harvesting the mushroom) as soil conditioner or biofertilizer for peanuts.

### **Improving Dairy Cattle Production**

The PNRI, in collaboration with the National Dairy Authority-South Luzon Island Office continued to use radioimmunoassay (RIA), a nuclear technique, and urea molasses mineral block (UMMB), a strategic feed

supplement, to help dairy cattle farmers on improving the breeding and nutritional management of dairy cattle.

#### **Radioimmunoassay (RIA)**

**Technique.** PNRI used RIA to obtain knowledge on the reproductive status of dairy cattle. This technique has helped increase the reproduction of cows through proper timing of artificial insemination. In the RIA technique, milk samples (aside from blood) can be used to determine the concentration of progesterone (a reproductive hormone) collected at the time of artificial insemination and 21 days after to detect the success of artificial insemination.

**Dairy Cattle Feed Supplement.** In cooperation with the PNRI, the PALCON Multipurpose Cooperative (a pilot dairy farm) in Barangay Concepcion, Sariaya, Quezon has continued to commercially produce urea molasses mineral block (UMMB) supplement using the UMMB mixer provided by the PNRI, through assistance of the International Atomic Energy Agency (IAEA). Seven cooperatives from southern and northern Luzon purchased the UMMBs for use as a cheaper feed supplement for dairy cattle. These cooperatives have approximately 500 dairy cattle including calves, heifers and bulls.

To help in partly solving the problem on the scarcity of animal feeds, PNRI also screened less utilized plants which can be potentially used as alternative animal feeds. Seven species of seagrasses and seaweeds were analyzed using the *in-vitro* gas production technique to determine their digestability. The tannin contents of the plants, which hinder full utilization of the plants as animal feeds, were also determined.

#### **Fruit Fly Control**

The project on the island-wide integrated management program in controlling the Oriental fruit flies in Guimaras based on a nuclear technology called sterile insect technique (SIT) is a continuing activity of the PNRI. As part of this project, the PNRI carried out the following activities:

- (1) mass rearing of fruit flies at the PNRI mass rearing facility to maintain the stock culture and to use the flies for various laboratory and quality control tests;
- (2) upgrading of the fruit fly mass rearing facilities; and
- (3) improving the artificial diet of the fruit flies. A total of 190 cages of adult fruit flies with about 70,000 to 75,000 fruit flies per cage were maintained at the PNRI mass rearing facility.

### **HEALTH AND MEDICINE**

#### **Radiation-Sterilized Amniotic Membranes as Burn Dressing**

A total of 817 radiation-sterilized amniotic membranes produced by PNRI researchers were used successfully by various hospitals on 73 patients. The amniotic membranes were used as biological dressings for open wounds in case of club-foot surgery, for second degree burns, and for reconstructive surgeries.

#### **Radiation Studies of Carrageenan**

Radiation technology has been effectively used by PNRI researchers in developing non-food application of carrageenan such as PVP-hydrogel dressing for burns and wounds. The pilot plant for the semi-commercial production of polyvinyl pyrrolidone (PVP)-carrageenan hydrogels for burn/wound dressing and bedsores is now being put in place. This project was given funding under the Technology Incubation for Commercialization (Technicom) Program of the Department of Science and Technology. The pilot plant, upon completion and at optimum operation, will produce 400 pieces of 8 by 8 inch hydrogel dressing per day (24 hours) of operation. The PNRI, in cooperation with ACTA International Laboratories, will work on the approval from the Bureau of Food and Drugs for the PVP-carrageenan hydrogel and its introduction to the market.



A press conference held in Cotabato City as part of PNRI's Advocacy program on Food Irradiation in Mindanao. In photo (from left to right) are DOST Regional Secretary Hamim Alfatah Abubakar; Albaj, Zenaida M. de Guzman, head, PNRI's Biomedical Research Group and Estelita G. Cabalfin, head, Irradiation Services Section.



PNRI uses isotope technique for fertilizer – N use efficiency studies in a rice-based cropping system.



A farmer uses the urea molasses mineral block (UMMB) as a feed supplement for dairy cattle.



Mass rearing of fruit flies at PNRI to maintain stock culture and to use the flies for various laboratory tests.



Preparation of hydrogel film for burn dressings

**Gamma column scanning is a powerful nuclear technique that can quickly identify internal defects and depict characteristics inside distillation columns at refineries without interrupting normal plant operations.**

#### Technetium-99m Generator Production

Technetium-99m, an artificially-produced radioisotope, is widely used in nuclear medicine in the Philippines for imaging various body organs and for the diagnosis of some metabolic disorders. It is imported to the country as Molybdenum - Technetium 99m generator which makes use of fission molybdenum adsorbed into an alumina column. The safety and economic problems associated with alumina chromatographic generators could be remedied by gel-type generators using low specific activity reactor-produced molybdenum adsorbed on a high capacity gel column material.

A dried form of a gel-type polyzirconium compound (PCZ) was developed by Kaken Company in Japan in cooperation with the Japan Atomic Energy Research Institute. The performance of this material is being tested under the framework of the Forum for Nuclear Cooperation in Asia. PNRI tested nine samples of PCZ for its application as column material for adsorbing reactor-produced molybdenum - 99. The samples gave good adsorption capacity though the elution yields obtained are lower than those previously obtained.

#### Mutational Screening for Workers Exposed to Mutagenic Agents

The PNRI and the University of the Philippines - Philippine General Hospital (UP-PGH) jointly conducted a study on the use of the PNRI-adapted HGPRT Mutation Index (MI) Assay protocol and Autoradiographic Assay (AR) for measurement of mutation frequency in lymphocytes of hospital workers with possible exposure to oncogenic substances used in cancer therapy. A total of 50 peripheral blood samples were collected from workers in the Department of Oncology at UP-PGH and processed for HGPRT gene locus mutation. Results of the analysis showed that frequency of mutation in blood lymphocytes of workers handling oncogenic chemicals is generally low. The protocol could be used to assess the level of mutations in lymphocytes within a short period of time after exposure to oncogenes.

#### Cytogenetic Analysis

The PNRI Cytogenetics Group performed the following for 18 patients referred by hospitals: (1) monitoring, through blood sample analyses, of the occupational radiation exposures of workers; and (2) determining/confirming the presence or absence of clinical disorders such as Downs syndrome, congenital abnormalities and infertility. The Group also extended the use of its photo microscope to three groups of students from different schools in Metro Manila for their research on tissues and chromosomes of plants and animals.

## INDUSTRY

### Radiotracer and Sealed Sources Applications

Using a graphic-based computer language (LabView version 6.5 by National Instruments), the Isotope Techniques Research Group (ITRG) developed a computer program that interfaces a ratemeter with a personal computer used in gamma column scanning. The interface displays experimental results through the generation of computer plots and projection graphs. Gamma column scanning is a powerful nuclear technique that can quickly identify internal defects and depict characteristics inside distillation columns at refineries without interrupting normal plant operations.

The ITRG also developed a system that could determine the operating limits of a portable Neutron Backscatter Gauge to optimize its use and effectivity in measuring interfaces between process fluids inside a vessel. The calibration involves sensitivity testing to hydrogenous liquid between different thickness of concrete slabs. Different thicknesses of vessel walls will give different neutron moderations and absorption readings.

### Dam Leakage Studies

Tests on temperature and conductivity of water in Angat Dam Dike reservoir and from the springs downstream were conducted every month during the year to establish the presence of leakage and predict the general leakage area in the dike. The water and rain water samples are being tested in Pakistan for isotopic composition.

### Urban Waste Management

The Isotope Techniques Research Group (ITRG) continued its study on determining the possible migration of leachate into groundwater using radiotracer techniques. Eight years after injection of the radiotracer into the San Mateo landfill, groundwater samples were found negative of the tracer. This finding indicates the absence of significant hydraulic connection between the landfill and groundwater.



In connection with this activity, the ITRG provided advice and assistance to Chemistry students from the Polytechnic University of the Philippines regarding their thesis on the determination of the concentration of heavy metals, specifically chromium (Cr), copper (Cu), nickel (Ni), and lead (Pb) from San Mateo landfill and Payatas dumpsite leachate and water samples. Results of the students' research showed that chromium, copper and lead were present in both leachate samples. However, only lead exceeded the standard limit set for effluents by the Department of Environment and Natural Resources.

### High Technology Materials Development

**Preparation of Rare-Earth-Based Ferrimagnetic Materials.** The PNRI Applied Physics researchers studied two types of ferrimagnetic materials that have potential applications in the electronics and communications industry. These materials were Samarium Orthoferrite doped with Manganese ( $\text{SmFe}_{1-x}\text{Mn}_x\text{O}_3$ ) and Aluminum doped (Samarium Yttrium) Ferrimagnetic Garnets ( $\text{R}_3\text{Fe}_{5-x}\text{Al}_x\text{O}_{12}$ ), where  $\text{R} = \text{Sm}, \text{Y}$ . The orthoferrite belongs to a class of materials that exhibit very large variation in resistivity when subjected to magnetic fields while the rare-earth ferrimagnetic garnets show interesting magneto-optical properties. Bulk samples of both materials were prepared and characterized using x-ray diffraction for structure determination while the electromagnetic properties were identified using nuclear gamma resonance spectrometry popularly known as Moessbauer effect. In addition, preliminary study on the preparation of thin films of magnetic oxides by self assembly technique with the aid of polymer was started.

**Neutron Scattering for Advanced Materials Characterization.** Carrageenan is a natural biopolymer that is being studied by various research and development groups in the country. The PNRI is currently pursuing the studies on the

structure of gamma irradiated kappa carrageenan by small angle neutron scattering (SANS). These studies have been conducted by a PNRI researcher at Japan Atomic Energy Research Institute, Tokai in cooperation with the Institute of Solid State Physics (OSSP) of Tokyo University under the Forum for Nuclear Cooperation in Asia. Complementary studies by Dynamic Light Scattering were also conducted.

### Survey for Rare Earths and Associated Radioactive Minerals

The PNRI, through its Nuclear Materials Research Group, pursued its nationwide project on assessing the nuclear resource potential and related minerals including rare earths in different parts of the country. A part of this project is the geochemical assessment for rare earths and radioactive materials conducted in Cauban and Lumabong areas, San Vicente in northern Palawan. Initial result of this investigation has identified a prospective area in Lumabong which has the economic potential for the development of rare earths and radioactive mineral sand deposits.

The delineated area occupies about 14,000 square meters. Based on the cut-off value of 500 gram heavy minerals per cubic meter, the estimated reserve was about 50,000 kilogram heavy minerals. The average grade rare earth elements (cerium, lanthanum) and thorium contents were relatively low (i.e. 2.00 percent and 0.03 percent, respectively). The average concentration of heavy minerals was approximately 1300 gram heavy minerals per cubic meter.

## ENVIRONMENT

### Harmful Alga Bloom (Red Tide) Studies

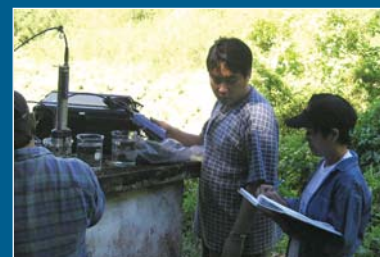
The PNRI's Chemistry Research Group has been conducting studies on the use of nuclear techniques to assist in the management of red tide or toxic harmful algal bloom (HAB). HAB is a recurring problem in some important aquaculture areas in the country. Aside from the



*Performance tests for the  $^{99}\text{Mo}$ -Tc generator*



*A PNRI researcher doing chromosomal analysis using a photo microscope*



*Conductivity and temperature tests of water samples from the Angat Dam reservoir and springs*



*Recovery of heavy minerals in San Vicente, Palawan using a sluice box*

economic losses arising from the shellfish harvest ban, the paralytic shellfish poisoning (PSP) resulting from eating contaminated shellfish is a major health concern. The incorporation of the Receptor Binding assay method in the HAB monitoring system will be useful in addressing the health and economic concerns.

**Receptor Binding Assay.** The Radiolabeling facility for the production of tritium-labeled saxitoxin is being upgraded to address safety issues related to working with high-level tritium. Tritium-labeled saxitoxin is used in the toxicity assay for PSP using Receptor Binding Assay method. The freeze-drying set-up is being improved to optimize its efficiency. However, due to the breakdown of the HPLC detector system, the experiments related to this activity were deferred.

In collaboration with the University of the Philippines, the PNRI prepared and submitted research proposals on alternative production of radioactive-labelled compounds for receptor binding assay to the International Atomic Energy Agency (IAEA) for financial assistance. A scientific visit on Receptor Binding Assay from the IAEA Chemistry Unit Laboratory in Seibersdorf, Austria was hosted by PNRI during the year.

#### **Lead-210 Dating Facility.**

Sedimentation rate in the different parts of Manila Bay was determined using lead-210 (Pb-210) dating method. These data will be useful not only for dating and modelling the occurrence of red tide in the bay but also for assessing environmental inputs and changes in a very important resource such as Manila Bay. This year, two more sediment cores from Manila Bay were processed and analyzed for Pb-210. The cores were subdivided into thinner subsections to obtain better data resolution. The Pb-210 profile obtained for these two cores further validated the sedimentation rate and pattern for previously analyzed cores. The recent sedimentation rate value is around one

centimeter per year. Attempts to validate the value with cesium -137 data failed because of the very low level of cesium-137 and very small amount of material in the sub-sections of the cores.

#### **Pollution- Related Studies**

The project aims to characterize major pollution sources at selected sites in Metro Manila through the use of nuclear and analytical techniques. Air particulate samples were collected in two fractions using Gent-type dichotomous samplers, then analyzed by x-ray fluorescence (XRF) spectrometer.

This year, PNRI researchers continued sample collection at the Ateneo de Manila University in Quezon City and at Poveda Learning Centre in Pasig City. Results showed an increase in particulate levels for Poveda Learning Center. Data analysis conducted during the year showed that PM10 levels are below long- and short-term local guideline values set by the national government. PM2.5 standards had been exceeded a greater part of the year. Trends in criteria elemental pollutants could also be derived from analysis of long- term database. While lead levels have gone down, sulfur (S) and black carbon (C) have increased. Study of the series plot of fine particulate matter showed that sulfur and black carbon largely influenced the fine mass. Increase in concentration of potassium (K), zinc (Zn) copper (Cu), and nickel (Ni) was also observed.

The co-location of samplers in two monitoring stations of the Environmental Management Bureau equipped with real time air quality monitors has been arranged by PNRI to allow for pollutant source apportionment.

#### **Isotope Techniques in Water Resource Management**

**La Mesa Dam Seepage.** In a study conducted by PNRI in collaboration with the Manila Water Company Inc. (MWCI), isotope and chemical techniques were used to obtain qualitative and quantitative information to address the seepage problem of the La Mesa Dam, the main

source of domestic water supply in Metro Manila. The data obtained include the following: (1) major ions and isotopic composition ( $^{18}\text{O}$ ,  $^2\text{H}$ ) of La Mesa Dam and its input sources, Angat, Ipo and Alat Dams; (2) stable isotope composition of precipitation at La Mesa Dam; and (3) major ions and isotopic composition of groundwater in the vicinity of the reservoir.

These data were used in the implementation of a quantitative water balance analysis of the La Mesa reservoir using the WSIBal model. The preliminary results were presented in the paper entitled "Environmental Isotope Techniques and Modeling Approaches for Improved Water Resource Management", during the 13th International Waters Association - Asia Conference (IWA-ASPAC) in October 2003 in Cebu City.

#### **Groundwater Contamination in Rodriguez and San Mateo.**

Isotope and chemical techniques were also applied in assessing groundwater contamination possibly caused by landfills and agricultural activities. Water samples were collected from the production wells in the municipalities of Rodriguez and San Mateo and from three stations along the river. Sampling was done for major ions, trace metals,  $^3\text{H}$ ,  $^{18}\text{O}$ , and  $^2\text{H}$ . Parameters such as acidity, dissolved oxygen, conductivity, total dissolved solids, temperature, Cl,  $\text{NO}_3$ , and F were measured in the field. A total of 15 stations were investigated. Data for the major ions Ca, Mg, Na, K,  $\text{HCO}_3$ , Cl,  $\text{SO}_4$ , minor ions Fe and Mn, and trace metals Cr, Cu, Zn, and Pb are available.

#### **Groundwater Contamination in Davao City.**

PNRI investigated the effect of agricultural activities within the watershed in Davao City. Water samples were collected from the Talomo and Lipadas Rivers at high and low elevations and from selected wells, particularly those proximate to the rivers and those found in an earlier PNRI study to contain mixed waters. Sampling was undertaken for major ions, trace metals,  $^3\text{H}$ ,  $^{18}\text{O}$ , and  $^2\text{H}$ . Various parameters were also measured in



the field. A total of nine sampling stations have been investigated. Data for major ions Ca, Mg, Na, K,  $\text{HCO}_3$ , Cl,  $\text{SO}_4$  are available, as well as minor ions and trace metals. Results of trace metal determination in groundwater from wells sampled showed that levels of lead (Pb) and cadmium (Cd) were below the minimum limits of detection of 0.005 ppm for Pb and 0.002 ppm for Cd. These levels are below the maximum allowed levels of 0.01 ppm and 0.003 ppm for Pb and Cd, respectively.

**Advocacy Efforts.** The results of the initial project conducted in Davao City on “Applications of Isotope and Chemical Techniques in the Study of the Davao City Groundwater Resources”, have been recognized by different stakeholders in the city. Together with the results of related studies conducted on the Davao City watershed, they have been used as basis by the City Council to reclassify delineated areas as protected areas in the watershed.

As a result of advocacy work, several water districts have signified interest in applying isotope techniques in solving specific problems in their areas. Formal requests and proposals had been submitted to PNRI by the Bacolod Water District for delineation of recharge zones for Bacolod City groundwater, and by the Aquadyne Technical Services, Inc (a private consulting firm for water resources management) for identifying recharge process of the groundwater in Bulacan.

### Establishment of CTBTO International Monitoring Stations

The Philippines, through the PNRI, has been actively involved in the establishment of a global communication system to verify compliance to the Comprehensive Nuclear Test Ban Treaty which was ratified by the Philippine Senate in 2001. As part of this commitment, the PNRI has continued to operate the National Data Center (N137) which was set up at the PNRI compound in 2001. The N137 station is linked by VSAT (very small aperture terminal) antenna to the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) headquarters in

Vienna, Austria, through a geo-satellite hub in Fucino, Italy. The PNRI has also submitted three preliminary site survey reports to the Provisional Technical Secretariat- (PTS) CTBTO for an alternate site of the RN52 radionuclide monitoring station in Quezon City. In April 2003, the PTS-CTBTO approved the final Site Survey Report for Tanay, Rizal and installation of the station is now in progress. A Memorandum of Agreement was signed between PNRI and PAGASA for free use of a permanent site within the PAGASA station in Tanay, Rizal for the RN52 Station.

### Radiological Assessment of Former US Bases: Poro Point Communications Facility

The PNRI, the Bases Conversion Development Authority (BCDA) and the Poro Point Management Corporation signed a Memorandum of Agreement (MOA) in March for radiological assessment of Poro Point Communications Facility in La Union. The study is aimed at generating radiological information that could be used by legislators and the BCDA in the appropriate conversion of the former US Base into a Special Economic Zone. The activities undertaken for this project included the following: (1) conduct of two sampling trips at the site to collect environmental samples (soil and drinking water) for specific radionuclide analysis and to measure outdoor gamma dose rates using portable BNC-Sam 935 gamma spectrometer, and (2) generation of a radiation map of Poro Point from 81 measurements of outdoor air gamma dose rates.

As of August 2003, the project was successfully completed. The results of the assessment showed that no-man made radiation is present inside the former US Communications Facility at Poro Point.

### Management of TENORM Released into the Environment

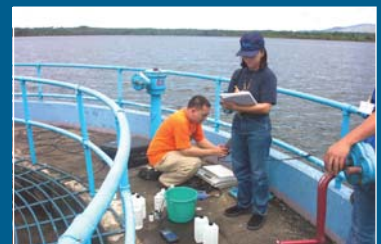
Phosphogypsum, a by-product in the production of phosphate fertilizer at Philphos, LIDE in Isabel, Leyte, contains technologically-enhanced naturally-



*The high throughput data analyzer used for the toxicity assay of paralytic shellfish poison*



*Air pollution monitoring station at the Ateneo de Manila University in Quezon City*



*Samples for isotopic and chemical analysis are collected from different depths in La Mesa Dam*



*PNRI researchers measure ambient radiant dose rate at Poro Point Communication Facility in La Union using a portable spectrometer (inset)*

occurring radioactive material (TENORM). Hundreds of metric tons of phosphogypsum are stored in ponds at Philphos of which more are produced every year. Plans are being instituted to use phosphogypsum as filling material for the reclamation area within the foreshore of Isabel, Leyte. The objective of the PNRI project is to analyze the level of radioactivity in phosphogypsum samples, particularly radium-226, radon-222 and cesium-137. Radiological information will be useful in determining the appropriate management approach for the phosphogypsum by-product of fertilizer manufacture.

This year, under a research contract from Philphos, the PNRI Health Physics researchers conducted a sampling trip in Isabel, Leyte to collect phosphogypsum samples and marine sediments, biota and water for radioactivity analysis and to measure ambient gamma dose rates in the area. A portable gamma spectrometer (BNC-SAM 935) and a portable scintillometer were used to measure outdoor gamma radiation dose rates in phosphogypsum stack ponds and in the proposed reclamation site. Analysis of the data showed that certain stack ponds contain radium-226 in phosphogypsum at lower concentration. Phosphogypsum from these ponds could be used as filling material for the proposed reclamation site in the foreshore of Isabel, Leyte.

### Soil Erosion/Sedimentation Studies

The PNRI and the Bureau of Soils and Water Management have an on-going collaborative project that will be helpful for soil conservation and sustainable agricultural production. The project involves determination of soil erosion and sedimentation rates through the use of cesium-137, an efficient tracer of soil movement since it is strongly absorbed in soil clay particles and can be detected with radiation instruments.

This year, soil erosion and sedimentation rate studies in three sites were undertaken. An area grown to corn in Dalwagan, Malaybalay City in Bukidnon has an average erosion and deposition rate value

of 14.35 and 12.69 tons per hectare per year, respectively. Results in two sites at Cadaclan, Pantabangan in Nueva Ecija showed erosion values ranging from 15 to 51 tons per hectare per year for bare soil and 6 to 50 tons per hectare per year for area previously planted with trees. In Iligan in Isabela, an area grown to root crops has erosion rate values ranging from 26 to 62 and deposition rate values of 12 to 102 tons per hectare per year. For an area grown to corn, erosion and deposition rate values range from 4 to 56 and 3 to 94 tons per hectare per year, respectively. The above results were indicative of severe erosion and sedimentation in the three sites studied. The results, however, need further validation using other models that convert cesium-137 data into soil erosion and sedimentation rates.

### NUCLEAR-BASED ANALYSIS

**Vinegar Adulteration.** A PNRI-developed nuclear technique, based on carbon-14 analysis by liquid scintillation counting, has been used as a tool by the PNRI Analytical Measurements Research Group (AMRG) for detecting synthetic glacial acetic adulteration in vinegar.

Using the nuclear technique, AMRG completed a survey on the incidence of adulteration in different locally available vinegar brands in 14 cities in the country in 2002. The survey results indicated that only 20 percent of the vinegar repackers produce 100 percent biogenic vinegar. To evaluate the impact of the initial findings, PNRI has started a resurvey on vinegar adulteration in 14 selected cities. In 2003, a re-survey of the carbon-14 levels of vinegar brands from seven major cities in the Philippines showed that 33 percent of the brands utilized acetic acid of plant origin -- an increase from 20 percent in the 2002 survey. This indicates a move of industry to conform to local regulation on vinegar standards due to the Bureau of Food and Drug intervention based on PNRI results.

**Quality System in Analytical Measurements Laboratory.** Progress has been made on the establishment of QA/QC measures in the PNRI Analytical Measurements Research (AMR) Laboratory as defined in ISO/IEC/1705. The laboratory Manager and the Quality and Assistant Managers have been designated and their duties defined. The draft Quality Manual is now 80 percent complete. Rewriting of AMR procedures to conform to a prescribed format is 40 percent completed. Control charts documenting performance of analytical instruments were maintained and uncertainties for the different analyses were determined. Two audits of the PNRI laboratories were conducted in 2003 under the International Atomic Energy Agency (IAEA) technical project on "QA/QC of Nuclear Analytical Laboratories". The PNRI also collaborated with the Food and Nutrition Research Institute in the distribution of candidate reference materials under the IAEA interregional project on "Preparation of Reference Materials" which aims to upgrade local capability in preparing reference materials and conducting proficiency tests.

**Radioactivity Analysis.** The AMRG provides analytical services using nuclear-based and related techniques to PNRI research groups and external clients. This year, radioactivity measurements were done on different kinds of samples received from external clients for the purpose of issuing certificates of non-radioactivity for exported and imported food products and for processed drinking water. The samples analyzed included milk products, tuna, cocoa powder, desiccated coconut and meat products. None of the samples analyzed exceeded the appropriate standards for radioactivity.

**X-Ray Spectrometry Applications.** The assessment of the capability of the existing total reflection x-ray fluorescence (TXRF) facility for performing various x-ray spectrometric applications was done. Activities were focused on the



development of measurement procedures, improvement/refinement of the spectrometry hardware and the development of appropriate softwares for data collection and analysis. A summary of the accomplishments are as follows:

(1) developed a procedure which allows the cut-off energy of the TXRF facility to be set to a few hundreds to several electron volts (eV) above the absorption edge of the element of interest. This will reduce the effective band pass to a level that would allow AD-TRF analysis of films via the

intensity gain profile; (2) studied the long term effect of reference standards deposited on quartz carrier; and (3) constructed a new mounting set-up for the TXRF facility to accommodate the new Side - Drift detector and conduct initial test of detector performance. A technical paper on "Plexiglass as a Disposal Sample Carrier for TXRF Analysis" was also completed and submitted for publication.

#### IAEA Technical Cooperation Projects (non-PNRI)

As the national liaison office of the PNRI, the Technical Assistance Group helps administer and manage the following IAEA technical cooperation projects (non-PNRI).

#### Gas Isotope Geochemistry for Geothermal Resources Management in the Philippines

The project is being undertaken by the Philippine National Oil Company - Energy Development Corporation (PNOC-ERDC), in collaboration with experts from the Institute of Geological / Sciences and Geo-resources (IGG), Council for National Research (CNR) in Pisa, Italy. The project generally aims to investigate the possible effects of reservoir processes on the noble gas isotopic and elemental components in the Palinpinon and Bacon-Manito (Bacman) geothermal fields in Southern Negros Oriental. In 2003, PNOC-EDC presented a project technical report entitled "Origin of rare earth gases in the Palinpinon Geothermal fluid as traced from isotopic and elemental compositions" during the 24th Annual PNOC -EDC Geothermal Conference held in Manila, Philippines. The report presented results of the research work carried out in Palinpinon. It discussed the origin of noble gases in Palinpinon derived from isotopic ratios and effects of reservoir processes correlated with rare gas compositions.

The results of this present study under the project are expected to provide a much clearer overall picture of the geothermal reservoir, especially in terms of present-day processes. This would eventually lead to a better and sounder basis for the formulation of a reservoir management strategy, which can then be implemented with a higher degree of confidence.

#### Expanding the Capability and Coverage of Neonatal Screening Program for Congenital Hypothyroidism in the Philippines

The production of information materials as well as the conduct of advocacy and awareness campaigns on newborn screening continued to be undertaken by the Institute of Human Genetics, UP National Institute of Health. Orientation seminars and lectures on newborn screening were conducted for various health professional associations and in government and private hospitals in the country. With these activities, more hospitals and institutions have been recruited to the Newborn Screening Network.

A significant factor in the advancement of the newborn screening program in the country is the evident support of the Department of Health (DOH). The DOH included newborn screening as one of the programs for newborns and infants in its "Essential Health Care Packages at Various Stages of Life" program.

Linkages and networking with various sectors such as non-government organizations, health professional societies and organizations, private companies have been continuously done.



*Cesium-137 activity measurement in soil samples obtained in the field by gamma spectrometry*



*PNRI researchers use the liquid scintillation counter for analysis of water and vinegar samples.*



*Phosphogypsum stack ponds at PHILPHOS Fertilizer Plant, Isabel, Leyte*

# nuclear &



## Gamma Irradiation Services

Gamma irradiation technology has demonstrated a variety of benefits to the local manufacturing and trade industries, as well as to research and the academe. In 2003, there was an increase in the number of companies that showed interest in the adoption of irradiation technology for their products (37 in 2003 compared to 24 in 2002). PNRI provided gamma irradiation services using two facilities: a Gammacell-220 and a multipurpose gamma irradiation facility.



*Spices contained in cartons are exposed to gamma radiation inside the cobalt-60 multipurpose irradiation facility for microbial decontamination.*

A total of 3,127 samples were irradiated using the Gammacell-220. On the other hand, a total of 3,603 samples were irradiated at the multipurpose gamma irradiation facility. Products irradiated for industry included empty aluminum tubes, orthopedic implants, spices and spice blends, frozen fruits and cosmetic raw materials such as talc and mica. Empty aluminum tubes and orthopedic implants were treated for radiation sterilization, while cosmetic raw materials, spices and

frozen fruits were treated for microbial decontamination.

## Radioisotope Supply / Dispensing

PNRI dispensed and supplied a total of 223 orders, amounting to 139,158 MBq Iodine-131 to nuclear medicine centers and hospitals. The hospitals served include the Capitol Medical Center, Jose Reyes Memorial Medical Center, Makati Medical Center, Metropolitan Hospital, Rizal Medical Center, University of Santo Tomas Hospital and Veterans Memorial Medical Center. Around 1,950 patients benefitted (about 170 for therapy and 1,780 for diagnosis) from the Iodine-131 supplied by PNRI.

## Radiation Protection Services

The PNRI, through the Radiation Protection Services (RPS), continued to provide the following services to authorized users of radiation and radioactive materials in medical, industrial and research institutions throughout the country: personnel monitoring of radiation exposures through the national film badge and thermoluminescent dosimetry services; calibration of radiation protection instruments used by various institutions to ensure reliability and accuracy of radiation measurements; leak testing of sealed radiation sources; collection and management of disused radiation sources; and other special services such as radiation hazards evaluation of radiation facilities. (See table on page 13). PNRI renders these services to ensure that workers

occupationally exposed to radiation as well as the general public will not receive undue exposure to radiation.



*PNRI provides dose assessment from external radiation using TLD.*

## Engineering Services

The Engineering Services' Instrumentation Unit completed 49 major and 80 minor jobs on the repair and maintenance of nuclear and non-nuclear equipment and instruments for PNRI and non-PNRI clients from the medical and industrial sectors. The major jobs included general repair, cleaning and upgrading of computers, radiation detection and measuring instruments and air sampler. The Unit had also put into operation expensive equipment such as the HPGe Coaxial Detector System, Ultra Freeze Drier, JASCO Spectrometer, Vital Scientific Spectrometer, NPI Secondary Standard Therapy Level X-Ray Exposure Meter and Precision Conventional Oven. The following were also fabricated: a competitive survey meter which is now 85 percent complete, 20 drop-out relays, UPS and DC power supply.



# allied services

The PNRI extends nuclear and allied services to clients from industrial, business, medical, government and the academic sectors to encourage and widen the safe and peaceful uses of nuclear technology in various fields.

## RADIATION PROTECTION SERVICES- 2003

|  |   |  |
|--|---|--|
| National film badge service                | – | 38,684 badges issued<br>7,608 personnel monitored            |
| Thermoluminescent dosimetry (TLD)          | – | 4,855 TLDs issued<br>1,229 personnel monitored               |
| Calibration of radiation protection        | – | 510 instruments calibrated instruments<br>255 clients served |
| Leak testing of sealed radioactive sources | – | 505 sources<br>121 institutions served                       |
| Management of spent sealed sources         | – | 63 units<br>18 institutions                                  |
| Management of solid wastes                 | – | 1.57 cubic meters<br>10 institutions served                  |
| Management of liquid wastes                | – | 56.7 liters<br>8 institutions served                         |
| Calibration of Radioactivity meter         | – | 15 units   |
| Audit of Teletherapy facility              | – | 2 facilities   |

The Mechanical Unit, on the other hand, completed 19 major and 158 minor repair jobs. The major repair jobs consisted of general repair, overhauling and preventive maintenance of equipment such as air-conditioning and refrigeration units, air sampling units and generator set. A total of 15 major shop fabrication works and 20 minor fabrication jobs were completed. The major jobs included fabrication of air sampler nozzles, guard house tower, rehabilitation of water tank, fabrication and installation of steel doors, among others. Preparation of plans and drawings for seven projects on the repair/upgrading of PNRI infrastructure facilities and 18 job

orders for the preparation of plans and drawings for various projects were also completed.

### Nuclear Training

For 2003, a total of 20 training courses were conducted by PNRI for manpower development in the field of nuclear science and technology and radiation safety. PNRI also conducted training courses on nondestructive testing techniques (in cooperation with the Philippine Society for Nondestructive Testing). The number of participants to these courses totaled

306 coming from 119 various private and government institutions.

In pursuit of manpower development in the undergraduate levels, 115 student trainees were given on-the-job training as well as thesis advisorship in the different offices and research laboratories within PNRI.



*A PNRI nuclear training staff lectures to seminar participants.*

The PNRI also conducted in-house seminars/lectures and seminars in different secondary schools as part of upgrading knowledge and information in the field of nuclear science and technology. A total of 1,895 participants attended these seminars.

### Computer Services

The Computer Services Group developed office application packages for the Technical Assistance, Training and Library Units of PNRI. The three software packages developed were: the Technical Assistance Overseas Fellows Information System, the Training Information System database and a Windows version of the Library User Account. The Computer

**The PNRI, through its Information Services Group, has been undertaking information dissemination activities and implementing strategies to increase the knowledge and understanding of the public which has little or no technical background about radiation and nuclear science and technology.**

Services completed the systems analysis and design of the Requisition Document Tracking System and the Employee Leave Credits information system.

In addition, the Group modified existing application softwares such as the Payroll System, the Library User Accounts System as well as the documentation for these packages. User manuals were produced. The Computer Services Group continued to manage and maintain the PNRI Local Area Network (LAN)/Internet, which included the administration of internet servers, enhancement and continuing update of the PNRI website.

As part of the computerization program of government agencies, a five-year PNRI Information System Strategic Plan was prepared and submitted to the Department of Science and Technology (DOST) and Commission on Audit for approval. The plan includes proposed software programs for project management, nuclear and analytical services, technical assistance, nuclear safeguards/regulation, finance and administration and the PNRI organizational set-up.

#### **Library Services**

A total of 2,020 clients, mostly students from government and private schools in Metro Manila, availed themselves of PNRI's library services. One of the services extended to clients was assistance in accessing bibliographic data from the International Nuclear Information System (INIS) database on CD-ROM.

The PNRI submitted 50 articles and seven non-conventional literature on nuclear science and technology to the International Atomic Energy Agency as contribution to the INIS database. The PNRI library also inputted and submitted 488 titles of books to the DOST-SCINET project on Union catalog on web.

#### **Nuclear Information Services**

The PNRI, through its Information Services Group, has been undertaking information dissemination activities and

implementing strategies to increase the knowledge and understanding of the public which has little or no technical background about radiation and nuclear science and technology.

#### **Development/Distribution of Information Materials**

The multimedia educational CD-ROM "The Atom, Radiation and Radioactivity" was successfully launched during the 31st Atomic Energy week celebration at PNRI. This information and educational resource material aims to educate teachers and students from the secondary and tertiary levels with the fundamentals of nuclear science and technology. The PNRI developed the CD with financial assistance from the Technology Application and Promotion Institute (TAPI).

The PNRI developed and produced print and non-print information materials consisting of the 2002 PNRI Annual Report, and six new brochures and flyers on PNRI technologies and services. Around 23,300 copies of these materials were provided to 6,200 clients. Through partial financial assistance from the TAPI, PNRI produced four banners which were exhibited during the 14th DOST Science and Technology fair at PHILTRADE. The Information Services group produced two graphic display banners: one for the food irradiation advocacy project and another on the multimedia educational CD. The group also developed an interactive DVD presentation of the PNRI projects highlighted during the DOST S & T Fair.

#### **Educational Tours and Seminars**

Information on the beneficial uses of nuclear technology were disseminated to around 4,700 students, teachers and other professionals through guided tours to the Institute's facilities and laboratories. The PNRI also conducted nuclear awareness seminars for students and teachers from different government and private schools as part of creating greater public awareness in nuclear science and technology. The total



number of seminars conducted in schools totaled ten with 1,872 participants consisting of high school and college students and science teachers.

#### Participation in S & T Events

The nuclear research projects and services of PNRI were also promoted this year through exhibitions in four national / regional / school science and technology fairs. As part of the public awareness program, PNRI through the celebration of the Atomic Energy Week (AEW), highlighted the beneficial uses of nuclear technology. Visitors were given guided tours to PNRI facilities and laboratories and video showings with lecture-demonstrations during the AEW open house celebration.

#### Mass Media Linkages

The public has been kept informed about PNRI activities through nine radio and three television interviews of PNRI officials and project leaders. PNRI media releases were also published in national broadsheets.



*PNRI Director Dr. Alumanda M. dela Rosa gives copies of the PNRI-developed multimedia CD "The Atom, Radiation and Radioactivity" to DOST Secretary Estrella F. Alabastro, DBM Secretary Emilia Boncodin and DepEd – NCR representatives. This was during the launching of the CD in December.*



*The PNRI exhibit during the DOST Annual Science and Technology Fair at PHILTRADE*

#### **PNRI Conducts Business Orientation Course**

The PNRI has created a Business Development Committee which is the precursor of the Business Development Unit (BDU). The BDU will serve as a bridge between the Institute and the potential users of its products and services.

As one of the preparatory activities for the establishment of the BDU, the PNRI in cooperation with the International Atomic Energy Agency (IAEA), conducted a Business Orientation Course for Scientists and Technologists on November 11-13. The introductory course provided scientists and technologists with learning materials in developing business skills and acquiring insights into management methods.

The course participants made an initial assessment of the strengths and weaknesses of the PNRI and recommended strategies to be adopted to increase the sustainability and relevance of the Institute.

The course was participated in by PNRI Division Chiefs, R and D section heads, senior researchers and members of the Business Development Committee.



*Dr. Peter Roberts, IAEA Technical Officer for the Regional Project on Enhancing Sustainability of Nuclear Institutions, lectures on how to prepare a business plan.*



*Participants of the Business Orientation Course prepare a business plan.*



*Jun, "Mr. Shooli" Urbano interviews PNRI Director Alumanda M. dela Rosa in a segment of Teledyaryo, an early morning TV program of NBN-4.*

# nuclear safety



## Standards Development

The Standards Development Section (SDS) developed three proposed regulations in the Code of PNRI Regulations (CPRs). These were CPR Part 23 (Land Disposal of Radioactive Waste), CPR Part 24 (Gamma Stereotactic Radiosurgery), and CPR Part 25 (Commercial Providers of Technical Services). The SDS continued to revise the drafts of CPR Part 17 (Commercial Sale and Distribution), CPR Part 19 (In-Vitro Clinical and Laboratory Tests), and CPR Part 21 (Radiation-Producing Particle Accelerators). Final revision of CPR Part 3, "Standards for Protection Against Ionizing Radiation", adopting the IAEA Safety Series No. 115 was done. Revisions were also done on five regulations, namely, CPRs Part 2 (Licensing of Radioactive Material), Part 4 (transport), Part 12 (teletherapy), Part 13 (nuclear medicine), and Part 14 (brachytherapy).

To assist the licensees in complying with the PNRI license application and regulatory requirements, the SDS continued to prepare Information Packages (INFOPACs) for each CPR. The INFOPAC contains the specific CPR license application form, regulatory guide, and model procedures. Draft INFOPACs had been completed for CPRs Part 18 (Research and Education), Part 19 (License for the Use of Radioactive Materials in In-Vitro Clinical or Laboratory Tests), Part 20 (Manufacture and Dispensing of Radiopharmaceuticals), and

Part 24 (Licenses for Use of Radioactive Materials in Gamma Stereotactic Radiosurgery). Revisions had been done for INFOPACs of CPR Parts 12 and 14. The SDS prepared and facilitated the publication in the Official Gazette of CPR Part 22, Administrative Order No. 1, Series of 2003, "Fees and Charges for Radioactive Material Licenses and Other Related Regulatory Services".

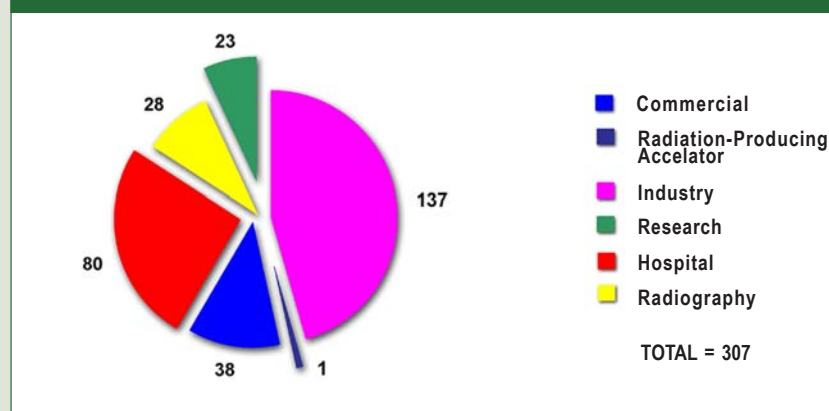
SDS drafted a technical paper on "Criteria for the Use, Design, and Installation of Fume Hood" and the following regulatory documents: 1) Proposed Criteria for Determining Severity Levels for Violations, and 2) Draft Rule of Procedure for Determining Enforcement Sanctions for Violation of PNRI Regulations and Licensing Requirements. Likewise, the following regulatory bulletins had been drafted: 1) Safety Concerns on Old or Ageing Teletherapy Units; 2) Appointment of RHSO; 3) Payment of Prescribed

Regulatory Fees Prior to Issuance of License; 4) Extended Storage of Sealed Sources; and 5) Issuance of Certificate of Transport by Licensees.

## Licensing Review and Evaluation

The Licensing Review and Evaluation Section (LRES) evaluated 325 license applications for the use of radioactive materials in industry, medicine, research and education. This is to ensure that the activities involving radioactive materials are carried out safely and would not pose unnecessary risk to public health and safety. A total of 417 evaluation reports were generated from the review and evaluation of applications for new, renewal and amendment of licenses. The PNRI, through LRES, issued 328 radioactive material licenses (17 new, 60 amended and 251 renewed).

## TOTAL NUMBER OF LICENSES ISSUED BY CATEGORY





# & regulations



The PNRI as mandated by law, enforces nuclear regulations to ensure that the use of radioactive materials is carried out safely and would not pose unnecessary risk to the general public and to workers occupationally exposed to radiation. The regulatory mandate of the Institute is being enforced by five sections of the Nuclear Regulations, Licensing and Safeguards Division.

LRES also issued 389 Certificates of Release for sealed radiation sources from the Bureau of Customs to licensed suppliers of radioactive materials. The section assisted in the organization and preparation of materials in the conduct of three regulatory conferences namely, Safety in Nuclear Medicine; Reinforcing Safety and Security of Sources: Portable Gauges; and Reinforcing Safety and Security of Sources: Industrial Radiography.

To improve the Section's licensing system and documentation, a proposal on "A Modified System of PNRI Licensing: License Structures, License Number System, License Amendment, Modification and Validity Period" was prepared. The LRES also spearheaded the drafting of a proposal for the recommended course content for each specific type of license application, e.g. Radiation Safety Officer Course, Radiation Safety in Medical Facilities Course, Radiation Safety Course for In-Vitro Diagnostic and Research Laboratories, Safety in the Use of Nuclear Equipment and Devices Training Course and Radiation Safety Officer Re-training Course.

The Section initiated the categorization of sealed sources in the LRES database based on the new International Atomic Energy Agency (IAEA) Categorization of Radioactive Sources.

The evaluator's checklists for nuclear gauges and nuclear medicine were revised to improve and facilitate the evaluation of application for the use of radioactive materials in industry and medicine. LRES also observed how packages of radioactive materials were received and released from the Ninoy Aquino International Airport and transported to licensed hospitals in Metro Manila.



*A PNRI regulatory staff performs dose rate monitoring of a package of radioactive material before it is released from the Ninoy Aquino International Airport.*

Twenty percent of the licensees found with items of non-compliance and concern implemented appropriate actions to correct the deficiencies reported by PNRI. Ninety-four percent of these corrective actions were evaluated and found to be in accordance with the regulatory requirements. The remaining open items were followed-up for compliance and subsequent closure.



*Regulatory inspection of a Krypton-85 (Kr-85) gas cylinder equipment in an electronics firm at FTI Complex in Taguig, Metro Manila*

PNRI issued 959 Certificates of Transport and Release for sealed radiation sources. Show Cause orders were served to two licensed facilities due to a number of items of non-compliance. The one issued to an industrial company has been lifted following PNRI evaluation of its response to the regulatory issues raised in the order.

# *The IPPAS mission provided advice and assistance in strengthening and enhancing the effectiveness of the physical protection of nuclear materials and facilities, as well as radioactive materials.*

## **Safeguards**

Safeguards inspectors from the International Atomic Energy Agency (IAEA) conducted physical inventory verification of nuclear materials present at the Philippine Research Reactor as well as design information verification of the reactor. The inspection is part of the comprehensive safeguards agreement of the Philippines with the IAEA. The summary of the accounting reports was submitted to the IAEA.

In line with the Radiological Threat Reduction Program of the US Department of Energy (US DOE), the Safeguards Section received a six-man US DOE mission on 6-10 October 2003. The objective of this mission was to find out how the US DOE could assist the Philippines in improving the security of high-risk radiation sources. The agenda of the mission included visits to two PNRI facilities and to eight operating teletherapy and blood irradiator facilities in Metro Manila. The mission was concluded with the signing of a Basic Ordering Agreement between the US DOE, through the Batelle Memorial Institute, Pacific Northwest Division, and the Philippines through the PNRI.

As per the Agreement, the US DOE through the Pacific Northwest Division of Batelle will undertake the following: (1) provide financial and technical assistance in the upgrading of the security of the PNRI multipurpose irradiation facility, (2) upgrade security of spent radiation sources at the radioactive waste facility in PNRI, and (3) upgrade security of high activity radiotherapy sources and blood irradiators of 18 medical institutions in the Philippines.

As a requisite to the above Agreement, the Safeguards Section coordinated the preparation and submission of a detailed description and layout of the facilities to be upgraded including source description and characterization. The Section submitted two Vulnerability Assessment reports for the PNRI Multipurpose

Irradiation Facility and for the PNRI Radioactive Waste Management Facility in accordance with the agreement.

In addition, the PNRI hosted the IAEA International Physical Protection Advisory Service (IPPAS) mission on 11-21 November. The IPPAS mission provided advice and assistance in strengthening and enhancing the effectiveness of the physical protection of nuclear materials and facilities, as well as radioactive materials.

## **Radiological Impact Assessment**

The Radiological Impact Assessment (RIA) Section continued to undertake radiological impact assessment studies in support of the licensing and regulatory function of the Institute. The RIA finalized the audit and performance assessment of radioisotope fume hoods of 13 medical laboratories in Metro Manila. The initial hazard assessment of a radioisotope dispensing facility was also evaluated. In connection with the radiological impact assessment of sealed sources used in industry, the RIA prepared a list of radioactive materials in which each source was characterized for evaluation of potential radiological impacts. The RIA also conducted an evaluation of the radiological impact of the Troxler surface and moisture density gauge owned by a licensed facility.

RIA is actively involved in the project management of the IAEA-assisted Technical Cooperation Project on Siting of Radioactive Waste Disposal Facility. In coordination with the Inter-agency Subcommittee on Radioactive Waste Management under the Nuclear Power Steering Committee, the Section participated actively in the site investigation and verification of six candidate sites for a permanent waste repository.



### Comparative Assessment of Nuclear Power Plants and Other Electricity Generating Power Plants

The PNRI, through the Radiological Impact Assessment Section, has continued its participation in the Regional Cooperative Agreement (RCA) project on the Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions. As part of this project, the PNRI coordinated with the Philippine study team members from the Department of Energy (DOE) regarding the hosting of the National Coordinators' Meeting on the RCA Project "The Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets. This was held at the DOE on 1 - 4 April 2003.

RIA also organized a new inter-agency national study team for the project on competitive electricity markets. The team is composed of the PNRI, DOE, National Power Corporation, Industrial Technology Development Institute/DOST, National Economic Development Authority and the Department of Trade and Industry.

### Radiological Emergency Planning and Preparedness

The PNRI, through the RIA Section, conducted seminars, workshops and other activities to effectively implement the National Radiological Emergency Preparedness and Response Plan (RADPLAN). The RIA conducted two seminars on radiological medical response

for emergency room personnel and resident doctors of the UP-Philippine General Hospital on April 2 and 8, 2003, respectively. A total of about 50 participants attended the two seminars. Two introductory seminars on Medical Radiological Emergency Preparedness were likewise conducted at the Quirino Memorial Medical Center on 10 September and 1 October 2003. Nineteen participants attended the two seminars.

RIA also coordinated and facilitated the PNRI participation in the CONVEX 2A Emergency Communications Exercises held in May and November 2003 and the CONVEX 1A Exercise held in July 2003. The exercises were conducted by the IAEA Emergency Response Center in Vienna, Austria to test the adequacy of the response time to a notification or request for verification of information.

The PNRI continued to participate in meetings and activities of the National Disaster Coordinating Council (NDCC) and coordinated with the Office of Civil Defense (OCD) and the Philippine National Police (PNP) regarding information on the need to recover a missing radioactive material licensed to a radiation facility.

RIA coordinated and facilitated the organization of the Core Group on the Medical Radiological Emergency Response with six representatives from four government agencies of the Department of Health and the PNRI.



*US Department of Energy officials inspect the PNRI radioactive waste facilities at PNRI.*



*A RIA staff performs radiological air sampling inside a nuclear medicine laboratory.*



*The lecturers and participants to the National Coordinators Meeting on the RCA Project: The Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets pose with PNRI Director Dr. Alumanda M. dela Rosa (11th from left).*

# administrative &



## Personnel Administration

In the year 2003, PNRI's personnel complement was 244. Out of these personnel, 108 were male and 136 were female.

### Distribution by Personnel

#### By Gender

|        |   |     |
|--------|---|-----|
| Female | – | 136 |
| Male   | – | 108 |

#### By Staff Category

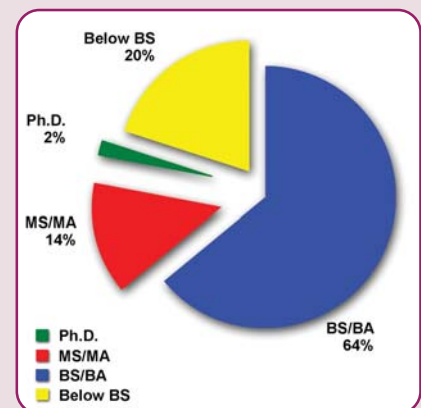
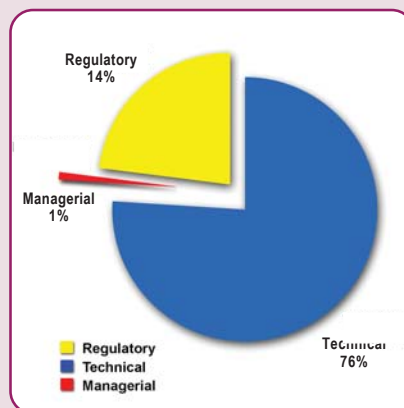
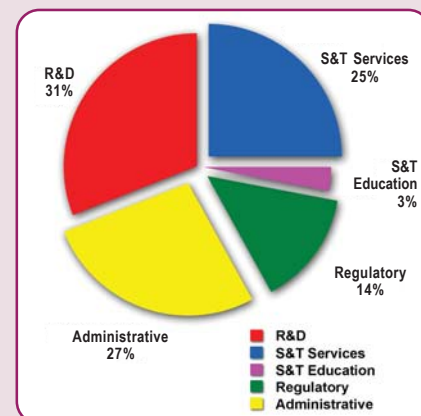
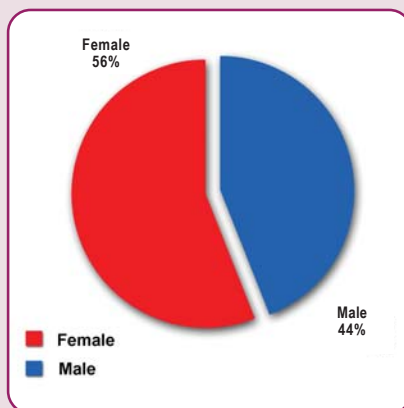
|                |   |     |
|----------------|---|-----|
| Managerial     | – | 3   |
| Technical      | – | 184 |
| Administrative | – | 57  |

#### By Staff Activity

|                          |   |    |
|--------------------------|---|----|
| Research and Development | – | 77 |
| S & T Services           | – | 61 |
| S & T Education          | – | 8  |
| Regulatory               | – | 33 |
| Administrative           | – | 65 |

#### By Education

|          |   |     |
|----------|---|-----|
| Ph.D.    | – | 6   |
| MS/MA    | – | 35  |
| BS/BA    | – | 154 |
| Below BS | – | 49  |





# support services

The Finance and Administrative Division (FAD) provides advise and assistance in policy formulation relative to fiscal and administrative matters. FAD also provides administrative, financial and auxiliary services for the successful implementation of the Institute's programs.

## PNRI SERVICE AWARD:

### 2003 Retirees

Leticia J. Alberto  
Apolinar B. Asencion  
Edilberto A. Cabalfin  
Armando M. dela Cruz  
Edgardo E. Poblete  
Antonio E. Refre

### 30 Years

Inocencio A. Agron  
Danilo A. Cuyco  
Emerenciana B. Duran  
Lourdez G. Fernandez  
Johnny R. Marin  
Erlinda S. Natera  
Laura R. Pineda  
Portia T. Villegas



Laura R. Pineda, one of the 30-year PNRI service awardees.

### 20 Years

Celia O. Asaad  
Grace M. Carlos  
Ana Elena L. Conjares  
Imelda S. Delfin  
Eliza B. Enriquez  
Sofronio O. Enriquez

Luz V. Esguerra  
Arminda V. Espineda  
Corazon M. Garcia  
Reynaldo S. Jimenez  
Luz V. Esguerra  
Roel A. Loterina  
Levelyn M. Tolentino



The 20-year service awardees pose with PNRI Director Dr. Alumanda M. dela Rosa (5th from left) and Finance and Administrative Division Chief Dr. Graceta DL. Cuevas (extreme left).

## PNRI RECOGNITION AWARD:

### 2003 Model Employee

- For her dedicated performance of her duties and functions in the Property and Procurement Unit  
Ana N. Villanueva, Buyer II  
Finance and Administrative Division



## Certificate of Recognition

- For exemplary work in nuclear analytical techniques  
Flora L. Santos  
*Head, Analytical Measurements Research  
Atomic Research Division*
- For exemplary work in the management of the Multipurpose Irradiation Facility  
Luvimina G. Lanuza  
*Senior Science Research Specialist  
Nuclear Services and Training Division*
- For enhancing public awareness of the application of nuclear techniques  
Rhodora R. Leonin  
*Head, Information Services  
Nuclear Services and Training Division*



PNRI Director Dr. Alumanda M. dela Rosa (middle) with the 2003 PNRI Model Employee (4th from left) and the recipients of PNRI Certificates of Recognition, namely (from left to right) Rhodora R. Leonin, Luvimina G. Lanuza and Flora L. Santos.

2003 PNRI model employee, Ana N. Villanueva, (extreme right) poses with (from left to right) Finance and Administrative Chief Dr. Graceta DL. Cuevas, PNRI Director Alumanda M. dela Rosa and Linda L. Leopando (Chairperson, AEW Committee on Awards and Prizes).



*The PNRI, as the Philippine focal agency for atomic energy matters, serves as a link between IAEA and government and private entities using atomic energy in the country.*

## LOCAL AND INTERNATIONAL NETWORKING

### Local Linkages

This year, the Institute strengthened its existing linkages and forged additional ones through collaborative projects with the following institutions:

- **Bases Conversion Development Authority (BCDA) and the Poro Point Management Corporation** for radiological assessment of Poro Point Communications Facility in La Union. The study is aimed at generating radiological information that could be used by legislators and the BCDA in the appropriate conversion of the former US Bases into a Special Economic Zone.
- **The Municipality of Isabel, Province of Leyte and the Philippine Phosphate Fertilizer Corporation** for radiological assessment of PHILPHOS phosphogypsum at LIDE, Isabel, Leyte. This study aims to evaluate levels of radioactivity in phosphogypsum samples.

### Foreign Linkages

The PNRI strives to maintain a healthy linkage with its established partners in nuclear science and technology research

and development. One of its major international partners is the International Atomic Energy Agency (IAEA). The PNRI, as the Philippine focal agency for atomic energy matters, serves as a link between IAEA and government and private entities using atomic energy in the country. Cooperation with IAEA affords PNRI the opportunity to take part in the Regional Cooperative Agreement for Asia and the Pacific (RCA) and in interregional and technical cooperation schemes that allow the Philippines to fully participate in nuclear-related activities.

Other partners of PNRI include international organizations and cooperative umbrellas such as the following:

- Forum for Nuclear Cooperation in Asia (FNCA)
- Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) - <http://www.ctbto.org>
- Other nuclear science and technology organizations from Australia, Canada, United States, Korea and many more through bilateral agreements



# & networking

Through the years, PNRI has established and maintained linkages with both local and foreign institutions in order to enhance the Institute's capabilities.



*Ms. Estelita G. Cabalfin, head, PNRI Irradiation Services Section, briefs The Hon. Dr. Rey D. Pagtakhan, Minister of Veterans Affairs and Secretary of State (Science, Research & Development) of Canada and Ambassador Robert Collette of the Canadian Embassy about the PNRI multipurpose irradiation facility.*



*Dr. Philip K. Hooke, an IAEA expert for the project "Metro Manila Air Pollutant Characterization and Source Identification", receives a certificate of appreciation from PNRI Director Dr. Alumanda M. dela Rosa while Flora L. Santos, head of PNRI Analytical Measurements Research Group, looks on.*



*The FNCA project leaders and participants of the Workshop on Mutation Breeding from eight Asian countries pose with DOST Secretary Dr. Estrella F. Alabastro (front row, 6th from left), PNRI Director Dr. Alumanda M. Dela Rosa (8th from left) and FNCA coordinator Dr. Sueco Machi (7th from left).*



# Special S&T Event

*DOST Secretary Estrella F. Alabastro delivers her inspirational message during the AEW opening ceremonies at PNRI.*

*Department of Budget and Management Secretary Emilia T. Boncodin was the keynote speaker during the AEW Opening Ceremonies at PNRI.*

*Mr. Bernie S. Justimbaste, Director of the Planning and Evaluation Services- DOST, was one of the resource speakers during the AEW technical sessions on "Nuclear Technology Applications for SMEs".*



*DOST Secretary Estrella F. Alabastro and DBM Secretary Emilia T. Boncodin view the AEW exhibits with (from L - R) Flora L. Santos, AEW Executive Committee Chairperson, former PNRI Director Carlito R. Aleta and PNRI Director Alumanda M. dela Rosa.*

*Around 2,500 visitors, composed mostly of students and teachers, viewed the AEW exhibits and were given guided tours to PNRI facilities and laboratories, video showings and lecture demonstrations during the AEW open house celebration.*

The PNRI spearheaded the 31st Atomic Energy Week (AEW) celebration on December 8 to 12 at the PNRI compound. The guiding theme for the 2003 celebration was “Enhancing Productivity Through Nuclear Technology”.



*The Information Services staff, the group responsible for the production of the multimedia educational CD*

*Launching of the PNRI multimedia educational CD “The Atom, Radiation and Radioactivity”.*

*AEW visitors had fun while learning chemistry concepts at the Chemical Magic booth.*

# AEW Celebration

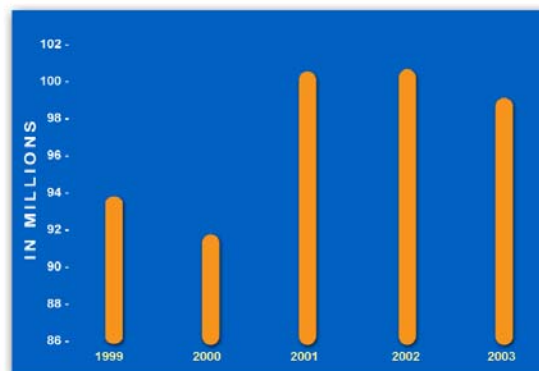
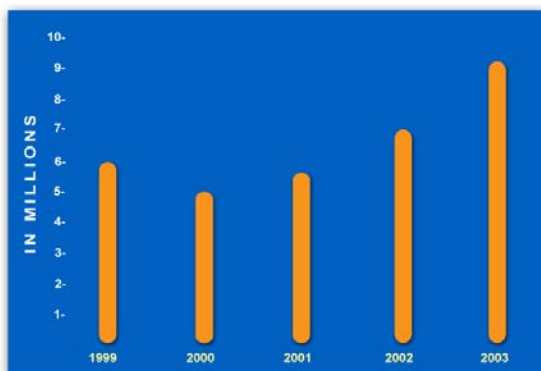
# financial statements

## STATEMENT OF FINANCIAL OPERATIONS

January to December 2003

|   |                 | Allotment            | Obligations<br>Overdraft | Balance*            |
|---|-----------------|----------------------|--------------------------|---------------------|
| <b>General Administration and Support</b>                   |                 |                      |                          |                     |
| General administration<br>and support services              | Php             | 28,301,500.00        | 28,301,400.00            | 100.00              |
|   | <b>SUBTOTAL</b> | <b>28,301,500.00</b> | <b>28,301,400.00</b>     | <b>100.00</b>       |
| <b>Support to Operations</b>                                |                 |                      |                          |                     |
| Supportive to nuclear activities                            |                 | 2,044,000.00         | 2,044,000.00             | 0.00                |
|   | <b>SUBTOTAL</b> | <b>2,044,000.00</b>  | <b>2,044,000.00</b>      | <b>0.00</b>         |
| <b>Operations</b>   |                 |                      |                          |                     |
| Nuclear Research, Technology<br>Development and Application |                 | 26,359,500.00        | 26,359,500.00            | 0                   |
| Nuclear Services and Training                               |                 | 22,936,500.00        | 22,936,500.00            | 0                   |
| Nuclear Regulations, Licensing<br>and Safeguards            |                 | 9,636,000.00         | 9,636,000.00             | 0                   |
|   | <b>SUBTOTAL</b> | <b>89,277,500.00</b> | <b>89,277,400.00</b>     | <b>100.00</b>       |
| <b>Other Releases</b>                                       |                 |                      |                          |                     |
| Retirement & Life Insurance<br>Premium                      |                 | 5,117,000.00         | 5,117,000.00             | 0                   |
| Terminal Leave and Retirement<br>Gratuity                   |                 | 2,599,816.00         | 2,599,815.31             | 0.69                |
| Extra Cash Gift   |                 | 931,000.00           | 931,000.00               | 0                   |
| GFA Furniture, Fixtures &<br>Books Outlay Cash Advance      |                 | 1,208,000.00         | 0                        | 1,208,000.00        |
| <b>GRAND TOTAL</b>  | <b>Php</b>      | <b>99,133,316.00</b> | <b>97,925,215.31</b>     | <b>1,208,100.69</b> |

\*Continuing Appropriations





## STATEMENT OF ACTUAL INCOME

January to December 2003

### Government Service

Licensing fees, etc.

1,132,110.75

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**SUBTOTAL Php 1,132,110.75**

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### Government Business Operations

|   |            |
|---|------------|
| - Sale of radioisotopes (Iodine-131)  | 677,490.00 |
| - Sale of Phil. Nuclear Journal, Information Packages (Nuclear Regulations) and radioactive material stickers | 1,240.00   |
| - Repair/rental of nuclear instruments  | 28,770.00  |
| - Fabrication of desiccator cabinet   | 5,050.00   |

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**SUBTOTAL Php 712,550.00**

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### Others - Service Fees for

#### *Cytogenetic Laboratory Services*

|                        |           |
|------------------------|-----------|
| - Cytogenetic analysis | 26,120.00 |
| - Microscopy services  | 2,550.00  |

*Microbiological Tests of Food/Medical Products* 106,755.00

#### *Radioactivity Analysis*

|   |            |
|---|------------|
| - Gammametric analysis                          | 218,125.00 |
| - Gross radioactivity (alpha and beta) analysis | 200,100.00 |
| - Radiological Analysis                         | 8,600.00   |

#### *Nuclear-Based Analytical Services*

|  |           |
|--|-----------|
| - Mass determination of samples                      | 32,625.00 |
| - X-ray fluorescence (XRF) analysis (ex.air-filters) | 17,250.00 |
| - X-ray diffraction (XRD) data analysis              | 4,860.00  |
| - Moisture content analysis                          | 600.00    |
| - Water analysis                                     | 4,300.00  |
| - Atomic Absorption                                  | 600.00    |
| - Gamma spectrometry                                 | 1,700.00  |
| - Vinegar analysis                                   | 31,500.00 |

#### *Radiation Protection Services*

|  |              |
|--|--------------|
| - Calibration of radiation protection instruments  | 319,955.00   |
| - Leak test of sealed radioactive sources          | 352,792.45   |
| - Smear/swipe tests for radioactive contamination  | 68,790.00    |
| - Radon test                                       | 6,700.00     |
| - Calibrator linearity test                        | 1,700.00     |
| - Monitoring films and cassettes (film/TLD badges) | 4,989,519.42 |
| - Decommissioning                                  | 72,434.17    |
| - Radioactive waste storage/disposal               | 174,900.50   |

*Use of Multipurpose Irradiation Facility* 709,251.50

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**SUBTOTAL Php 7,351,728.04**

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Fines and penalties

Surcharge

**SUBTOTAL Php 9,372.50****GRAND TOTAL Php 9,205,761.29**

# appendices

**TABLE 1. IAEA RESEARCH CONTRACTS<sup>1</sup>**

| RESEARCH PROJECT   | CHIEF INVESTIGATOR      | AGENCY  |
|--|-------------------------|---|
| • Development of Quality Control Procedures for Mass-produced and Released Fruit Flies   | Sotero S. Resilva       | PNRI  |
| • Stimulating Water and Nitrogen Interactions in the Rice-Wheat Cropping System  | Jagdish Ladha           | International Rice Research Institute, Laguna |
| • PSP Toxicity Risk Assessment: Accumulation and Elimination of Saxitoxin in Green Bay Mussels Using Nuclear Techniques  | Elvira Z. Sombrito      | PNRI  |
| • Nitrate-Augmented Myocardial Perfusion Imaging for the Assessment of Myocardial Viability  | Jerry Obaldo            | Philippine Heart Center                       |
| • Development of Deletion Mutants of Tomato Hawaii 7996 for Resistance to <i>Ralstonia Solanacearum</i> and Other Important Traits by Targeted EMS and Irradiation Mutagenesis | Haydee Flandez - Galvez | Institute of Plant Breeding                   |
| • Development of Gamma Radiation-Induced Mutants of Nipponbare Rice Variety and Their Genetic Analysis   | Thelma Padolina         | Philippine Rice Research Institute            |
| • Comparative Evaluation of Radiopharmaceuticals for Radiosynovectomy in the Philippines   | Emerita Barrenechea     | St. Luke's Medical Center                     |

**TABLE 2. IAEA TECHNICAL COOPERATION PROJECTS<sup>2</sup>**

| RESEARCH PROJECT   | COUNTERPART  | AGENCY   |
|--|--|--|
| • Human Resources Development and Nuclear Technology Support                   | Pilar C. Roceles   | PNRI   |
| • Enhancing Agricultural Productivity through Radiation Technology in Mindanao | Avelina G. Lapade<br>Ma. Delia Morados<br>Leocadio S. Sebastian        | PNRI<br>DOST XI – Davao City<br>Philippine Rice Research Institute                                   |
| • Neonatal Screening for Congenital Hypothyroidism                             | Carmencita D. Padilla<br>Teofilo O.L. San Luis, Jr.<br>Teresita Bonoan | UP – National Institute of Health<br>Santo Tomas University Hospital<br>Department of Health         |
| • Nuclear Techniques to Study the Red Tide Problem                             | Alumanda M. Dela Rosa<br>Rhodora V. Azanza                             | PNRI<br>U.P. Marine Science Institute  |
| • Nuclear Analytical Techniques for Air Quality Management                     | Flora L. Santos<br>Cesar Siador, Jr.<br>Leni Quirit                    | PNRI<br>Environmental Management Bureau<br>University of the Philippines                             |
| • Large - Scale Gamma Irradiation Services                                     | Estelita G. Cabalfin   | PNRI   |
| • Isotope Hydrology Application in Water Resources Management                  | Soledad S. Castañeda<br>Carol Balagtas<br>Ricarte Javelosa             | PNRI<br>Manila Water Co.,Inc.<br>Presidential Task Force on Water Resources Management & Development |
| • Gas Isotope Geochemistry for Geothermal Resources Management                 | Manuel S. Ogena  | PNOC-Energy Development Center   |
| • Site Selection and Conceptual Design of a Near-Surface Disposal Facility     | Eulinia M. Valdezco<br>Angelita Brabante<br>Clarissa Cabacang          | PNRI<br>Dept. of Environment and Natural Resources<br>Department of Energy                           |

<sup>1</sup>Research Contracts are grants under the IAEA Research Contract Programme whose funding is sourced from the IAEA regular budget and also from extrabudgetary contributions to the IAEA. Through this program, minor equipment and miscellaneous local purchases are provided. The grant to a project is of the average US\$5,000.00 per year.

<sup>2</sup>Technical Cooperation Projects are under the IAEA Technical Cooperation Programme and are funded by the Technical Assistance Committee Fund (TACF) and the extrabudgetary contributions to the IAEA. Financial support is provided in the form of three components, namely, expert assistance, equipment donation and overseas training

**TABLE 3. GRANTS-IN-AID FROM OTHER AGENCIES**

| PROJECT TITLE  | PROJECT LEADER        | FUNDING AGENCY  |
|--|-----------------------|---|
| • Semi-Commercial Production of PVP Carrageenan Hydrogels for Burn/Wound Dressing and Bedsores       | Alumanda M. Dela Rosa | Dept. of Science and Technology (DOST)  |
| • Radiation Processing of Carrageenan for Health Care Applications -Year II                          | Alumanda M. Dela Rosa | Philippine Council for Advanced Science and Technology Research and Development |
| • Technological Innovation Commercialization Program: Radiation Processing for Philippine Industries | Estelita G. Cabalfin  | DOST  |
| • National Meteorology Program: Upgrading of PNRI Secondary Standards Dosimetry Laboratory (SSDL)    | Eulinia M. Valdezco   | DOST  |
| • National Metrology Program: Upgrading of the National and Regional Metrology Laboratory            | Eulinia M. Valdezco   | DOST  |
| • Study Within Poro Point Special Economic and Freeport Zone, San Fernando City , La Union           | Teresa Y. Nazarea     | Bases Conversion Development Authority  |
| • Management of Technologically Enhanced Naturally- Occurring Radioactive Materials (TENORM)         | Teresa Y. Nazarea     | PHILPHOS  |
| • Surface Analysis and Coating Thickness Determination of High Technology Materials- Year II         | Pablo P. Saligan      | Technology Application and Promotion Institute (TAPI)                           |
| • Fabrication of Exhibit Materials for the 14 <sup>th</sup> DOST Annual Science and Technology Fair  | Rhodora R. Leonin     | TAPI  |
| • Reproduction and Promotion of PNRI Multimedia Presentation in CD-ROM                               | Rhodora R. Leonin     | TAPI  |

**TABLE 4. EXPERTS/MISSIONS**

| FIELD/PURPOSE  | NAME   | DATE               |
|--|--|--------------------|
| • NSRA Expert Dispatch – Radiation Safety, Waste Management and Research Reactor | Kakuzo Tomii<br>Yutaka Kawakami                        | 24 Jan – 9 Mar '03 |
| • Quantitative Water Balance Analysis of the La Mesa Dam Reservoir               | Anthony Barr   | 27 Jan – 7 Feb '03 |
| • Radioactive Waste Management   | Shoji Futatsugawa<br>Hisao Eda                         | 24 – 25 Feb '03    |
| • Management of Marine Coastal Environment and its Pollution                     | Catherine Hughes                                       | 24 – 28 Feb '03    |
| • Project Reviews (RAS/8/092, INT/0/060 and PHI/8/023)                           | Zonghe Pang  | 28 Jan – 1 Feb '03 |
| • Air Particulate Sampling   | David Cohen  | 21 – 25 Apr '03    |
| • Newborn Screening Manual   | Brad Therell   | 23 – 28 Apr '03    |
| • Implementation of Model Project for Radiation Protection                       | Sujit Dey  | 2 – 7 Jun '03      |
| • International Physical Protection Advisory Service (IPPAS pre-mission)         | Mark Soohoo<br>Pierre Legoux<br>Erin Ryan              | 25 – 26 Jun '03    |
| • Design Engineering of Co-60 Source Rack and Conveyor System                    | Janos Balla  | 14 – 18 Jul '03    |
| • Quality Auditing of Nuclear Analytical Laboratories                            | Anareddy V. Reddy<br>Klaus Hoppstock                   | 4 – 5 Aug '03      |
| • Safety Assessment  | Peter Ormai  | 4 – 8 Aug '03      |
| • MEXT/NSRA Exchange Program: Radiation Safety and Waste Management              | Yutaka Kawakami  | 4 Aug – 3 Oct '03  |
| • Integrated Safety Evaluation of PRR-1 (Phil. Research Reactor-1)               | Heriberto Boado - Magan                                | 14 – 15 Aug '03    |
| • Radioactive Waste Management   | Atsuko Takano<br>Masahiro Munakata<br>Hidelfumi Iimura | 22 – 25 Sep '03    |
| • Radiology and Radiation Injury   | Yoshihiro Aoki   | 22 – 28 Sep '03    |
| • AIDA Database for National AI Data Management                                  | Mario Garcia – Podesta                                 | 6 – 10 October '03 |



TABLE 4. EXPERTS/MISSIONS

| FIELD/PURPOSE  | NAME   | DATE            |
|--|--|-----------------|
| • United States – Department Of Energy Team: Physical Security   | Anne Kohnen<br>Jim Kauber<br>Tom Skinner<br>John Haynie<br>Dan Rutherford<br>Kyle Wright | 6 – 10 Oct '03  |
| • Rice Breeding and Molecular Markers  | John Perry Gustafson   | 13 – 17 Oct '03 |
| • National Training Course on Data Analysis and Receptor Modeling  | Philip Hopke   | 3 – 7 Nov '03   |
| • National Training Course on Business Orientation for PNRI Staff  | Peter Roberts  | 10 – 14 Nov '03 |
| • Review of On-going TC Projects; Conduct of National Workshop and Discussion on 2005 –2006 TC Programme | Reyad Kamel  | 10 – 15 Nov '03 |
| • IPPAS Mission: Physical Security of Nuclear Facilities and Nuclear/Radioactive Materials               | Mark Ling<br>Andreas Musilek<br>Keith Dessent<br>Daniel Lowe<br>Pierre Legoux            | 1 – 21 Nov '03  |
| • Safeguards Inspection  | Y. Feng, K. Babos  | 17 – 18 Nov '03 |
| • Tissue Culture and Genetic Transformation of Fruit Crops   | Richard Litz   | 17 – 21 Nov '03 |
| • Labeling of Rhenium-188  | M. Saw, F. Sundram   | 8 – 12 Dec '03  |

TABLE 5. PNRI HOSTINGS

| FIELD/PURPOSE   | PHILIPPINE PARTICIPANT  | AGENCY/INSTITUTE                                     | ORGANIZER  | VENUE   | DATE                        |
|---|---|--|--|---|-----------------------------|
| • Project Review and Formulation Meeting on the Application of Food Irradiation for Food Security, Safety and Trade                       | Zenaida M. de Guzman  | PNRI   | IAEA & PNRI  | PNRI  | 20 – 24 Jan '03             |
| • Final Research Coordination Meeting of the CRP on Quality Control of Pesticide Product and a Scientific Seminar Workshop (RAS/5042)     | Ma. Esperanza Uy  | Bureau of Plant Industry (BPI)                       | IAEA, PNRI & BPI                                   | BPI   | 17 – 21 Feb '03; 22 Feb '03 |
| • Project Coordinators Meeting on the Preparation of Reference Materials and Organization of Proficiency Test Rounds (INT/1/054)          | Flora L. Santos<br>Teresita Portugal  | PNRI<br>Food and Nutrition Research Institute (FNRI) | IAEA, PNRI & FNRI                                  | FNRI  | 10 – 14 Mar '03             |
| • Regional Training Course on Chemical Analysis of Geothermal Waters and Gases (RAS/8/092)  | No Philippine participant   |  | IAEA, PNRI<br>PNOC- Energy Development Corporation | Makati; Dumaguete City & Leyte                                  | 10 Mar – 4 Apr '03          |
| • Project Review and Formulation Meeting on Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets (RAS/0/038) | Teofilo Leonin, Jr.<br>Elma Karunungan<br>Herminio Ariola<br>Marie Paz De Leon<br>Eduardo Fernandez<br>Dadee Fernandez<br>Marie Claire De Los Trinos<br>Alvin David Lim | PNRI<br>Department of Energy (DOE)                   | IAEA, PNRI & DOE                                   | DOE   | 1 – 4 Apr '03               |
| • Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Mutation Breeding  | Avelina G. Lapade,<br>Apolinar B. Asencion,<br>Florencio Isagani S.<br>Medina III, Ana Marie S.<br>Veluz, Alfonso O. Grafia   | PNRI   | FNCA / MEXT & PNRI                                 | Manila Southwoods, Cavite; Manor Hotel and EDSA Shangrila Plaza | 22 – 26 Sep '03             |
| • Regional Workshop on Reviewing Results of Regional Mutants Multilocation Trials (RMMT)–RAS/5040   | Alfonso O. Grafia<br>Conсорcia Reano  | PNRI<br>Institute of Plant Breeding, UPLB            | IAEA, PNRI & Institute of Plant Breeding, UPLB     | AIM Conference Center   | 27 – 31 Oct '03             |

**TABLE 6. PLACEMENTS FOR FELLOWSHIP/SCIENTIFIC VISIT TO THE PHILIPPINES**

| FIELD  | NAME                                | AGENCY/INSTITUTE  | PLACE OF FELLOWSHIP                                  | DATE                    | SPONSOR |
|--|-------------------------------------|---|--|-------------------------|---------|
| • Soil Science, Irrigation and Plant Nutrition   | Md. Ashraful Islam                  | Bangladesh Institute of Nuclear Agriculture             | Bureau of Soils and Water Management                 | 1 Jun – 29 Aug '03      | IAEA    |
| • Nuclear Medicine   | Damayanthi Kusum Kumari Nanayakkara | University of Peradeniya, Sri Lanka                     | St. Luke's Medical Center                            | 1 Jul '03 – 28 Feb '04  | IAEA    |
| • Nuclear Medicine   | Md. Reazul Islam                    | Nuclear Medicine Center, Bangladesh                     | St. Luke's Medical Center                            | 14 Jul '03 – 13 Jul '04 | IAEA    |
| • Nuclear Medicine   | Masoud M. Saleh A. Elgadafi         | Tripoli Eye Hospital, Libya                             | St. Luke's Medical Center                            | 21 Jul '03 – 20 Jul '04 | IAEA    |
| • Mutation, In Vivo and Molecular Marker Techniques for Rice Improvement                         | Muhammad Ashraf                     | Pakistan Atomic Energy Commission                       | Philippine Rice Research Institute                   | 1 Aug – 31 Oct '02      | IAEA    |
| • Genetic Improvement for Salt Tolerance in Non-Aromatic Rice Varieties Through Induced Mutation | Mohammad Sharif Bughio              | Nuclear Institute of Agriculture, Pakistan              | International Rice Research Institute                | 5 Aug '03 – 31 Jan '04  | IAEA    |
| <b>SCIENTIFIC VISIT</b>  |                                     |   |  |                         |         |
| • Socio-economic Aspects of Agroforestry Practices   | Mohammad Serajul Islam              | Bangladesh Agricultural University                      | Farming Systems and Soil Resources Institute         | 20 – 24 Jan '03         | IAEA    |
| • Optimising Nutrient Management Practices for Production of Rice and Improvement of its Quality | Sy Tan Pham                         | Cuu Long Delta Rice Research Institute, Vietnam         | International Rice Research Institute (IRRI), Laguna | 7 – 11 Apr '03          | IAEA    |
| • Plant Breeding and Genetics  | Abdul Wahid Baloch                  | Nuclear Institute of Agriculture, Pakistan              | IRRI; Philippine Rice Research Institute             | 23 – 27 Jun '03         | IAEA    |
| • Entomology and Plant Pathology   | Farhat Fatima Jamil                 | Nuclear Institute for Agriculture and Biology, Pakistan | International Rice Research Institute                | 28 Jul – 1 Aug '03      | IAEA    |
| • Plant Breeding and Genetics  | Zia Uddin Ahmed                     | Bangladesh Institute of Nuclear Agriculture             | International Rice Research Institute                | 29 Sep – 3 Oct '03      | IAEA    |

**TABLE 7. NON-PNRI MANPOWER DEVELOPMENT (FOREIGN)**

| FIELD   | NAME  | AGENCY/INSTITUTE   | VENUE     | DATE                | SPONSOR      |
|---|---|--|-----------|---------------------|--------------|
| <b>ON-THE-JOB TRAINING</b>  |   |  |           |                     |              |
| • Nuclear Medicine  | Charity Jomento   | University of the Philippines National Institute of Health | USA       | 9 Feb – 8 Mar '03   | IAEA         |
| • RIA of Thyroid Hormones   | Jose Carlo Isaac  | Santo Tomas University Hospital                            | Slovenia  | 11 May – 14 Jun '03 | IAEA         |
| <b>TRAINING COURSE</b>  |   |  |           |                     |              |
| • Myocardial Perfusion Scintigraphy Using SPECT for Nuclear Medicine Physicians     | Juanito Olpindo, Jr.                                    | St Luke's Medical Center                                   | Japan     | 24 – 28 Feb '03     | IAEA         |
| • Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets | Marie Claire Delos Trinos                               | Department of Energy                                       | Korea     | 4 – 22 Aug '03      | IAEA         |
| • Application of Induced Mutations and Biotechnology for Crop Improvement           | Consortia Reano   | Institute of Plant Breeding                                | Sri Lanka | 4 – 15 Aug '03      | IAEA         |
| • Mutant Germplasm Characterization Using Molecular Markers                         | Haizel Pastor   | Philippine Rice Research Institute                         | Austria   | 6 – 31 Oct '03      | IAEA         |
| • National Data Center Managers   | Jocelyn Alvarado  | Assistant Secretary, DOST                                  | Austria   | 3 – 7 Nov '03       | CTBTO        |
| • Methodology for Multilocation Trial and Data Analysis                             | Amelita Infortuno                                       | Bulacan National Agricultural State College                | India     | 10 – 14 Nov '03     | IAEA         |
| • Interventional Nuclear Medicine for Nuclear Physicians                            | Emerita Barrenechea Ruben V. Ogbac Juanito Olpindo, Jr. | Veterans Memorial Medical Center (VMMC)                    | India     | 13 – 17 Nov '03     | IAEA         |
| • Authorization and Inspection of Radiation Sources in Diagnostic Radiology         | Ma. Gladys Cabrera                                      | Bureau of Health Devices and Technology                    | Thailand  | 17 – 21 Nov '03     | IAEA         |
| • Radiation Protection and Safety in Diagnostic and Interventional Radiology        | Dexter Rodelas  | JRRMMC   | India     | 17 – 21 Nov '03     | IAEA         |
| • Nuclear Power Policy, Planning and Project Management                             | Lana Rose Manaligod                                     | Department of Energy                                       | Korea     | 20 Nov – 10 Dec '03 | KOICA / IAEA |
| • Clinical and Technological Aspects of Radiotherapy for Uterine Cancer             | Teresita Sy Ortin                                       | Makati Medical Center                                      | Japan     | 1-5 Dec '03         | IAEA         |
| • Evidence-Based Radiation Therapy  | Kathleen Baldivia Mary Ann Genina Reyna                 | Philippine General Hospital                                | China     | 6 – 9 Dec '03       | IAEA         |

TABLE 7. NON-PNRI MANPOWER DEVELOPMENT (FOREIGN)

| FIELD  | NAME                             | AGENCY/INSTITUTE  | VENUE     | DATE               | SPONSOR   |
|--|----------------------------------|---|-----------|--------------------|-----------|
| • Application of Radiation Processed Natural Polymers  | Maria Rona Rodriguez             | UP-Material Science Institute                             | Vietnam   | 8 – 12 Dec '03     | IAEA      |
| • Radiation Protection and Safety in Radiotherapy  | Emmanuel Mercado                 | Davao Medical Center                                      | Korea     | 9 – 19 Dec '03     | IAEA      |
| <b>WORKSHOP/SEMINAR</b>  |                                  |   |           |                    |           |
| • Regional Coordination Seminar for Decision Makers for the Implementation of Radiation Protection                                       | Jocelyn Alvarado                 | Assistant Secretary, Department of Science and Technology | Thailand  | 3 – 5 Feb '03      | IAEA      |
| • Regional Coordination Seminar for Decision Makers for Implementation of Radiation Protection   | Agnette Peralta                  | Director, Bureau of Health Devices and Technology (BHDT)  | Thailand  | 3 – 5 Feb '03      | IAEA      |
| • Regional Seminar for Effective Regulation of Radiation Protection and Safety of Radiation Sources                                      | Agnette Peralta                  | Director, BHDT  | Thailand  | 6 – 7 Feb '03      | IAEA      |
| • International Seminar on Nuclear Safety: Course on Dissemination of Nuclear Knowledge  | Leah Salvaleon<br>Jonathan Derez | UP-NISMED<br>Manila Science High School                   | Japan     | 3 – 7 Mar '03      | MEXT/RADA |
| • National Planning, Selection and Design of IAEA TC Projects  | Bernie Justimbaste               | DOST Planning   | Korea     | 21 – 24 Jul '03    | IAEA      |
| • Preparation of In -House Reference Materials   | Teresita Portugal                | Food and Nutrition Research Institute                     | Belgium   | 15 – 19 Sep '03    | IAEA      |
| • Data Validation for Airborne Particulate Data  | Cesar Siador, Jr.                | Environment Management Bureau                             | India     | 13 – 17 Oct '03    | IAEA      |
| • Regional Workshop on Effective Implementation of National Nuclear Energy Legislation   | Jocelyn Alvarado                 | Assistant Secretary, DOST                                 | Thailand  | 27 – 31 Oct '03    | IAEA      |
| • Interregional Trainers Workshop on Radiation Protection in Medicine  | Lilian V. Rodriguez              | Jose R. Reyes Memorial Medical Center (JRRMMC)            | Turkey    | 27 – 31 Oct '03    | IAEA      |
| • Implementation of the International Code of Practice for Radiotherapy Dosimetry  | Nieva Lingatong                  | Bureau of Health Devices and Technology                   | Thailand  | 17 – 21 Nov '03    | IAEA      |
| • Implementation of the International Code of Practice for Radiotherapy Dosimetry  | Lilian V. Rodriguez (as expert)  | JRRMMC  | Thailand  | 17 – 21 Nov '03    | IAEA      |
| • Application of Public Awareness Strategy for Tissue Banks  | Norberto Agcaoli (as expert)     | Philippine General Hospital                               | Thailand  | 24 – 28 Nov '03    | IAEA      |
| • FNCA Workshop on Radiation Oncology  | Miriam Joy Calaguas              | St. Luke's Medical Center                                 | China     | 15 – 18 Dec '03    | IAEA      |
| <b>MEETING</b>   |                                  |   |           |                    |           |
| • Expert Advisory Meeting - Diagnosis of Osteoporosis Using Nuclear Techniques (RAS/7/012)   | Trinidad Trinidad                | Food and Nutrition Research Institute                     | China     | 20 – 24 Jan '03    | IAEA      |
| • Project Formulation Meeting & Strategic Planning on a Sustainable FMD Kit Production in Southeast Asia                                 | Blesilda Verin                   | Philippine Animal Health Center                           | Australia | 24 – 28 Feb '03    | IAEA      |
| • Project Review and Project Formulation Meetings on Nuclear Techniques to Address HAB Concerns/Enhancing the Marine Coastal Environment | Rhodora Azanza                   | U.P. – College of Science                                 | Malaysia  | 3 – 7 Mar '03      | IAEA      |
| • PCM on Use of Radiosynovectomy in the Management of Patients Suffering from Painful Joint Disorders                                    | Emerita Barrenechea              | St. Luke's Medical Center                                 | Malaysia  | 24 – 28 Mar '03    | IAEA      |
| • Project Coordination Meeting on Strengthening Medical Physics in Asia and the Pacific  | Agnette Peralta                  | Bureau of Health Devices and Technology                   | Thailand  | 31 Mar – 4 Apr '03 | IAEA      |
| • Final RCM on Isotope Response to Dynamic Changes in Groundwater Systems Due to Long-Term Exploitation                                  | Joeffrey Caranto                 | PNOC – Energy Development Center                          | Austria   | 12 – 16 May '03    | IAEA      |
| • Regional Project Coordination Meeting and Advisory Board Meeting on Distance-Assisted Training in Radiation Oncology                   | Gaudencio Vega                   | St. Luke's Medical Center                                 | Korea     | 2 – 5 Jun '03      | IAEA      |
| • Geothermal Resources Council Annual Meeting  | Ramoncito Malate                 | PNOC – Energy Development Center                          | Mexico    | 12 – 15 Oct '03    | IAEA      |
| • 4 <sup>th</sup> Forum for Nuclear Cooperation in Asia Meeting  | Estrella F. Alabastro            | Secretary, DOST   | Japan     | 3 Dec '03          | MEXT      |
| <b>CONFERENCE/SYMPOSIUM</b>  |                                  |   |           |                    |           |
| • International Conference on Security of Radioactive Sources  | Francisco Mier                   | National Security Council                                 | Austria   | 10 – 13 Mar '03    | IAEA      |
| • International Symposium on Application of Gene-Based Technologies for Improving Animal Production and Health in Developing Countries   | Blesilda Verin                   | Philippine Animal Health Center                           | Austria   | 6 – 10 Oct '03     | IAEA      |
| <b>SCIENTIFIC VISIT</b>  |                                  |   |           |                    |           |
| • Newborn Screening  | Teofilo O.L. San Luis            | St Luke's Medical Center                                  | USA       | 24 Feb – 8 Mar '03 | IAEA      |
| • Legal Aspects of Atomic Energy   | Michelle Dizon-Go                | Dept of Environment and Natural Resources                 | France    | 25 Aug – 6 Sep '03 | IAEA      |



TABLE 8. PNRI MANPOWER DEVELOPMENT (FOREIGN)

| FIELD   | NAME  | COUNTRY   | DATE                   | SPONSOR     |
|---|---|-----------|------------------------|-------------|
| <b>ON-THE-JOB TRAINING</b>  |   |           |                        |             |
| • Groundwater Hydrology   | Rosalina V. Almoneda  | Australia | 10 – 28 Feb '03        | IAEA        |
| • Radiological Application of Air Dispersion Models   | Mary Rose Q. Mundo  | Austria   | 17 Feb – 16 Apr '03    | IAEA        |
| • Soil Science, Irrigation and Plant Nutrition  | Adelina M. Bulos  | U.K.      | 17 Mar – 16 Jul '03    | IAEA        |
| • Radionuclides and Radiation in Aquatic Biology  | Azucena C. De Vera  | USA       | 1 Apr – 30 Jun '03     | IAEA        |
| • Nuclear Medicine  | Ma. Teresa M. Salabit   | Thailand  | 1 Jul – 30 Sep '03     | IAEA        |
| • Nutritional and Health-Related Environmental Studies  | Preciosa Corazon Pabroa   | Slovenia  | 14 Jul 0 13 Oct '03    | IAEA        |
| • Analytical Chemistry (Gamma Spectrometry of Natural and Anthropogenic Radionuclides)  | Eliza B. Enriquez   | Korea     | 1 Sep – 31 Oct '03     | IAEA        |
| • Nuclear Medicine  | Teresa L. Borrás  | China     | 6 Oct – 5 Nov '03      | IAEA        |
| • Gene Technologies   | Custer C. Deocarís  | Japan     | 14 Nov – 25 Dec '03    | AIST, Japan |
| <b>TRAINING COURSE</b>  |   |           |                        |             |
| • Regional Training Course on Internal Auditing   | Flora L. Santos<br>Luz V. Esguerra  | Pakistan  | 17 – 20 Mar '03        | IAEA        |
| • International Training Course on Implementation of State Systems of Accounting for and Control of Nuclear Materials                               | Julietta E. Seguis  | USA       | 28 Apr – 16 May '03    | IAEA        |
| • Data Acquisition and Control Module Applicable in Refurbishment of Nuclear Instruments  | Albert G. Dizon   | Malaysia  | 7 – 18 Jul '03         | IAEA        |
| • Regional Training Course- Application of Induced Mutation and Biotechnology for Crop Improvement  | Alfonso O. Grafia   | Sri Lanka | 4 – 15 Aug '03         | IAEA        |
| • Role of Nuclear Power and other Energy Options in Competitive Electricity Markets   | Christina A. Petrache   | Korea     | 4 – 22 Aug '03         | IAEA        |
| • Radiation Protection of Radioactive Waste Management  | Abelardo A. Inovero<br>Merrian C. Tagonan                                     | China     | 13 – 17 Oct '03        | IAEA        |
| • Regional Training Course – Implementation of the International Maritime Dangerous Goods (IMDG) Code   | Vangelina K. Parami   | Vietnam   | 4 – 7 Nov '03          | IMO         |
| • Capability- Building on Technology Transfer of DOST-Funded Researches to Small and Medium Enterprises (SMEs)                                      | Luvimina G. Lanuza  | Australia | 17- 28 Nov '03         | AUSAID      |
| • Radiation Protection and Safety of Radiation Sources  | Lynette B. Cayabo<br>Louie R. del Castillo                                    | Malaysia  | 1 Dec '03 – 26 Nov '04 | IAEA        |
| • Application of Isotope and Geochemical Techniques to Groundwater Contamination Studies  | Raymond Suggang   | Indonesia | 8 – 19 Dec '03         | IAEA        |
| • Accreditation of NDT Laboratories as Per ISO 17025  | Estrella D. Relunia   | Malaysia  | 15 – 19 Dec '03        | IAEA        |
| <b>WORKSHOP</b>   |   |           |                        |             |
| • Nuclear Safety Culture (FNCA Workshop)  | Vangelina K. Parami   | Vietnam   | 13 – 17 Jan '03        | MEXT        |
| • Utilization of Research Reactors (FNCA Workshop)  | Flora L. Santos<br>Elvira Z. Sombrito   | Indonesia | 13 – 17 Jan '03        | MEXT        |
| • Refurbishment of an Uptake System   | Eduardo T. Cabildo  | Myanmar   | 27 – 31 Jan '03        | IAEA        |
| • Tracers in Oilfield Investigation   | Michael Dennis T. Fernandez   | India     | 3 – 14 Mar '03         | IAEA        |
| • Protection Against Fire for Research Reactors and Facilities  | Renato T. Banaga<br>Alan M. Borrás<br>Arturo F. Salih<br>Armando M. Dela Cruz | Korea     | 14 Mar '03             | IAEA / EBP  |
| • 7 <sup>th</sup> On-Site Inspection Introductory Course  | Rolando Y. Reyes  | Austria   | 31 Mar – 4 Apr '03     | CTBTO       |
| • Regional Workshop on National Planning, Selection and Design of IAEA Technical Cooperation Projects   | Pilar C. Rocoles  | Korea     | 21 – 24 Jul '03        | IAEA        |
| • Application of Electron Accelerators  | Estelita G. Cabalfin<br>Lorna S. Relleve                                      | Malaysia  | 18 – 22 Aug '03        | FNCA        |
| • Use of Receptor Binding Assay (as speaker)  | Elvira Z. Sombrito  | Italy     | 1 – 5 Sep '03          | ICTP        |
| • Preparation of In-House Reference Materials   | Preciosa Corazon Pabroa   | Belgium   | 15 – 19 Sep '03        | IAEA        |
| • Human Resource Development in the Nuclear Field   | Corazon C. Bernido  | Thailand  | 8 – 10 Oct '03         | FNCA        |
| • Regional Training Workshop on Data Validation for Airborne Particulate Data   | Luz V. Esguerra   | India     | 13 – 17 Oct '03        | IAEA        |
| • Enhancing Partnership Between Member States and IAEA for the Delivery of the Technical Cooperation Programme for the East Asia and Pacific Region | Pilar C. Rocoles  | Malaysia  | 13 – 17 Oct '03        | IAEA        |

TABLE 8. PNRI MANPOWER DEVELOPMENT (FOREIGN)

| FIELD   | NAME  | COUNTRY   | DATE               | SPONSOR    |
|---|---|-----------|--------------------|------------|
| • RCA Regional Training Workshop on Environmental Impact and Assessment Modeling  | Luzviminda L. Venida  | Malaysia  | 13 – 17 Oct '03    | IAEA       |
| • Biofertilizer Project and Multilateral Cooperative Research Program in the Field of Biotechnology, Development of Biomanure Based on Symbiotic System               | Richard M. Balog  | Vietnam   | 20 – 24 Oct '03    | FNCA       |
| • Promising Fertilizer and Crop Residue Management Practices for Sustainable Crop Production in Rice-Based Cropping Systems   | Faye G. Rivera  | Vietnam   | 20 – 24 Oct '03    | IAEA       |
| • 3 <sup>rd</sup> Regional Workshop on Evaluation of the Project on QA and QC of Nuclear Analytical Techniques  | Flora L. Santos   | Korea     | 20 – 24 Oct '03    | IAEA       |
| • Effective Implementation of National Nuclear Energy Legislation   | Vangelina K. Parami   | Thailand  | 27 –31 Oct '03     | IAEA       |
| • Radiation Processing of Natural Polymers for Health Care Application  | Lorna S. A. Relleve   | India     | 3 – 7 Nov '03      | IAEA       |
| • Application of Knowledge Management Techniques  | Corazon C. Bernido<br>Angel B. Anden                                | Korea     | 10 – 14 Nov '03    | IAEA       |
| • Regional Training Workshop on Safety Culture in Nuclear Installations   | Graceta DL Cuevas<br>Rosita R. Daroy<br>Haydee M. Solomon           | Korea     | 10 –14 Nov '03     | IAEA / EBP |
| • Development of National Strategies for Improving Control Over Radioactive Sources   | Sylvia S. Busine  | Vietnam   | 14 – 27 Nov '03    | IAEA       |
| • Nuclear and Related Methodologies for Quantification of Tannins in Shrub and Tree Leaves, Agro-Industrial By-Products and Other New Feed Sources                    | Azucena C. De Vera  | Pakistan  | 1–12 Dec '03       | IAEA       |
| • Radioactive Waste Management  | Eulinia M. Valdezco<br>Editha A. Marcelo                            | Indonesia | 15 – 19 Dec '03    | FNCA/MEXT  |
| <b>SEMINAR</b>  |   |           |                    |            |
| • International Seminar on Nuclear Safety: Course on Radiation Application  | Haydee M. Solomon   | Japan     | 20 – 31 Jan '03    | RADA/MEXT  |
| • Regional Coordinators Seminar for Decision Makers — For the Implementation of Radiation Protection  | Alumanda M. dela Rosa   | Thailand  | 3 – 5 Feb '03      | IAEA       |
| • Regional Seminar on Approaches for the Effective Regulation on Radiation Protection and Safety of Radiation Sources   | Alumanda M. Dela Rosa   | Thailand  | 6 – 7 Feb '03      | IAEA       |
| • International Seminar on Nuclear Safety: Course on Dissemination of Nuclear Knowledge   | Estrella D. Relunia<br>Justina S. Cerbolles<br>Percedita T. Cancino | Japan     | 3 – 7 Mar '03      | RADA/MEXT  |
| • Seminar for ASEAN States on the Non-Proliferation of Nuclear Weapons: The Role of Safeguards Agreement Additional protocols/Export Controls and Additional Protocol | Julietta E. Seguis  | Malaysia  | 31 Mar – 3 Apr '03 | IAEA       |
| • Regional Executive Seminar on the Management of Research Reactor Safety   | Leonardo L. Leopando<br>Corazon M. Garcia                           | Australia | 25 – 27 Aug '03    | IAEA       |
| • International Seminar on Nuclear Safety 2003: Course on Operation and Maintenance of Nuclear Facilities   | Renato T. Baniaga   | Japan     | 20 – 31 Oct '03    | RADA/MEXT  |
| • International Seminar on Nuclear Safety 2003: Course on Safety Analysis   | Carl M. Nohay   | Japan     | 10 –21 Nov '03     | RADA/MEXT  |
| • International Seminar on Nuclear Safety 2003: Management Course   | Emma L. Cancino   | Japan     | 8 – 12 Dec '03     | RADA/MEXT  |
| <b>MEETING</b>  |   |           |                    |            |
| • Net-Enabled Waste Management Database ( NEWMDB)   | Eulinia M. Valdezco   | Austria   | 27 – 29 Jan '03    | IAEA       |
| • Final Project Coordinators Meeting on Harmonization of Radiation Protection   | Eulinia M. Valdezco   | Vietnam   | 17 – 21 Feb '03    | IAEA       |
| • Project Review/Project Formulation Meeting on Nuclear Techniques to Address Harmful Algal Bloom Concerns/Enhancing the Marine Coastal Environment                   | Elvira Z. Sombrito<br>Teofilo Y. Garcia                             | Malaysia  | 3 – 7 Mar '03      | IAEA       |
| • 4 <sup>th</sup> Coordinators Meeting – Forum for Nuclear Cooperation in Asia  | Alumanda M. Dela Rosa<br>Victoria Fe O. Medina                      | Japan     | 5 – 7 Mar '03      | MEXT       |
| • Technical Meeting on Asian Nuclear Safety Network   | Alejandro J. Mateo  | Korea     | 24 – 28 Mar '03    | IAEA       |
| • Regional Project Planning Meeting: Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas                                       | Soledad S. Castañeda  | Indonesia | 31 Mar – 4 Apr '03 | IAEA       |
| • Experts Group Meeting – Nuclear Energy  | Eulinia M. Valdezco   | USA       | 7 – 10 May '03     | CSAP       |
| • 3 <sup>rd</sup> Regional Coordinators Meeting on QA of Mass-Produced and Released Fruit Flies for SIT Programmes  | Sotero S. Resilva   | Australia | 19 – 23 May '03    | IAEA       |
| • 25 <sup>th</sup> National Representatives Meeting: Regional Cooperative Agreement(RCA)  | Alumanda M. dela Rosa   | Sri Lanka | 26 – 28 May '03    | IAEA       |

TABLE 8. PNRI MANPOWER DEVELOPMENT (FOREIGN)

| FIELD   | NAME   | COUNTRY               | DATE                     | SPONSOR  |
|---|--|-----------------------|--------------------------|----------|
| • Project Formulation Meeting on Improving Regional Capacity for Assessment, Planning and Response  | Alejandro Q. Nato, Jr.   | Australia             | 21 – 25 Jul '03          | IAEA     |
| • Project Consultative Meeting on Design of Regional Resource Unit Database   | Antonio E. Refre   | Korea                 | 19 – 22 Aug '03          | IAEA     |
| • Project Consultative Meeting on Design of Regional Resource Unit Database   | Ana Elena L. Conjares  | Korea                 | 19 – 22 Aug '03          | IAEA     |
| • Midterm Review Meeting- Restoration of Soil fertility and Sustenance of Agricultural Productivity, Part 2   | Elvira Z. Sombrito   | Indonesia             | 13 – 17 Oct '03          | IAEA     |
| • 3 <sup>rd</sup> Meeting of State's Point of Contact for the Illicit Trafficking Database Programme  | Alumanda M. Dela Rosa<br>Julietta E. Seguis                        | Austria               | 20 – 22 Oct '03          | IAEA     |
| • Regional Meeting on Advanced Mechanisms for Technology Transfer in the Region   | Reynaldo P. Jacinto<br>Elvira Z. Sombrito                          | Indonesia             | 20 – 24 Oct '03          | IAEA     |
| • Experts Group Meeting on Quality Control and Accreditation in Radioisotope Applications in Petroleum/Chemical Industries  | Linda L. Leopando  | Thailand              | 27 – 30 Oct '03          | IAEA     |
| • Public Information on Nuclear Energy  | Rhodora R. Leonin  | Vietnam               | 4 – 6 Nov '03            | FNCA     |
| • Progress Assessment Meeting to Review and Evaluate Analytical Data in Support of Urban Air Quality Management   | Flora L. Santos  | Thailand              | 10 – 14 Nov '03          | IAEA     |
| • 1 <sup>st</sup> RCM on Nuclear Applications to Determine Bioaccumulation Parameters and Processes Used for Establishing Coastal Zone Monitoring and Management Criteria | Elvira Z. Sombrito   | Monaco                | 2 – 5 Dec '03            | IAEA     |
| • Technical Meeting to Review Progress and Future Activities of the EBP on the Safety of Nuclear Installations  | Alejandro J. Mateo   | Austria               | 8 – 11 Dec '03           | IAEA/EBP |
| • Forum for Nuclear Cooperation in Asia Meeting   | Alumanda M. Dela Rosa<br>Corazon C. Bernido                        | Japan                 | 2 – 3 Dec '03            | MEXT     |
| • Use of Isotopes in Dam Safety and Sustainability  | Silvestre L. Abaya   | Austria               | 15 – 19 Dec '03          | IAEA     |
| <b>CONFERENCE/SYMPOSIUM</b>   |  |                       |                          |          |
| • International Conference on Security of Radioactive Sources   | Alejandro J. Mateo   | Austria               | 10 – 13 Mar '03          | IAEA     |
| • International Conference on Safety of Transport of Radioactive Material   | Vangelina K. Parami  | Austria               | 7 – 11 Jul '03           | IAEA     |
| • International Conference on National Infrastructures for Radiation Safety   | Alumanda M. dela Rosa<br>Eulinia M. Valdezco<br>Alejandro J. Mateo | Morocco               | 1 – 5 Sep '03            | IAEA     |
| • 47 <sup>th</sup> General Conference; 32 <sup>nd</sup> RCA General Conference; Senior Regulators Meeting   | Alumanda M. Dela Rosa  | Austria               | 15 – 19 Sep '03          | IAEA     |
| • International Symposium – Application of Gene-Based Technologies for Improving Animal Production and Health in Developing Countries                                     | Custer C. Deocaris   | Austria               | 6 – 10 Oct '03           | IAEA     |
| <b>SCIENTIFIC VISIT</b>   |  |                       |                          |          |
| • Safety Standards, Regulations and Procedures  | Teofilo V. Leonin, Jr.   | Ireland               | 3 – 10 Feb '03           | IAEA     |
| • Flowrate Measurement and Residence Time Distribution Study of Gas Phases  | Silvestre A. Abaya   | Korea                 | 25 Aug – 5 Sep '03       | IAEA     |
| • Animal Production and Fisheries   | Celia O. Asaad   | Thailand and Malaysia | 22 Sep – 17 Oct '03      | IAEA     |
| • Geographic Information System   | Socorro P. Intoy   | China                 | 6 – 17 Oct '03           | IAEA     |
| • Sterile Insect Technique  | Glenda B. Obra   | Austria               | 13 – 24 Oct '03          | IAEA     |
| • Web Database and Site Development and Maintenance   | Ana Elena L. Conjares  | Austria               | 20 – 31 Oct '03          | IAEA     |
| • Use of Induced Mutations for the Development of Improved Varieties of Fruit Crops (Mangosteen and Cashew)   | Avelina G. Lapade  | Italy                 | 20 – 31 Oct '03          | IAEA     |
| <b>EXPERT ASSIGNMENT</b>  |  |                       |                          |          |
| • Expert Assignment to Identify Radiation Protection Needs in Member States of the Asia-Pacific Region  | Eulinia M. Valdezco  | Austria               | 1 – 5 Dec '03            | IAEA     |
| <b>RESEARCHERS / SCIENTISTS EXCHANGE PROGRAM</b>  |  |                       |                          |          |
| • Radiation Degradation of Carrageenan and Its Application  | Charito T. Aranilla  | Japan                 | 23 Jun – 20 Dec '03      | MEXT     |
| • Scientist Exchange Program- Small Angle Neutron Scattering on Nano-Structures of Soft Matter  | Lucille V. Abad  | Japan                 | 28 Jul '03 – 24 Jul '04  | MEXT     |
| <b>DEGREE COURSE</b>  |  |                       |                          |          |
| • M.S. Degree in Engineering Management   | Ma. Celerina M. Ramiro   | Australia             | 26 Jan '03 – 31 July '04 | AUSAID   |



TABLE 9. PNRI MANPOWER DEVELOPMENT (LOCAL)

| FIELD  | NAME   | VENUE  | DATE                            |
|--|--|--|---------------------------------|
| <b>TRAINING COURSE</b>   |  |  |                                 |
| • Monitoring and Evaluating  | Victoria Fe O. Medina  | DOST   | 1 – 4 Apr '03                   |
| • Product Costing and Financial Analysis   | Lucille V. Abad & Lorna S. Relleve   | ITDI, Taguig MM                                    | 5 Jun '03                       |
| • Appointments and Other Personnel Actions   | Cattleya Savellano   | Sulo Hotel, Quezon City                            | 2 – 25 Jul '03                  |
| • Program Logic Formulation  | Estrella S. Caseria & Editha A. Marcelo  | Pasig City   | 18, 25 Jul & 1 Aug '03          |
| • Toxic and Hazardous Waste Certificate Training Program   | Editha A. Marcelo  | UP, Diliman  | 15 – 19 Sep '03                 |
| • In -House Training on Basic Technology Management  | Luvimina G. Lanuza   | FNRI, Taguig MM                                    | 30 Sep – 1 Oct '03              |
| • Training Course for Finance and Property Officers  | Ana N. Villanueva  | DOST   | 11 Nov '03                      |
| • Capability Building on Technology Transfer of DOST Funded Researches to Small and Medium Enterprises (Component 1 and Component 2) | Luvimina G. Lanuza   | FNRI, Taguig AIM, Makati                           | 11 – 12 Nov '03                 |
| • Eddy Current Testing Methods level II  | Archimedes Andres  | PNRI   | 10 – 26 Nov '03                 |
| • Animal Care Personnel Training Course  | Lorna S. Relleve, Celia O. Asaad   |  |                                 |
| <b>SEMINAR / WORKSHOP</b>  |  |  |                                 |
| • Seminar on Effective Customer Service for Bottom Line Results  | Victoria Fe O. Medina, Luvimina G. Lanuza  | Phil. Trade and Training Center                    | 18 – 19 Feb '03                 |
| • Information System Strategic Plan (ISSP) Workshop  | Angel B. Anden   | DOST   | 4 – 7 Mar '03                   |
| • Seminar on Computerization in Records Management   | Josefina J. Omandam  | DOST   | 13 – 14 Mar '03                 |
| • Seminar on Women's Rights in the Society   | Emma L. Cancino  | DOST   | 25 Mar '03                      |
| • Basic Value Seminar — Series for Government Employees  | Alicia F. Lagunzad   | Malacanang, Manila                                 | 24 – 25 Apr '03                 |
| • Chemical Weapons Seminar and Training Course Seminar on E- Commerce  | Eulinia M. Valdezco  | National Defense College of the Philippines (NDCP) | 21 – 22 Apr '03                 |
| • PWU Training Workshop on Using ICT in Education for Teachers   | Antonio E. Refre (Resource Speaker)  | Baguio City & PWU, Taft                            | 5 – 8 May '03 & 12 – 16 May '03 |
| • Preginet 1 <sup>st</sup> Network/System Administration Workshop  | Ana Elena L. Conjares  | CSRC   | 12 – 16 May '03                 |
| • Seminar of Total Quality Management  | Victoria Fe O. Medina  | PTTC, Pasay City                                   | 7 – 8 May '03                   |
| • Seminar/Workshop on Preparing a Quality Management System Conforming to ISO 9001: 2000 Standard                                    | Luvimina G. Lanuza   | MIRDC, Taguig MM                                   | 8 – 9 May '03                   |
| • 6 <sup>th</sup> Annual Meeting and Symposium of the Philippine Society for Soil Science and Technology Inc.                        | Richard Balog  | Camarines Sur                                      | 8 – 9 May '03                   |
| • Seminar/Workshop on Supervisory Development Course 2: Powerful Coaching Techniques   | Alicia F. Lagunzad<br>Christina A. Petrache<br>Estrella D. Relunia<br>Corazon M. Garcia<br>Estrella S. Caseria   | MIRDC, Taguig MM                                   | 3 – 4 Jun '03                   |
| • Nondestructive Testing (NDT) Seminar   | Alejandro J. Mateo & Renato T. Banaga (Resource Speakers)  | Pangasinan   | 12 Jun '03                      |
| • Exhibit Design   | Rhodora R. Leonin & Justina S. Cerbolles   | TAPI, Taguig MM                                    |                                 |
| • Radiological and Technological Hazards   | Eulinia M. Valdezco (Resource Speaker)   | Baguio City  | 8 – 9 Jul '03                   |
| • Workshop on Validation of the R & D Management Information (RDMIS) and Technology Transfer Management Information System (TTMIS)   | Angel B. Anden   | DOST   | 16 Jul '03                      |
| • Seminar Orientation on the Use of the Sci-NET Phil Integrated Library Management Module  | Isabel M. Miscalaray   | STII, Taguig MM                                    | 16 Jul '03                      |
| • Free Government Website Development Workshop   | Grace M. Carlos  | UP, Diliman  | 30 Jul '03                      |
| • Values Orientation Workshop  | Eligio L. Abrigana, Archimedes Andres, Denis Aquino, Richard Balog, Theresa Baltazar, Geusaffe Dean, Custer C. Deocaris, Jade Dungao, Edilberto Dumentay, Michael Fernandez, Allan Flores, Noel B. Gerilla, Rommel Gutierrez, Michael Hernandez, Amelia Hilario, Ma. Celestina Honrado, Valerie Ann Innis, Jerry | PNRI   | 5 – 7 Aug '03                   |

**TABLE 9. PNRI MANPOWER DEVELOPMENT (LOCAL)**

| FIELD   | NAME   | VENUE                             | DATE            |
|---|--|-----------------------------------|-----------------|
|   | Mandiguiado, Jay F. Nacianceno, Alejandro Q. Nato, Annalie Ocampo, Christine Pinera, Randy Salazar, Cattleya Savellano, Alfonso Singayen, Raymond Suggang, Ramoncito Sulit, Geoffrey Tranquilan, Florante Valderama, Amaldo Valenzuela   |                                   |                 |
| <ul style="list-style-type: none"> <li>Seminar/Workshop on Developing and Implementing a Laboratory Quality Management System Based on ISO/IEC 17025</li> </ul>   | Silvestre L. Abaya, Ma. Luz M. Ascano, Adelaida C. Barrida, Virginia S. Calix, Marilyn K. Castillo, Lorena A. Del Castillo, Fe M. Dela Cruz, Custer C. Deocaris, Lourdez G. Fernandez, Teofilo Y. Garcia, Neil D. Guillermo, Maricel Honrado, Annalie Ocampo, Faye G. Rivera, Elvira Z. Sombrito, Raymond Suggang, Mitos M. Tolentino, Ma. Theresa L. Borras, Estrella S. Caseria, Luvimina G. Lanuza, Editha A. Marcelo, Haydee M. Solomon, Ramoncito Sulit, Ana Villanueva | PNRI                              | 11 – 13 Aug '03 |
| <ul style="list-style-type: none"> <li>Four-Day Workshop on the Redrafting of the Proposed Hazardous and Nuclear Waste Management Act</li> </ul>  | Eulinia M. Valdezco  | Laguna                            | 25 – 28 Aug '03 |
| <ul style="list-style-type: none"> <li>Training Seminar on Implementing Rules and Regulations of the Republic Act No. 9184</li> </ul>   | Ruby Liza M. Gabriel, Virgilio R. Santiago, Julieta C. Mendoza   | NIA, EDSA, QC                     | 29 Sep '03      |
| <ul style="list-style-type: none"> <li>Seminar on the Importance of Patent Information and the Patent Cooperation Treaty (PCT) as a Source of Technical Information</li> </ul>  | Lorna S. Relleve, Lorena A. Del Castillo   | UP, Diliman                       | 2 – 3 Oct '03   |
| <ul style="list-style-type: none"> <li>Workshop on Chemical Management in the Philippines and Its Related Regulations</li> </ul>  | Soledad S. Castaneda   | DOST, Taguig, MM                  | 10 Oct '03      |
| <ul style="list-style-type: none"> <li>Training Seminar on the Implementing Rules and Regulations of Republic Act No. 9184</li> </ul>   | Normita C. Lim, Susan S. Pascual, Ana Villanueva   | NIA, EDSA, QC.                    | 15 Oct '03      |
| <ul style="list-style-type: none"> <li>Seminar on Sample Preparation by Fusion for Analysis by XRF, AAS, ICP and Wet Chemistry</li> </ul>   | Lourdes G. Fernandez & Marilyn K. Castillo   | Holiday Inn, Galleria, Manila     | 21 Oct '03      |
| <ul style="list-style-type: none"> <li>5<sup>th</sup> CO-Exist SEA Workshop (Cooperation on the Exchange of Information on Science and Technology in South East Asia) Workshop of the Philippine Task Force of Hazardous Waste</li> </ul> | Teresa Y. Nazarea & Teofilo Y. Garcia  | Olongapo City                     | 22 –23 Oct '03  |
| <ul style="list-style-type: none"> <li>Seminar on Cash Management and Control System</li> </ul>   | Christine Pinera   | COA, Quezon City                  | 17 – 19 Nov '03 |
| <ul style="list-style-type: none"> <li>Success and Motivation Training Workshop</li> </ul>  | Alicia F. Lagunzad, Jocelyn L. David   | DOST, Taguig, MM                  | 14 Nov '03      |
| <ul style="list-style-type: none"> <li>Business Orientation Course for PNRI Staff</li> </ul>  | Alan M. Borras, Corazon M. Garcia, Erlinda S. Natera, Rolando Reyes, Lourdes G. Fernandez & All PNRI Unit Heads  | PNRI                              | 11 – 13 Nov '03 |
| <ul style="list-style-type: none"> <li>Seminar/Workshop on Increasing Productivity Through Value-Based Time Management</li> </ul>   | Cristina A. Petrache, Estrella S. Caseria  | MIRDC, Taguig, MM                 | 3- 5 Dec '03    |
| <b>MEETING</b>  |  |                                   |                 |
| <ul style="list-style-type: none"> <li>SciNET- Phil Consultative Meeting</li> </ul>   | Isabel M. Amiscaray  | STII, Taguig, MM                  | 31 Jan '03      |
| <ul style="list-style-type: none"> <li>Tutorial Meeting on Enhancing the Marine Coastal Environment</li> </ul>  | Alejandro Q. Nato, Albert Dizon  | PNRI                              | 26 Feb '03      |
| <ul style="list-style-type: none"> <li>Meeting on Project Feasibility Studies</li> </ul>  | Lucille V. Abad  | ITDI, Taguig, MM                  | 6 June '03      |
| <ul style="list-style-type: none"> <li>Sci-NET –Phil Meeting</li> </ul>   | Isabel M. Amiscaray  | STII, Taguig, MM                  | 26 Sep '03      |
| <b>SYMPOSIUM / FORUM</b>  |  |                                   |                 |
| <ul style="list-style-type: none"> <li>Investors Forum on Commercial Technologies for High tech Industries (Electronics Equipment and IT Products)</li> </ul>   | Randy Salazar  | PTTC, Pasay City                  | 16 Jul '03      |
| <ul style="list-style-type: none"> <li>Policy Forum on Women Entrepreneurship Development</li> </ul>  | Emma L. Cancino  | TESDA, Taguig, MM                 | 16 Dec '03      |
| <b>CONVENTION / CONGRESS / CONFERENCE</b>   |  |                                   |                 |
| <ul style="list-style-type: none"> <li>2<sup>nd</sup> National Convention on Health Emergency Management</li> </ul>   | Erlinda S. Natera  | Bayview Plaza, Roxas Blvd, Manila | 3 – 5 Dec '03   |

TABLE 9. PNRI MANPOWER DEVELOPMENT (LOCAL)

| FIELD   | NAME                                       | VENUE                                    | DATE            |
|---|--|--|-----------------|
| • DOST-Wide Planning Conference   | Virginia S. Calix                          | Development Academy of the Philippines   | 6 – 7 Feb '03   |
| • 25 <sup>th</sup> Convention of the Philippine College of Occupational Medicine            | Erlinda S. Natera                          | EDSA- Shangrila                          | 23 – 25 Feb '03 |
| • 10 <sup>th</sup> Biennial Convention of the PARP  | Estrella S. Caseria,<br>Arlean L. Alamares | Cebu City                                | 26 – 27 Sep '03 |
| • Physics Congress  | Valerie Ann Innis                          | Cebu City                                | 22 – 25 Oct '03 |
| • 21 <sup>st</sup> Samahang Pisika ng Pilipinas Congress                                    | Jade Dungao                                | Cebu City                                | 21- 25 Oct '03  |
| • National Mining Conference  | Rolando Y. Reyes                           | Holiday Inn Galleria, Pasig City         | 3 – 4 Dec '03   |
| • 2 <sup>nd</sup> National Convention for Health Emergency Management for the Health Sector | Emma L. Cancino &<br>Erlinda S. Natera     | Manila                                   | 3–5 Dec '03     |
| <b>DEGREE COURSE</b>  |  |  |                 |
| • Master of Engineering, Major in Computer Engineering                                      | Albert G. Dizon                            | Pamantasan ng Lungsod ng Maynila, Manila | Apr '03         |

TABLE 10. LIST OF TECHNICAL PAPERS

**PAPERS PUBLISHED**

**Abad, Lucille V., Lorna S. Relleve, Charito T. Aranilla, and Alumanda M. dela Rosa.** "Properties of Radiation Synthesized PVP-kappa Carrageenan Hydrogel Blends". Radiation Physics and Chemistry, 68, 901-908. 2003.

**Bernido, Corazon C.** "Country Report for the Philippines, The 2002 Activities and the 4<sup>th</sup> Workshop of the Human Resources Development Project in FNCA. Japan Atomic Energy Research Institute", JAERI-Review 2003 –018.

**Cabalfin, Estelita G.** "Utilization of Electron Accelerator in the Philippines". Proceedings of the FNCA Workshop on Application of Electron Accelerator, January 28 – February 1, 2002, Takasaki, Japan, JAERI-Conf 2002 –013, February 2003.

**Cabalfin, Estelita G.** " Status of Radiation Treatment of Liquid Samples in the Philippines". Proceedings of the FNCA 2002 Workshop on Application of Electron Accelerator – Radiation System for Liquid Samples, 16 – 20 December 2002, Takasaki, Japan, JAERI- Conf 2003 – 016, October 2003.

**Guillermo, Neil Raymond G., Lorena A. Del Castillo and Virginia S. Calix.** "Evidence of Site Preference of Al<sup>3+</sup> in the Sm<sub>3</sub>Fe<sub>5-x</sub>Al<sub>x</sub>O<sub>12</sub> by Moessbauer Spectrometry". Proceedings of the 21<sup>st</sup> Samahang Pisika ng Pilipinas Physics Congress. University of San Carlos, Cebu City, Philippines, 22 – 25 October 2003, pp 458 – 461.

**Innis, Valerie A., Pablo P. Saligan and Virginia S. Calix.** "Plexiglas as a Disposal Sample Carrier for TXRF Analysis". Proceedings of 21<sup>st</sup> Samahang Pisika ng Pilipinas Physics Congress, . University of San Carlos, Cebu City, Philippines, 22 – 25 October 2003, pp 110 - 113.

**Palattao, Maria Visitacion B.** "Current Practice in Dealing with Natural Radioactivity from Selected Industries". Technical article submitted to the FNCA Newsletter of Japan, Nov. 2003.

**Sombrito, Elvira Z. and Adelina M. Bulos.** "Performance Tests on New Chromatographic Material <sup>99</sup>Mo-<sup>99m</sup>Tc Generators". Proceedings of the 2002 Workshop on the Utilization of Research Reactors. Jakarta and Serpong Indonesia, 13 – 17 January 2003.

**Sombrito, Elvira Z., Adelina M. Bulos, E. F. Furio, E. Sta. Maria, and M. Honrado.** "Application of <sup>210</sup>Pb –derived Sedimentation Rates and Dinoflagellate Cyst Analyses in Understanding *Pyrodinium bahamense* Harmful Algal Blooms in Manila Bay and Malampaya Sound, Philippines". Journal of Environmental Radioactivity, Elsevier Press. (Submitted for Publication)

**PAPERS PRESENTED**

**Balog, Richard M. and Juliet Anarna.** "A Synopsis of the Vital Role of Biotechnology to the Development and Sustainability of Philippine Agriculture". Paper presented during the 2003 Joint Workshop on Biofertilizer Project and JSPS –NRTC/DOST/LIPI/VCC Multilateral Cooperative Research Program in the Field of Biotechnology, Development of Biomanure Based on Symbiotic System, Hanoi and Ho Chi Minh City, Vietnam, 20 – 24 October 2003.

**Balog, Richard M., Faye G. Rivera, Crispina M. Rosales and Hilarion M. Mamaril.** "The Use of Nuclear Techniques in Fertilizer- N Use Efficiency and Crop Management in the Upland". Paper presented during the , 2003 Joint Workshop on Biofertilizer Project and JSPS –NRTC/DOST/LIPI/VCC Multilateral Cooperative Research Program in the Field of Biotechnology, Development of Biomanure Based on Symbiotic System, Hanoi and Ho Chi Minh City, Vietnam, 20 – 24 October 2003..

**Cabalfin, Estelita G.** "Radiation Processing of Thin Films in the Philippines". Paper presented at the FNCA 2003 Workshop on Application of Electron Accelerator – Radiation System for Thin Film, Kuala Lumpur, Malaysia, 18–22 August 2003.

**Cansino Percedita T.** "Activities of Radiation and Nuclear Knowledge Dissemination Paper presented at the Philippine Nuclear Research Institute". Paper presented during the International Seminar on Nuclear Safety: Course on Dissemination of Nuclear Knowledge. Tokai Japan, 3-7 March 2003.

**Castañeda, Soledad S.** "Environmental Isotope Techniques and Modelling Approaches for Improved Water Resources Management". Paper presented in the 13<sup>th</sup> International Waters Association. Asia- Pacific Conference (IWA-ASPAC) and Exhibition, Cebu City, Philippines, 13 – 18 October 2003.

**Castañeda, Soledad S., L. Fernandez, L. Ascaño, T. Y. Garcia, A. Ramos, E. Conjares, L. Africa, R. Cabanag, H. Maspinas, E. Calonzo, J. Diaz, and E. Regalado.** "Isotope Techniques Application in Understanding the Recharge Process of the Davao City Aquifers". Paper presented at the IWA-ASPAC Conference, Davao City, 14 March 2003.

**Castañeda, Soledad S.,** "Application of Environmental Isotope Techniques for Improved Groundwater Resource Management and Protection". Paper presented in the Water Drillers Conference, Rembrandt Hotel, 15 August 2003.

**Cerbolles, Justina S.** "Activities of Radiation and Nuclear Knowledge Dissemination at the Philippine Nuclear Research Institute". Paper presented during the International Seminar on Nuclear Safety: Course on Dissemination of Nuclear Knowledge. Tokai, Japan, 3-7 March 2003.

**De Guzman, Zenaida M.** "Radiation - Sterilized Amnion Membranes and Its Clinical Application". Paper presented during the Asian Congress on Microcirculation, Westin Philippine Plaza Hotel, February 2003.

**De Guzman, Zenaida M.** "Production of Radiation- Sterilized Amnion Membranes and its Clinical Usage". Paper presented during the Asian Congress of Cosmetic Scientist, Westin Philippine Plaza Hotel, March 2003.



**TABLE 10. LIST OF TECHNICAL PAPERS**

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|---|
| <b>De Guzman, Zenaida M.</b> "Safety and Regulatory Aspects of Food Irradiation". Paper presented during the 42nd Annual Convention of Philippine Association of Food Technologists., Robinson Galleria Suites, Manila, Philippines. November 2003.   |
| <b>De Guzman, Zenaida M.</b> "Applications of Food Irradiation". Paper presented during the Annual Mango Congress, Waterfront Hotel, Cebu City, Philippines, November 2003..  |
| <b>Dela Rosa, Alumanda M., Lucille V. Abad, Lorna S. Relleve and Charito T. Aranilla.</b> "Radiation Processing of Carrageenan for Healthcare Applications." Paper presented at the IAEA/RCA Workshop on Radiation Processing of Natural Polymers, Mumbai, India, 2 – 7 November 2003.  |
| <b>Lapade, Avelina G.</b> "Status of Mutation Breeding in Root Crops in the Philippines". Paper presented during the 2003 FNCA Workshop on Mutation Breeding. Manila Southwoods Manor Hotel, Philippines, 22 – 26 September 2003.   |
| <b>Lapade, Avelina G and Apolinar B. Asencion.</b> "Status Report on the FNCA Multilateral Research Programme (MRP-1) on Drought Tolerance of Soybean, <i>Glycine max L</i> ". Paper presented during the 2003 FNCA Workshop on Mutation Breeding. Manila Southwoods Manor Hotel, The Philippines, 22 – 26 September 2003.  |
| <b>Leopando, Linda L.</b> "QC and Accreditation in Radioisotope Applications in Philippines Industries". Philippine Country Report presented during the Expert's Group Meeting on Quality Control and Accreditation in Radioisotope Applications in Industries, 27 – 30 October 2003, Bangkok, Thailand.  |
| <b>Loterina, Roel, A.</b> "Radiological and the Other Safety Aspects in the Operations of Electron Beam Facility". Technical paper presented to the Faculty of Science and Technology of Univesristi Kebangsaan Malaysia in accordance with the requirement of the Post-Graduate Diploma Course in Radiation Protection, Malaysia, 7 January 2003.  |
| <b>Natera, Erlinda S.</b> "Reference Man: Dietary Elemental Intake of Filipinos". Paper presented during the Convention of the Philippine Association of Occupational Medicine". EDSA Shangrila, Mandaluyong City, Philippines, 21 April 2003.  |
| <b>Obra, Glenda B.</b> "Efficacy of Irradiation as a Quarantine Treatment". Paper presented during the Food Irradiation Seminar for Plant Quarantine Officers., PNRI, Dilman, Quezon City, November 27, 2003.   |
| <b>Parami, Vangeline K., Carl M. Nohay et al.</b> "Some Aspects of Ensuring Safe Transport of Radioactive Material". Paper presented during the International Conference on the Safety of Transport of Radioactive Material, Vienna Austria, 7 – 11 July 2003.  |
| <b>Relunia, Estrella D.</b> "Activities of Radiation and Nuclear Knowledge Dissemination at the Philippine Nuclear Research Institute". Paper presented during the International Seminar on Nuclear Safety: Course on Dissemination of Nuclear Knowledge. Tokai Japan, 3-7 March 2003.  |
| <b>Resilva, Sotero S. and Glenda B. Obra.</b> "Development of Quality Control Procedures for Mass Produced and Released Oriental Fruit Flies, <i>Bactrocera philippinensis</i> for SIT Programmes, I. Measuring, Monitoring and Improving the Quality of Mass-reared Fruit Flies. Paper presented at the Third Research Coordination Meeting of the CRP on "Quality Assurance in Mass-reared and Released Fruit Flies for Use in SIT Programmes". Perth, Australia, 19 – 23 May 2003. |
| <b>Sombrito, Elvira Z., Adelina M. Bulos, Richard Balog, Crispina M. Rosales, Faye G. Rivera and Efren J. Sta. Maria.</b> "Application of Cs-137 Tracer Techniques in Soil Redistribution Studies in the Philippines". Presented during the IAEA/RCA 5/039 Midterm Review Meeting on Restoration of Soil Fertility and Sustenance of Agricultural Productivity, Part 2. Measuring Soil Erosion/Sedimentation Associated Pesticide Contamination". 2003.                               |
| <b>Venida, Luzviminda L.</b> "An Assessment of the Environmental Impacts of Liquid and Gaseous Discharges in the Philippines". Country report presented during the IAEA/RCA Regional Training Workshop on Environmental Impact and Assessment Modelling". Kuala Lumpur, Malaysia, 13 – 17 October 2003.   |

**TABLE 11. LIST OF TECHNICAL POSTER PRESENTATIONS**

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| <b>Abad, Lucille V., Lorna S. Relleve, Charito. T. Aranilla, and Alumanda M. De la Rosa.</b> "Properties of Radiation Synthesized Water Soluble Polymer-Carrageenan Hydrogels and their Applications". Poster presented during the 5 <sup>th</sup> Gel Symposium, Polymer Gels: Fundamentals and Nano-Fabrications, Kashiwa Campus, University of Tokyo, Japan, 18 November 2003.      |
| <b>Reyes, Rolando Y., Christina A. Petrache, E. U. Tabora, S.P. Intoy, T.Y. Gracia and A. Q. Nato, Jr.</b> "Gamma Ray Surveys for Geologic Studies and Environmental Monitoring: Experiences at the Philippine Nuclear Research Institute. Poster presented during the 25 <sup>th</sup> Annual Scientific Meeting of the National Academy of Science and Technology, 9 – 10 July 2003. |
| <b>Palattao, Maria Visitacion B., and Luzviminda L. Venida.</b> "Siting of a Near – Surface Radioactive Waste Repository in the Philippines". Technical poster presented during the 31 <sup>st</sup> Atomic Energy Week (AEW) celebration, PNRI, Diliman, Quezon City, Philippines, 8 – 12 December 2003.  |
| <b>Lapade, Avelina G.</b> "Mutation Breeding in Fruit Trees: Mangosteen and Cashew". Technical poster presented during the 31 <sup>st</sup> Atomic Energy Week (AEW) celebration, PNRI, Diliman, Quezon City, Philippines, 8 – 12 December 2003.   |
| <b>Palattao, Maria Visitacion B. and Luzviminda L. Venida.</b> "Siting of Near-Surface Radioactive Waste Repository in the Philippines". Technical poster exhibited during the 31 <sup>st</sup> Atomic Energy Week Celebration, PNRI, Diliman, Quezon City, Philippines, 8 – 12 December 2003.   |

**LIST OF ABBREVIATIONS**

|  |  |
|--|--|
| AUSAID ..... Australian Aid                                  | ICTP ..... International Center for Theoretical Physics  |
| CSAP ..... Council for Strategic Cooperation in Asia Pacific | KOICA ..... Korean International Cooperation Agency  |
| CTBTO ..... Comprehensive Test Ban Treaty Organization       | MEXT ..... Ministry of Education, Culture, Sports and Science and Technology, Japan  |
| DOST ..... Department of Science and Technology              | NSRA ..... Nuclear Safety Research Association   |
| EBP ..... Extrabudgetary Programme                           | RADA ..... Radiation Application Development Association   |
| FAO ..... Food and Agriculture Organization                  | RCA ..... Regional Co-operation Agreement for Research and Development and Training Related to Nuclear Science and Technology for Asia and the Pacific |
| FNCA ..... Forum for Nuclear Cooperation in Asia             |  |
| IMO ..... International Maritime Organization                |  |
| IAEA ..... International Atomic Energy Agency                |  |
| INIS ..... International Nuclear Information System          |  |

# pnri officials & organization



## Annual 2003 Report



Top Photo: Dr. Alumanda M. dela Rosa

Middle Photo (L-R): Edilberto A. Cabalfin, Graceta D.L. Cuevas and Eulinia M. Valdezco

Bottom Photo (L-R): Virginia S. Calix and Flora L. Santos

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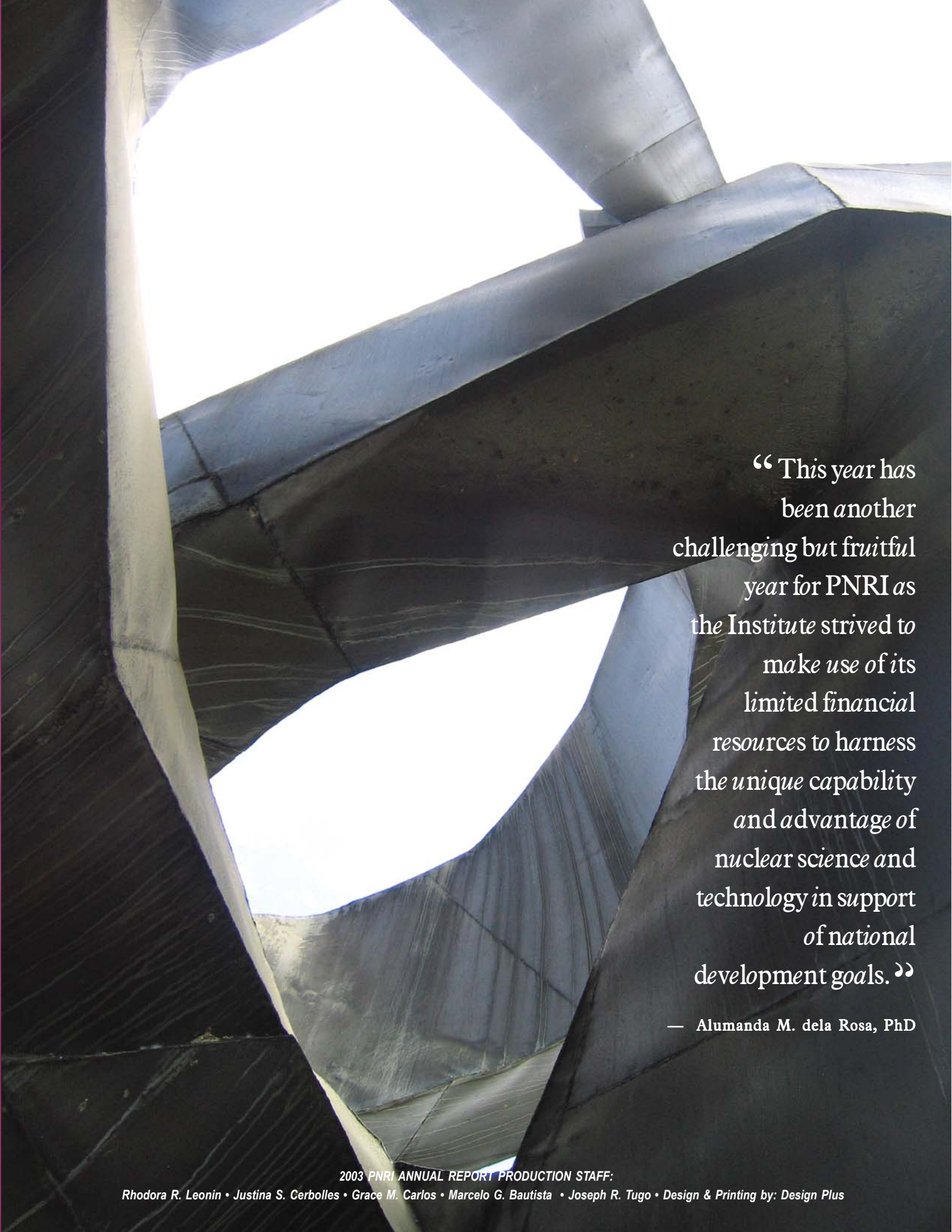
*FINANCE & PROPERTY SECTION • Budget Unit • Accounting Unit • Cash Unit •  
Property and Procurement Unit • PERSONNEL SERVICES SECTION • Personnel Unit •  
Records and Communications Unit • Medical Unit • GENERAL SERVICES SECTION •  
Plant Services Unit • Motorpool Unit*

\* Served January 1-May 31, 2003

\*\* Served September 1 - November 30, 2003 / December 17-31, 2003

\*\*\* Served June 1-August 31, 2003 / December 1 - 16, 2003





“This year has  
been another  
challenging but fruitful  
year for PNRI as  
the Institute strived to  
make use of its  
limited financial  
resources to harness  
the unique capability  
and advantage of  
nuclear science and  
technology in support  
of national  
development goals.”

— Alumanda M. dela Rosa, PhD

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