

Annual Report 2002



DEPARTMENT OF SCIENCE & TECHNOLOGY
PHILIPPINE NUCLEAR RESEARCH INSTITUTE



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Message

There is much pressure for government to address the myriad of concerns and problems besetting the Philippines. The alleviation of poverty and the reduction of pressures in the environment remain as primary thrusts of government because of the ramifications implied by such thrusts. As an agency of government, the Philippine Nuclear Research Institute engages in activities supportive of these thrusts.

Again, we take stock of the year just past, to see how well the Philippine Nuclear Research Institute progressed in its avowed role to contribute to national development and from there determine how to chart our course to avoid the pitfalls and reach higher heights of effectiveness and efficiency.

I am pleased to note the progress we have made in the national nuclear science and technology program as seen in the 2002 PNRI Annual Report. May the achievements we have realized encourage us to consciously and carefully plan our intervention and development programs and thus continue to be valuable contributors to Philippine development.



ALUMANDA M. DELA ROSA, PhD
Acting Director

This brass sculpture of Eduardo Castrillo inside the PNRI compound is titled 'Humane Growth of Nuclear Science'. It epitomizes the commitment of the Filipino nuclear scientist to the task of utilizing the energy from the atom for peaceful applications in agriculture, industry, medicine and public health.

A gloved hand holds a test tube containing a small green plant growing in a liquid medium. The background is a blurred laboratory setting with various equipment and containers.

Nuclear Research & Development

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

Food & Agriculture



Tissue culture technique is being used as a tool in PNRI's mutation breeding studies for micropropagation and mass propagation of irradiated crops.

MUTATION BREEDING

The PNRI continued to use gamma radiation combined with tissue culture technique and aided with molecular techniques to develop new crop varieties with improved characteristics.

Rice >> This year, two mutant lines were obtained when the improved radiation-induced Bengawan mutant was crossed with several varieties. These selections were as high-yielding as IR 54 rice variety. On the other hand, the radiation-induced Denorado mutant was crossed with Azmil, Azucena, Jasmin, Basmati and Denorado varieties to determine if its desirable characteristics can be easily transmitted. The Denorado mutant has short, stiff and strong straws. It has very early maturity and has about seven strong tillers which is ideal for the development of a new desirable plant type capable of yielding 25 to 30 percent more.



The Denorado rice mutant is a good source of genes for development of new plant type.

Mungbean and Peanuts >> Studies to determine the effects of different doses of gamma radiation in mungbean (PSB Mg1) and in two varieties of peanuts (NSIC Pn 8 and Pn 10) were conducted by PNRI in an experimental site at the Bulacan Agricultural State College in San Ildefonso, Bulacan. Initial results of the study indicated a significant difference in the

plant yield per plot, percent germination and percent survival of the plants exposed to varying radiation doses. The harvested seeds will be used for the second generation planting.

Soybean >> A project on the use of gamma radiation to improve soybean varieties, particularly those that are drought tolerant, was started at PNRI. This study is part of the multilateral research program under the Forum for Nuclear Cooperation in Asia (FNCA). Initial research activities focused on the irradiation of four soybean varieties (namely, PSB-Sy 4, PSB-Sy 5, BPI -Sy 4 and NSIC Sy 8). Soybean varieties sent by Vietnamese counterparts in the program will also be studied at PNRI to develop drought tolerant mutants.



PNRI uses gamma radiation to improve varieties of crops such as soybean.

Ornamentals and Cutflovers >> Mutation breeding studies in foliage ornamentals had resulted in the development of dwarf mutants in *Murraya exotica* and chlorophyll mutants in *Dracaena sanderiana*. These mutants namely, *Murraya 'Ibarra Santos'* and *Dracaena 'Marea'*, were registered with the National Seed Industry Council of the Department of Agriculture as improved varieties.

This year, 406 dwarf *Murraya* mutants were propagated at PNRI and 68 of these were sold to clients. Around 180 chlorophyll mutants of *Dracaena 'Marea'* were also propagated. One hundred of these mutants were given to an ornamental grower for large-scale mass production. Research studies using gamma irradiation, coupled with tissue culture technique, were likewise continued to improve the characteristics of chrysanthemum and orchids (*Dendrobium Pattaya beauty*, *Vanda sp.*).



The dwarf mutant of *Murraya exotica*



The chlorophyll mutant of *Dracaena sanderiana*

SCREENING OF RADIATION-INDUCED VARIANTS OF FOLIAGE PLANTS

In previous years, the PNRI Health Physics Research Group had produced a user-friendly computer database through the AFLP-Polymerase Chain Reaction technique. This database contains information on DNA markers and graphic description of radiation-induced stable plant mutants developed by the Institute's Agricultural Research Group. This year, the database was expanded to include five rice mutants and two ornamental mutants. The PNRI-developed database can serve as ❶ resource material for plant growers and commercial plant breeders and exporters, ❷ catalogue for selection of desired plant varieties intended for mass propagation, and ❸ supporting document in the registration of variants with the Department of Agriculture.

FOOD IRRADIATION

The use of gamma radiation to improve the quality and prolong the shelf-life of several food and agricultural products is a continuing research project of the PNRI. Under this project, PNRI biomedical researchers have effectively used the irradiation process to extend the shelf-life and improve the physico-chemical and sensory properties of the following tropical fruit samples: ❶ one ton of carabao mangoes, ❷ 500 kilograms of solo papayas, and ❸ one ton of Cavendish bananas. The results of the efficacy of irradiation on the three important tropical fruits will serve as basis for technical evaluation of the fruits for local and export markets.



Random sampling of irradiated and unirradiated "Carabao" mangoes for chemical and sensory evaluation.

QUANTIFICATION OF NITROGEN IN INORGANIC FERTILIZER AND NITROGEN-FIXING BACTERIA

The use of nitrogen -15 isotopic technique to determine the nitrogen-fixing ability of BIO N (an effective and cheap nitrogen fixing inoculant) and several combinations of BIO N and inorganic fertilizer in rice have been investigated by PNRI at its experimental site in Dalwangan, Malaybalay City, Bukidnon. This activity, which aims to minimize the use of inorganic fertilizers in plants, is part of the multilateral research program under the Forum for Nuclear Cooperation in Asia (FNCA) framework .

Initial results obtained from plant samples collected between panicle initiation and flowering stage of growth indicated a higher fertilizer nitrogen utilization for rice treated with a combination of BIO N and one-half of the recommended rate of inorganic fertilizer.

FERTILIZER USE EFFICIENCY IN RICE-BASED CROPPING SYSTEM

The PNRI agricultural researchers have been conducting studies on minimizing the use of inorganic (commercial) fertilizers in rice plants. In field experiments conducted at San Ildefonso in Bulacan and at Bucal, Calamba City, Laguna, the PNRI researchers applied varying combinations of inorganic fertilizer with organic ones (in the form of compost) in the soil. The amount of nitrogen uptake and the best combination of organic and inorganic fertilizers were determined using the nitrogen-15 isotopic technique. Promising results were obtained by combining compost containing 60 kilograms of nitrogen per hectare with inorganic fertilizer consisting of 30 kilograms of nitrogen per hectare. This combination is comparable to that of using 90 kg nitrogen per hectare from inorganic fertilizer alone.



A PNRI science research specialist (seated, left) determines the yield component data of rice plant samples at an experimental site in San Ildefonso, Bulacan as part of the fertilizer use efficiency studies.

CONVERSION OF SUGARCANE WASTES INTO USEFUL PRODUCTS

The PNRI continued to use gamma radiation and fermentation processes in its studies on converting sugarcane wastes like bagasse into useful products such as substrate for the production of edible mushroom (*Pleurotus sajor caju*), as biofertilizers or soil conditioners and as feed to ruminants.

Success on mushroom production was obtained on formulated sugarcane bagasse irradiated at 15 to 25 kilogray. The formulated bagasse was developed by PNRI research counterparts from the Sugar Regulatory Administration. The yield of *Pleurotus Sajor caju* was also 15 percent higher in irradiated sugarcane bagasse substrate than the autoclaved substrate. PNRI harvested about 100 grams of mushroom from a kilo of substrate with one to four flushes or fruiting per bag. Fruiting bags remained viable up to a period of one month.

PNRI researchers also conducted field experiments in Rodriguez (formerly Montalban), Rizal on the use of spent irradiated sugarcane bagasse as biofertilizer. The study is a research undertaking between the PNRI and the Montalban Ladies Association in connection with the livelihood and clean and green program of the municipality. Initial results showed improved yield of okra, peanuts and corn grown on soil applied with agrowastes.

IMPROVING DAIRY CATTLE PRODUCTION

In collaboration with the National Dairy Authority South Luzon Island Office, the PNRI continued to use radioimmunoassay (RIA), a nuclear technique, and urea molasses mineral block (UMMB), a strategic feed supplement, to help dairy cattle farmers in improving the breeding and nutritional management of dairy cattle.

Radioimmunoassay (RIA) Technique.

Radioimmunoassay was used to obtain information on the reproductive status of dairy cattle, and thus help increase the reproduction of cows through proper timing of artificial insemination. In the RIA technique, milk samples (aside from blood) are also 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.



Radioimmunoassay is used as a tool to improve dairy cattle production.

Dairy Cattle Feed Supplement.

A pilot dairy farm —PALCON Multipurpose Cooperative in Barangay Concepcion, Sariaya, Quezon — is now commercially producing the urea molasses mineral block (UMMB) supplement. PNRI, through assistance of the International Atomic Energy Agency, provided the Cooperative with a mixer for the UMMB commercial production. Seven cooperatives with an aggregate of more or less 500 dairy cattle (including calves, heifers and bulls) in southern and northern Luzon are now using UMMB as a cheaper strategic feed supplement for dairy cattle. The results of the UMMB supplementation in 13 dairy cattle are higher milk yield (326 liters per month) and improvement of reproductive performance as shown by a shorter calving to conception interval (112) in the UMMB supplemented cows. The unsupplemented group had milk yield of 261 liters per month and a longer calving to conception interval of 140 days. A total of 120 farmers and 18 extension workers were trained on basic cattle husbandry including the utilization of UMMB.

FRUIT FLY CONTROL



Fruit fly pupae contained in boxes are exposed to gamma radiation inside the cobalt-60 multipurpose irradiation facility to make them sterile.

The PNRI, in collaboration with the National Mango Research and Development Center (NMRDC), has been undertaking an island-wide integrated management program in controlling the Oriental fruit flies in Guimaras based on a nuclear technology called sterile insect technique (SIT). The SIT activities involved the mass-rearing of fruit flies at the PNRI Entomology laboratory for quality control tests and for irradiation of the mass-reared fruit fly pupae to gamma rays to make them sterile. Twenty batches of 68 boxes of 134 million sterile pupae were shipped and released in Guimaras to mate with the wild fruit fly population. Through continuous releases of the sterile fruit flies, PNRI and NMRDC hope to eventually eliminate the pest. Quality control of mass-produced fruit flies was also undertaken to monitor the behavior of fruit flies from the mass-rearing facility to the release site.

Health and Medicine

RADIATION-STERILIZED AMNIOTIC MEMBRANES AS BURN DRESSING

Forty-five patients from six hospitals benefitted from the application of 600 pieces of radiation-sterilized amniotic membranes processed by PNRI. The amniotic membranes were used as dressing for open wounds, diabetic ulcers, pressure sores and club foot surgeries. These amniotic membranes (obtained from human placentas) were collected from the Capitol Medical Center and sterilized by gamma radiation at PNRI's multipurpose irradiation facility.

RADIATION STUDIES OF CARRAGEENAN

Radiation technology has been successfully used by PNRI researchers in their studies on new applications of carrageenan. PNRI has explored the non-food uses of carrageenan by developing PVP-hydrogel dressing for burns and wounds and as visual radiation dose indicators of irradiated products.



Preparation of hydrogel from carrageenan and polyvinyl pyrrolidone (PVP)

Burns and Wounds. Through radiation crosslinking technology, PNRI researchers had successfully developed hydrogels from carrageenan and polyvinyl pyrrolidone (PVP), a water soluble polymer. For 2002, the hydrogel formulations were clinically tested on 50 patients at United Doctors Medical Center (UDMC) who had varying degrees of bedsores. Healing of the patients' bedsores was promoted with the application of the hydrogel dressing. A carrageenan-based hemostatic material was also formulated at the Institute. This has been tested on animals by Dr. Jasper Viloria of the UDMC. The results indicated that the material is comparable to commercially available oxidized regenerated cellulose.

Radiation Dose Indicators of Irradiated Products. PNRI's Chemistry Research Group has developed a low-cost carrageenan-based product that can be used to determine

visually whether a product has been irradiated or not. The indicator, also known as the Go-no-Go indicator, is about four times cheaper than the commercially available imported indicators. This visual radiation dose indicator is an important tool in the quality assurance program of radiation processing such as in food irradiation and medical products sterilization. This study won first prize in Likha Award, Health, Environment and Entertainment Category (Government Sector), National Inventors' Week held in November 2002.

HGPRT MUTATIONAL SCREENING FOR WORKERS EXPOSED TO MUTAGENIC AGENTS

The PNRI and the University of the Philippines – Philippine General Hospital (UP-PGH) Medical Oncology Section drafted a Memorandum of Agreement (MOA) on the use of the PNRI-developed HGPRT Mutation Index (MI) Assay protocol and the Autoradiographic Assay (AR) for measurement of mutation frequency in lymphocytes of workers exposed to mutagenic agents. Under the draft MOA, the PNRI will provide the expertise and laboratory space while UP-PGH will source out the project funds and the blood samples. Initial work was done to adopt the AR protocol for lymphocytes.

CYTOGENETIC ANALYSIS

The PNRI Cytogenetics Group performed the following for 20 patients referred by hospitals: ❶ monitoring, through blood sample analyses, of the occupational radiation exposures of workers; ❷ determining/confirming the presence or absence of clinical disorders such as Down's syndrome, congenital abnormalities and infertility. The Group also extended the use of their photo microscope to seven groups of students from different schools in Metro Manila.

GENE TECHNOLOGIES FOR IMPROVING CANCER MANAGEMENT

Under this project, a total of 30 patients were tested for breast cancer mutation using radioisotopic molecular techniques. Out of these, one patient was found to be positive for BRCA mutation for Exon 11. DNA sequencing analysis revealed a novel genetic change never before reported to exist. This is suspected to be a potential founder, an information by which future mutation screening protocols can base on to develop more rapid approaches for the early detection of inherited breast cancer specific for Filipinos.

RESPONSE MODULATION OF BIOLOGICAL SYSTEMS TO RADIATION

Chemical protectors of radiotherapy. Radioprotectors are a group of chemical agents that can alter the radiosensitivity of normal tissues to minimize side-effects of radiotherapy of cancer, particularly solid tumors. Three cyclooxygenase (COX)-inhibitors, namely ketorolac, celecoxib and indomethacin, were analyzed for their ability to radioprotect mouse gastrointestinal tract (GI). COX inhibitors do not have an effect on occurrence of radiation-induced programmed cell death (apoptosis) based terminal transferase FITC-labelling and anti-p53 immunolabelling techniques. However, the COX-2 selective inhibitor celecoxib significantly improved villus regeneration after three days based on the microcolony assay. This is accompanied by incise expression of cyclin D1, a cell cycle protein. The results demonstrate the potential merits of administering COX-2-inhibitors to patients to

minimize morbidities associated with GI tract damage during radiotherapy of thoracic/abdominal regions.

Liquid crystal (LC) analysis of biomembranes. Studies on liquid crystalline properties of biological membranes exposed to radiation were explored by PNRI together with the National Institute of Physics, University of the Philippines. Irradiated blood and brain biomembranes showed marked alterations in the optical and thermotropic properties in their lamellar phases. Lipids of meat (pork, chicken and beef) also showed distinct shifts in liquid crystal transition temperatures indicating a disorder in the phospholipid bilayers, possibly attributed to the “kinks” created by radiation on the fatty acid chain. These radiation-induced biophysical changes in membrane systems may be used as possible biomarkers for radiation injury as well as for developing a novel assay system for detecting irradiated meat products.

The PNRI continued to use nuclear techniques to help improve industrial processes.

Industry

TRACER AND SEALED SOURCE APPLICATION

The PNRI continued to use nuclear techniques to help improve industrial processes. This year, the institute completed two projects, namely, gamma ray scanning of an atmospheric column at the Caltex Refinery and residence time distribution (RTD) study of a simulation reactor of a biological treatment plant.

Gamma-ray Scan of Atmospheric Column. Gamma-ray column scans were carried out at the 2C-atmospheric column of Caltex Refinery to obtain baseline data of the column while operating normally. The results of the scans indicated that all trays and vapor spaces were well-defined. The top four trays had low transmission values due to the new Monel-lined shell used at this section of the column. One packed bed of the column had stagnant liquid in the upper part of the bed while the other packed beds were in good working condition.

Residence Time Distribution (RTD) Study. The PNRI's Isotope Techniques Research Group (ITRG) assisted the Department of Chemical Engineering of the University of the Philippines in obtaining the RTD curves of a simulation reactor of a biological treatment plant. With water flowing through

the reactor, approximately 74 Megabecquerel (Mbg) of Iodine-131 was injected instantaneously into the inlet of the reactor. The tracer concentration versus time in the output stream was recorded. ITRG did several tests using different flowrates. The Group analyzed the resulting RTD curves using the computer program DTSPRO Version 4.2 while some curves were also analyzed using softwares RTDO and RTD2. From the results, flow models that fit the RTD curves and the corresponding model parameters were obtained.

HIGH TECHNOLOGY MATERIALS DEVELOPMENT

Research studies on preparing magnetic materials that are of importance to the electro-mechanical, electrical, electronics and communication industries were continued. This year, the PNRI Applied Physics researchers successfully synthesized and characterized rare earth ferrimagnetic garnet and orthoferrite by the conventional ceramics technology. The electromagnetic properties were determined by Mossbauer effect. Thin films of these garnets and orthoferrites with different thicknesses were prepared on quartz and silicon wafer as substrates. Films having the

The PNRI, has been undertaking geochemical surveys to delineate potential indigenous nuclear raw materials & other associated minerals, including rare earths, in the country.

right structure were formed but their quality has to be improved further.

The researchers also studied the possibility of using the scattered peaks for thin film thickness analysis by angle dispersive TXRF (AD-TXRF) for the case of low Z (atomic number) films such as organic or polymer films and SiO_2 coatings on a high Z substrate such as metallic materials. For Mo target x-ray tube, the Compton and Rayleigh scattered peaks of the Mo characteristic lines are separated far enough to allow the intensities for each interaction to be extracted. The wide difference in the Compton and Rayleigh scattering amplitudes between low Z (strong Compton scatterer) film and high Z (strong Rayleigh scatterer) substrate can be used to distinguish between film and scattered signals. The feasibility of the method is illustrated for the case of SiO_2 layer on gold mirror.



The total x-ray fluorescence spectrometer (TXRF)

SURVEY FOR RARE EARTHS AND ASSOCIATED RADIOACTIVE MINERALS

The PNRI, through its Nuclear Materials Research Group, has been undertaking geochemical surveys to delineate potential indigenous nuclear raw materials and other associated minerals, including rare earths, in the country. As part of this project, the Group conducted a preliminary geological assessment for rare earths in Ted area, San Vicente in northern Palawan. Results of these geochemical investigations

delineated a prospective area of about 75,000 square meters. The measured reserve within this area is about 64,000 kilogram heavy minerals with an average grade of 17.20 % rare earth elements (Ce, La,) and 0.44 % thorium (Th). The average concentration of heavy minerals was approximately 400 gram heavy minerals per cubic meter.

A geochemical investigation conducted in New Canipo area revealed a prospective area of 80,000 square meters. Preparation of the heavy mineral samples and their analysis by X-ray fluorescence (XRF) are on-going.

RECOVERY OF RARE EARTH ELEMENTS AND RADIOACTIVE MINERALS FROM ALLANITE AND MONAZITE

The Nuclear Materials Research Group developed a recovery flow process (laboratory-scale) to extract rare earth elements (REE) and radioactive minerals (uranium and thorium) in the form of oxides from allanite found in beach sands from Ombo, northern Palawan. This undertaking is a three-year project funded by the Philippine Council for Advanced Science and Technology Research and Development (PCASTRD). The recovery process includes in-situ pan concentration, screening, heavy media (bromoform) separation, grinding, leaching, solvent extraction using Ionquest, precipitation and drying. The overall recovery needs further tests to optimize the extraction technology.

Environment

HARMFUL ALGAL BLOOM (RED TIDE) STUDIES

Red tide or toxic harmful algal bloom is a recurring problem in some important fishing areas in the country. Aside from the economic losses arising from the banning of shellfish in the occurrence of red tide, paralytic shellfish poisoning resulting from eating shellfish contaminated by the algal toxins (saxitoxin) is a major health concern. To assist in the management of the problem, the PNRI established two nuclear techniques: ❶ Receptor binding assay for saxitoxin and ❷ Isotopic techniques for establishing the historical profile of cyst in the area for assessing the role of sediments in triggering the bloom.

Receptor Binding Assay. The PNRI has already established the Receptor Binding Assay Laboratory, now a recognized training center in the East Asia and the Pacific region by the IAEA/RCA Member States.

Saxitoxin Labelling. The PNRI established a protocol for radiolabelling of saxitoxin (STX) and acquired the skill in purifying STX from shellfish extracts.

Lead-210 Dating Facility. Sedimentation rate in the different parts of Manila Bay was determined using lead-210 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 as Manila Bay.

POLLUTION-RELATED STUDIES

PNRI continued to monitor the major pollution sources in Metro Manila by collecting samples of airborne particulate matter in the PM₁₀ range, fractionated to coarse and fine fractions at three sites, namely: Ateneo de Manila University, Poveda Learning Centre and University of Sto. Tomas. Results of the sample analysis showed that the levels of PM₁₀ for the three stations were below the short- and long term standard set by the national government. Data from the Ateneo station indicated a decrease in lead concentrations in airborne particulate matter but increase in sulfur levels as compared to 1998 and 1999 values. Principal component analysis performed for the Ateneo de Manila University showed the contributions in the fine fraction of vehicular emissions as well as of industry and biomass burning. Large contributions of sea salt and soil are seen in the coarse fraction.

The PNRI also analyzed 55 different types of samples from coal-fired power plants as assistance to the Environmental Management Bureau (EMB) – Department of Environment and Natural Resources. The samples consisting of fly ash, bottom ash, stream sediment and raw coal from Sual, Calaca,

Masinloc and Quezon power plants were analyzed by X-ray fluorescence (XRF) spectrometer.

Initial evaluation of the partial results of the XRF analysis showed relatively low concentrations of lead (Pb), arsenic (As), selenium (Se) and other trace elements when compared with European-established values. The Philippines, however, lacks the standards of reference values for such parameters in sediments and materials. The reference standards used — the Dutch intervention values (DIVS) — are sets of values that should not be exceeded for a specific amount of material or sediment sample to cause unhealthful interference to humans and the environment.



Sampling of airborne particulate matter using Gent sampler

ISOTOPE TECHNIQUES IN WATER RESOURCE MANAGEMENT

Isotopic techniques were applied in the characterization of the groundwater systems in Davao City, now being envisioned to be the premier socio-economic and tourism growth center for the whole of Mindanao.

Benchmark hydrogeochemical and isotopic data have been established for the Davao City water resource systems. From these data, the origin of groundwater recharge has been determined and the vulnerability of the aquifer systems to pollution could be assessed. These information could provide information which can be used by decision makers and water managers as basis for delineating protection zones in the Davao City watersheds and for undertaking measures to abate degradation of drinking water quality.

PNRI also used isotopic techniques to characterize the major ion compositions and isotopic signatures of reservoir water from La Mesa Dam and groundwater in the vicinity. Initial results indicate the possibility of quantifying and understanding the mechanism of interaction between the water sources. This could be used as basis for better management of dam storage.

ESTABLISHMENT OF CTBTO INTERNATIONAL MONITORING STATIONS

As part of the Philippine commitment under the Comprehensive Nuclear Test Ban Treaty which was ratified by the Philippine Senate in 2001, the PNRI has been actively involved in the following activities: ❶ operation of the National Data Center (N137) which was established at the PNRI compound in 2001. The N137 station is linked via VSAT antenna (very small aperture terminal) to the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) in Vienna, Austria through the geo-stationary satellite hub in Fucino, Italy, ❷ upgrading of AS80 seismic station in Tagaytay. AS 80 is now a certified CTBTO station after six months of testing, and ❸ approval of the site survey report for the establishment of the Radiation Station (RN-52) at the PAGASA weather station in Tanay, Rizal, as an alternate site of the CTBTO designated site for RN-52.



The VSAT antenna at PNRI that connects the N137 station to a satellite hub in Fucino, Italy.

RADIATION ASSESSMENT FOR NATURALLY – OCCURRING THORIUM

The PNRI, through the Health Physics Research Group and the Nuclear Materials Research Group, monitored San Vicente in Palawan for the presence of thorium, a naturally-occurring radioactive material. Ambient air measurements for gamma radiation in this area indicated that thorium-232 activity is higher than the natural background radioactivity normally measured in the country. The results of this monitoring has verified a previous PNRI geochemical study for rare earth mineral deposits in the area which contain radioactive elements including thorium. PNRI has prepared a radiation map of San Vicente, northern Palawan using portable gamma spectrometer (SAM) to measure dose rates. The results of the study on thorium will also be reported to the United Nations

Scientific Commission on the Effects of Atomic Radiation (UNSCEAR) for inclusion in the global environmental radioactivity database for naturally-occurring radionuclides.

MARINE RADIOACTIVITY STUDIES

Under an IAEA Expert Contract, PNRI published a compilation of an updated marine radioactivity database for Asia-Pacific region. The compilation entitled “Asia-Pacific Marine Radioactivity Database (ASPAMARD)” consists of two volumes (Volumes 1 and 2). ASPAMARD contains a database on radionuclide concentrations in seawater, sediments and marine biota in Asia-Pacific region. The compilation includes the Philippine marine radioactivity database on cesium-137, polonium-210 and lead-210 in samples collected along coastal areas facing the South China Sea.

GAMMA RAY SPECTROMETRIC SURVEY OF THE PHILIPPINES

As part of this continuing IAEA technically-assisted project, the Nuclear Materials Research Group conducted ground gamma-ray spectrometric surveys in the Batanes group of islands, particularly Batan island. The main objective of this survey is to produce natural background radioactivity and multielement geochemical maps of the island. These maps could be used for geological/geochemical mapping as well as for environmental studies and monitoring. The multielement geochemical data obtained from this survey will be used as the Philippine model for comparative studies with other areas of the Philippines since Batanes is relatively free from industrial, commercial and residential pollution. The baseline information on natural radioactivity levels in Batanes can also be used as basis for monitoring radiation-related accidents that may occur within and outside the Philippine national territory. Batanes is only 150 to 200 kilometers from the southern tip of Taiwan where two nuclear plants are situated.



A PNRI researcher (standing) takes the location of the sampling station using the global positioning system while gamma ray measurements are going on.

This year, the following were undertaken in Batan Island:

❶ 300 gamma ray measurements in 41 data stations and in nine populated areas, ❷ regional geological mapping and collection of rock samples in some areas, and ❸ collection of 41 soil samples for trace element analysis. Preliminary result for the Batan island survey showed that the average radiation dose due to naturally-occurring radioactive elements potassium, uranium and thorium is 0.7 mSv per year. This average is below the the annual dose limit of 1 mSv that may be received by any individual as set by the International Commission on Radiological Protection (ICRP).

SOIL EROSION/SEDIMENTATION STUDIES

The PNRI, in collaboration with the Bureau of Soils and Water Management, has an on-going project on estimating soil erosion and sedimentation using cesium-137 (Cs-137), an artificially-produced radioisotope that has been introduced to soils through fallout in 1950s. Cs-137 is an efficient tracer of soil movement since it is strongly absorbed in soil clay particles and is non-exchangeable. Initial results at the study site in Bukidnon showed an average erosion rate of 4.35 tons per hectare per year while average deposition rate was 12.69 tons per hectare per year. These results will be presented to the policy makers in the locality to develop measures on prevention of further soil erosion of the area that could affect agricultural productivity and the environment.



The soil erosion study site in Bukidnon showing a deeply inclined area.

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. 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 the 14 selected cities.



Carbon-14 measurement of vinegar samples using liquid scintillation counting

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 also for distributors and producers of 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 Institute continued to use atomic and nuclear techniques for the characterization of materials. Samples from various R & D groups of the Institute as well as clients from industry, academe and other institutions requiring special materials characterization were received. The analytical services conducted were the following: ❶ non-destructive and quantitative elemental analysis by x-ray fluorescence (XRF) using radioisotope and tube-excited x-ray sources, ❷ thin film coating determination and surface analysis by total x-ray fluorescence (TXRF) and ❸ structural analysis of powdered materials by x-ray diffraction.

A close-up photograph of a person's hand, wearing a white lab coat sleeve, interacting with a control panel. The panel features several rows of red indicator lights and black toggle switches. Some switches are labeled 'OFF-ON'. A label 'SOURCE SELECTION' is visible above one of the switches. The background is a light-colored wall.

Nuclear & Allied Services

To encourage and widen the safe and peaceful uses of nuclear technology in various fields, the PNRI extends nuclear and allied services to clients from industry, business, health, government and the academe.

GAMMA IRRADIATION SERVICES

Interest in the adoption of irradiation technology took a giant leap in 2002 with an increase in the number of companies whose products were treated with gamma radiation at the PNRI's multipurpose irradiation facility (MIF). Thirteen companies availed themselves of gamma irradiation services at the MIF as compared with six companies in 2001. The volume of products irradiated increased by about 150 percent, from 97.50 cubic meters in 2001 to 241.68 cubic meters in 2002. A total of 5,202 samples were irradiated at the MIF. The products irradiated for industry included food products such as spices and frozen fruits (for microbial decontamination), medical products like empty aluminum tubes and orthopedic implants (for sterilization) and cosmetic raw materials (for microbial decontamination).

PNRI also extended gamma irradiation services to other clients through the Gammacell-220. A total of 2,520 samples were irradiated in this facility.



Boxes containing mangoes are prepared prior to irradiation.

RADIOISOTOPE PRODUCTION SERVICES

Around 2,240 patients benefited (380 for therapy and 1,860 for diagnosis) from the Iodine-131 supplied by PNRI to nuclear medicine centers and hospitals in Metro Manila. PNRI dispensed and supplied a total of 343 orders, amounting to 181,195 megabecquerels of Iodine-131 to the following hospitals: Jose Reyes Memorial Medical Center, Makati Medical Center, Metropolitan Hospital, Rizal Medical Center, University of Santo Tomas Hospital and Veterans Memorial Medical Center. Iodine-131 is a radioactive material used by doctors for diagnosis and treatment of patients with thyroid disorders.

RADIATION PROTECTION SERVICES

The PNRI, through the Radiation Protection Services (RPS), has been continuously providing the following services to authorized users of radiation and radioactive materials in medical, industrial and research institutions throughout the country: ❶ personnel monitoring of radiation exposures through the national film badge and thermoluminescent dosimetry services; ❷ calibration of radiation protection instruments used by various institutions to ensure reliability and accuracy of radiation measurements; ❸ leak testing of sealed radiation sources; ❹ collection and management of disused radiation sources; and ❺ other special services such as radiation hazards evaluation of radiation facilities. (See table below for list of services). 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.

The RPS conducted continuing studies on site investigation for a near-surface radioactive waste disposal site in collaboration with the Sub-committee on Radioactive Waste Management under the Nuclear Power Steering Committee. Site verification surveys were conducted in Coron, Palawan; Gattaran, Cagayan; and Talibon, Bohol.

RADIATION PROTECTION SERVICES • 2002

National film badge service	– 27,934 badges issued 7,491 personnel monitored
Thermoluminescent dosimetry (TLD)	– 4,957 TLDs issued 721 personnel monitored
Calibration of radiation protection instruments	– 484 instruments calibrated 185 clients served
Leak testing of sealed radioactive sources	– 262 sources 63 institutions served
Management of spent sealed sources	– 30 units 16 institutions
Management of solid wastes	– 4.93 cubic meters 9 institutions served
Management of liquid wastes	– 78.7 liters 5 institutions served
Calibration of activity meter	– 11 units 11 facilities
Audit of teletherapy facility	– 6 facilities

ENGINEERING SERVICES

The Instrumentation Unit developed a prototype survey meter to demonstrate to the users of radioactive materials in the country the PNRI's capability to produce commercially-competitive survey meters using locally-available materials. The survey meter is an instrument used for radiation detection. The unit completed 30 major and 108 minor jobs on the repair and maintenance of nuclear equipment and instruments for PNRI and non PNRI clients from the medical and industrial sectors. The Unit also refurbished the ball and mortar pulverizer of the Nuclear Materials Research Group resulting in savings of almost Php 400,000 for PNRI. The pulverizer is used in the preparation of geological samples.

The Mechanical Unit completed 42 major repair jobs consisting of general repair, overhauling and preventive maintenance of electro-mechanical devices and equipment at PNRI facilities/laboratories. In addition, the Unit completed 61 minor repair jobs. It has performed 30 major fabrication jobs of mechanical parts, tools and devices such as the 1,000 liter fruit fly diet mixer and gamma cell-220 timer.

The Unit also decommissioned the cobalt-60 teletherapy source head of Davao Medical Center.



Decommissioning of cobalt-60 teletherapy source head at Davao Medical Center.

NUCLEAR TRAINING

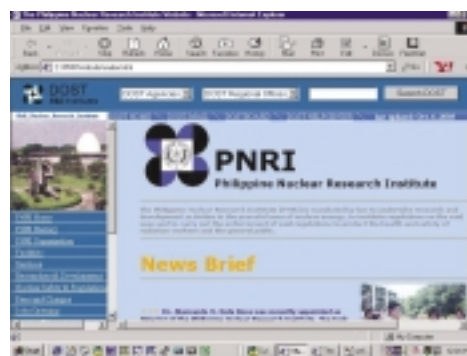
The PNRI trained a total of 348 professionals and technicians who participated in the 22 training courses in nuclear science and technology, radiation safety and nondestructive testing techniques. The participants represented 150 private and government companies and institutions. The training courses included two courses in nuclear science for high school teachers and college faculty. The NDT training courses in levels 1, 2 and 3 were conducted in cooperation with the Philippine Society for Nondestructive Testing.

As part of nuclear manpower development in the undergraduate and high school levels, 138 trainees were

given on-the-job training and thesis advisorships in the different research laboratories and facilities at PNRI. A total of 1,008 participants benefited from the 16 in-house seminars/lectures and seminars in secondary schools. These seminars aim to upgrade knowledge and information of participants in the field of nuclear science and technology.

COMPUTER SERVICES

The Computer Services Group constructed the Philippine Regional Cooperative Agreement (RCA) national homepage (www.rcaro.org). This homepage contains the activities and accomplishments/progress reports of the different RCA projects in the country. The PNRI homepage was updated and enhanced as well. The Computer Services also accomplished the following: ❶ setting-up of the local area networking (LAN) extension to the PNRI modular laboratories/facilities, ❷ development of the MS Access-based GSIS Premium master list reporting system, ❸ maintenance of existing software applications such as the payroll, payindex, library user account and sealed radiation sources inventory systems, and ❹ integration of separate personnel database and reporting programs into a single system.



The PNRI homepage.

LIBRARY SERVICES

PNRI provided library services to around 2,000 clients, mostly students from different government and private schools. One of the services provided to the clients was the CD-ROM database searches of bibliographic literature on nuclear energy and related fields. PNRI acquired 523 volumes of books and journals. Some of the acquisitions were donated by the International Atomic Energy Agency (IAEA) and the International Center for Theoretical Physics.

The PNRI submitted 33 articles/papers for inputs to the International Nuclear Information System (INIS) database. Researchers can access the INIS through the Internet

PNRI has produced a multimedia educational compact disc 'The Atom, Radiation and Radioactivity'

(<http://www.iaea.org/inisdb.htm>). As part of the promotional program of INIS products, CD-ROM disks of non-conventional literature like reports, patents, thesis and annual reports were added to the library collection from 1997 to 2002. The libraries of the University of the Philippines College of Science and UP College of Medicine availed themselves of free subscription to INIS database for on-line access.

The PNRI also participated in the DOST-SCINET project on Union Catalog on the Web. The catalog aims to facilitate search and retrieval of S & T information by providing a single entry point to all the library collections and other information within the DOST system.

INFORMATION SERVICES

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



The Atom, Radiation and Radioactivity on CD-ROM

Development of Information Materials. PNRI has produced a multimedia educational compact disc (CD-ROM) - "The Atom, Radiation and Radioactivity" - with financial assistance from the Technology Application and Promotion Institute (TAPI). The CD will serve as a learning resource material on nuclear science and technology for teachers and students from the secondary and collegiate levels. This CD also aims to promote PNRI nuclear research and development projects and services. PNRI also produced two new brochures, two technology flyers as well as exhibit materials on the applications of nuclear technology in agriculture, health and the environment. The PNRI exhibit materials were produced with financial assistance from TAPI.

Educational Tours & Seminars. PNRI information officers disseminated information on the beneficial uses of nuclear technology to around 2,000 students, teachers and other professionals through guided tours to the Institute's facilities and laboratories. In-house seminars/lectures were conducted at PNRI and in different government and private secondary schools as part of creating greater public awareness in nuclear science and technology. The Information Services Group conducted a total of ten nuclear awareness seminars which were participated in by 1,650 high school and college students and science teachers.

Participation in S & T Events and Mass Media Linkages.

The nuclear research projects and services of PNRI were also promoted this year through exhibitions in eight national, regional and school science and technology fairs. The public was informed about PNRI activities through 14 interviews of PNRI officials, project leaders and staff on seven radio stations. A total of 11 news and feature reports about PNRI projects and events and interviews of officials on nuclear energy issues were broadcasted over three television stations. PNRI media releases were also published in national broadsheets.



PNRI Acting Director Dr. Alumanda M. Dela Rosa briefs Finance Secretary Isidro Camacho and DOST Secretary Dr. Estrella F. Alabastro on the Institute's agroforestry system project which was featured during the 13th DOST S & T Fair.

Regional Cooperative Project on Public Information.

In cooperation with the Department of Education, PNRI conducted a survey among 1,200 fourth year high school students from 28 schools in the National Capital Region to determine their awareness about radiation and science concepts. This survey was a joint undertaking among eight countries under the Forum for Nuclear Cooperation in Asia, namely Australia, China, Japan, Korea, Malaysia, Thailand, the Philippines and Vietnam.



These are some of the fourth year high school students from 28 government and private schools who were selected as respondents in the survey on radiation.

A person wearing a white lab coat is using a Geiger counter. In the background, there is a yellow sign with a large red radiation warning symbol (a trefoil) and the word "CAUTION" in large red letters. The word "AREA" is partially visible at the bottom right of the sign. The title "Nuclear Safety & Regulations" is overlaid on the image in a black serif font.

Nuclear Safety & 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 the Nuclear Regulations, Licensing and Safeguards Division.

The PNRI conducts *inspection and audit* of licensed radioactive materials and facilities in the Philippines as part of its *mandated nuclear regulatory responsibilities*.

LICENSING, REVIEW AND EVALUATION

The PNRI issues licenses to institutions, firms, companies and individuals for the authority to use, own, possess, store, sell, transfer, import and export radioactive materials in the Philippines as mandated by the provision of RA 2067 and RA 5207, as amended.

This year, PNRI's Licensing, Review and Evaluation Section issued 342 licenses (249 renewals of licenses, 76 amendments of existing licenses and 17 new licenses).

The PNRI issued the first facility license to St. Luke's Medical Center for its Radioisotope Production Accelerator or Medical Cyclotron. This cyclotron is the first of its kind in the country.

Companies importing unsealed radioactive materials secured certificates of release (COR) from the PNRI prior to the release of these radioactive sources from the Bureau of Customs, PNRI issued 389 CORs to these companies.



Ceremonial issuance of the PNRI license for the first PET-Medical Cyclotron of St. Luke's Medical Center.

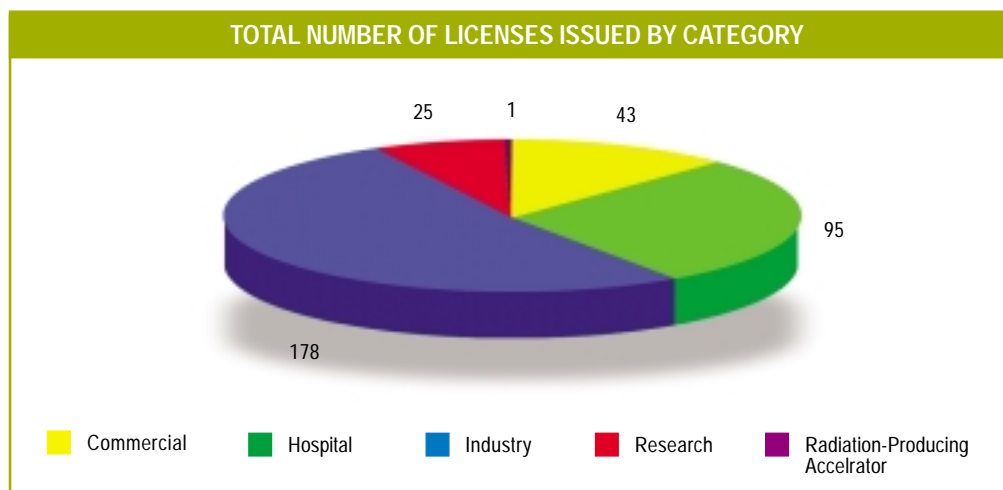
INSPECTION AND ENFORCEMENT

The PNRI conducts inspection and audit of licensed radioactive materials and facilities in the Philippines as part of its mandated nuclear regulatory responsibilities. In 2002, PNRI inspectors conducted regulatory inspections and audits of 261 licensed nuclear materials and facilities to determine compliance with PNRI rules and regulations and the conditions of the issued licenses. The PNRI inspectors reported that 75 percent of the inspected licensees complied with PNRI regulations. Twenty-five percent implemented dispositions and actions to correct the deficiencies reported by the PNRI inspectors. Twenty follow-up and two investigative inspections were conducted on the licensed facilities to verify licensee's response/actions on PNRI licensing requirements. The Inspection and Enforcement Section also issued 649 certificates of transport and release for sealed radiation sources.

STANDARDS DEVELOPMENT

To emphasize the enforcement of nuclear regulatory requirements and enhance safety in the use of radioactive materials in the country, the Standards Development Section (SDS) continued to develop and update nuclear regulations, standards, regulatory guides and bulletins. The nuclear rules and regulations are codified in the Code of PNRI Regulations (CPRs).

This year, the SDS continued to develop three proposed regulations in the CPRs. These were



CPR Part 17 (Commercial Sale and Distribution), CPR Part 21 (Radioisotope-Producing Particle Accelerators) and CPR Part 23 (Land Disposal of Radioactive Waste). Final revisions of CPR Part 3 (Standards for Protection Against Ionizing Radiation) and CPR Part 4 (Safe Transport of Radioactive Materials) were done and revisions for CPRs Part 2, Part 12 (teletherapy), Part 13 (nuclear medicine) and Part 14 (brachytherapy) were continued.

To guide PNRI licensees in complying with licensing and regulatory requirements, the SDS assembled information packages (INFOPACs) that contain the license application form, the specific part of the CPR, regulatory guide and model procedures. The group completed draft INFOPACs for three CPRs, namely, Part 18 (Research and Education), Part 19 (In-Vitro Clinical and Laboratory Tests) and Part 20 (Licenses to Manufacture and Dispense Radiopharmaceuticals). Revisions were done for INFOPACs of CPR Parts 12 and 14. The SDS also prepared and facilitated the publication of the following in the Official Gazette: (a) CPR Part 20 (Licenses to Manufacture and Dispense Radiopharmaceuticals), (b) Administrative Order No. 1, Series of 2001, "Adoption of IAEA Safety Series No. 115", and (c) Administrative Order No. 2, Series 2002, "Regulatory Fees and Charges Relative to the Licensing of a Particle Accelerator Facility for the Production of Radioisotopes."

NUCLEAR SAFEGUARDS

The Philippines, through the PNRI, carries out a comprehensive safeguards agreement with the International Atomic Energy

Agency (IAEA) on the non-proliferation of nuclear weapons. As part of this agreement, physical inventory taking of nuclear fuels at the Philippine Research Reactor - 1 and design information verification of the reactor were done by IAEA safeguards

inspectors assisted by PNRI Safeguards staff. The Safeguards Group (SG) prepared five reports on nuclear material accounting which were submitted to the IAEA. The PNRI has also availed itself of the Australian outreach program that extends assistance to ASEAN countries in signing and in ratifying the additional protocol on safeguards agreement. Australian experts conducted a seminar on safeguards agreement, the Protocol Reporter and related export control in March 2002.



Participants in the National Seminar on Illicit Trafficking of Nuclear and Radioactive Materials pose with the organizers and IAEA resource speakers.

The Safeguards Group organized a meeting with scrap/junk dealers in August and a two-day national seminar on Illicit Trafficking of Nuclear and Radioactive Materials in November. This seminar, held in cooperation with the IAEA, provided the participants with a broad picture of the illicit trafficking of nuclear and radioactive sources and increased their awareness on safety issues regarding radiation sources. SG also facilitated the briefing meeting on the IAEA Nuclear Security Plan Action. In this meeting, representatives from the Philippine government and from the ASEAN were informed of the activities of the IAEA on nuclear terrorism, particularly its nuclear security plan of action. The meeting was conducted by IAEA experts.

RADIOLOGICAL IMPACT ASSESSMENT

The PNRI's Radiological Impact Assessment (RIA) Section has undertaken several radiological impact assessment studies in support of the licensing and regulatory functions of the Institute. The RIA completed the performance audit and evaluation of laboratory fume hoods of 13 licensed medical facilities in Metro Manila. The Section has conducted the study on derivation of site specific clearance levels for specific types of medical wastes released to the environment. The PNRI-derived levels were compared with the proposed IAEA values. An assessment of the health and environmental risks involved in lost or mismanaged radioactive sources, as well as the risks in a radiopharmaceutical / dispensing facility, was also conducted. The RIA has completed studies on site verification studies and assessment of six candidate sites for a future near surface radioactive waste disposal facility. These studies were in coordination with the Inter-agency Subcommittee on Radioactive Waste Management under the Nuclear Power Steering Committee.

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 project on the Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions. As part of this project, the Philippine study team composed of the PNRI, Department of Energy, National Power Corporation, Department of Science and Technology and PAGASA improved the Energy Model of the country's electrical energy system by using real data and values on the different sources of electrical energy with nuclear power as another option. This model was developed by the project

team using the Energy and Power Development Program computer software of the IAEA. The study team also completed case studies using country specific data and information on electricity generation. In these case studies, three options were considered to mitigate greenhouse gas emissions.

RADIOLOGICAL EMERGENCY PLANNING AND PREPAREDNESS

The PNRI conducted seminars and workshops as part of the activities to implement the National Radiological Emergency Preparedness and Response Plan or RADPLAN. Five seminars and workshops on Radiological Emergency Response and Nuclear Terrorism for First Responders were conducted during the year. This was participated in by 168 personnel from local government units in the different regions of the country. Around 40 medical personnel from 23 government and private institutions in Metro Manila participated in the seminar/workshop for the Development of Capability for Medical Response to Radiological Emergencies. The PNRI's Radiological Impact Assessment Section undertook the following activities to develop capability on emergency preparedness and response: ❶ conduct of impact assessment studies and review and evaluation of PNRI response actions on accidents and emergencies, ❷ evaluation of the potential radiological impact to the country in the event of a nuclear accident from Taiwan nuclear power reactor, and ❸ establishment of derived intervention levels for local applications resulting from various exposure pathways during radiological emergencies.



PNRI Seminar on 'Radiological Emergency Response and Preparedness' for the Disaster Coordinating Council of Cordillera Administrative Region (CAR) attended by 40 participants from 26 government offices in the CAR.

*IAEA Technical Cooperation Projects (Non-PNRI) **

GAS ISOTOPE GEOCHEMISTRY FOR GEOTHERMAL RESOURCES MANAGEMENT IN THE PHILIPPINES

**PHILIPPINE NATIONAL OIL COMPANY (PNOC)
ENERGY DEVELOPMENT CENTER (EDC)**

The Philippine National Oil Company - Energy Development Corporation, in collaboration with the IAEA experts from the Institute of Geosciences and Geo-resources (IGG) Council of National Research (CNA) in Pisa, Italy, completed a technical report entitled "Origin of rare earth gases in the Palinpinon geothermal fluid as traced from isotopic and elemental compositions". This report is part of the studies being conducted by PNOC-EDC under a two-year IAEA technical cooperation project. The project generally aims to assist in determining the distribution and identifying the origin of the geothermal gases in the Philippine geothermal system, and in modelling the evolution of gaseous species in geothermal fluids during exploitation of the resource.

The report, which covers the Palinpinon phase of the research work, includes results on the following: noble gas isotope data set generated from Palinpinon, evaluation and interpretation of the data set, origin of noble gases and correlation of effects of reservoir processes with rare gas elemental composition.

EXPANDING THE CAPABILITY AND COVERAGE OF NEONATAL SCREENING PROGRAM FOR CONGENITAL HYPOTHYROIDISM IN THE PHILIPPINES

**INSTITUTE OF HUMAN GENETICS,
NATIONAL INSTITUTE OF HEALTH, UNIVERSITY OF THE PHILIPPINES**

Production of information materials as well as the conduct of advocacy and awareness campaigns on newborn screening were continued. Orientation seminars and lectures on newborn screening were conducted in various health professional associations and government and private hospitals in the country. With these activities, more hospitals and institutions have been recruited to the Newborn Screening Network.

A significant increase of almost 80 percent in the number of babies screened was achieved as of June 2002. The significant increase in the screening coverage of the regions could be attributed to the active participation and support of the Department of Health, particularly its regional units.

* The reports on IAEA Technical Cooperation projects (PNRI) are mentioned under the heading "Nuclear Research and Development". For a complete list of these projects, please see Appendices, p.30



Administrative & 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.

Personnel Administration

In the year 2002, PNR's personnel complement was 264. Out of the 264 personnel, 122 were male and 142 were female.

PNRI SERVICE AWARDS

30 YEARS

Percedita T. Cansino
 Loreto P. Galler
 Alfonso O. Grafia
 Josefina G. Natera
 Francisco S. Pancho, Jr.
 Alma S. Piñera
 Adelaida Q. del Rosario
 Bernardo S. Ventura

20 YEARS

Lucille V. Abad
 Alan M. Borrás
 Patricia Andrea V. Carillo
 Justina S. Cerbolles
 Ma. Lucia C. Cobar
 Julieta C. Mendoza
 Nelia M. Montilla
 Ma. Teresa Y. Nazarea
 Lorna Jean H. Palad
 Ma. Visitacion B. Palattao
 Crispina M. Rosales
 Cesar M. Salabit
 Merrian C. Tangonan
 Luzviminda L. Venida



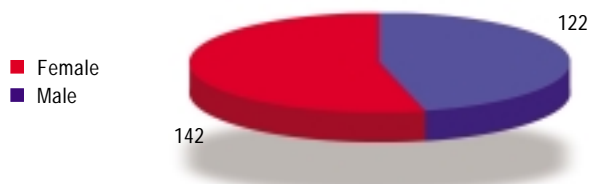
Alfonso O. Grafia, one of the 30-year service awardees, poses with Dr. Alumanda M. dela Rosa and DOST Undersecretary for R&D Rogelio A. Panlasigui



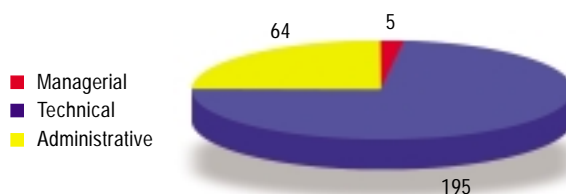
Justina S. Cerbolles, one of the 20-year service awardees.

DISTRIBUTION BY PERSONNEL

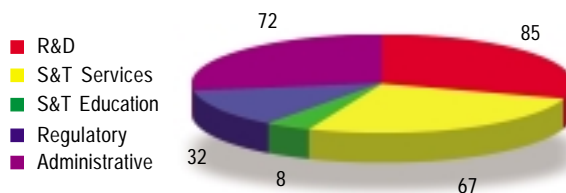
BY GENDER



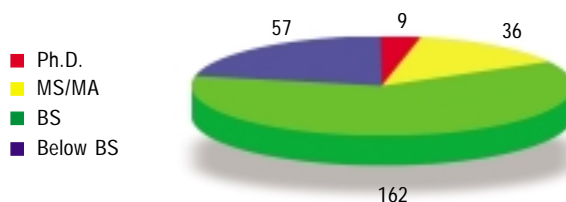
BY STAFF CATEGORY



BY STAFF ACTIVITY



BY EDUCATION



PNRI RECOGNITION AWARD

**Best PNRI Employee for 2002 and Civil Service Commission PAGASA Awardee
(Individual Category)**

Crispina M. Rosales
Senior Science Research Specialist
Atomic Research Division



Crispina M. Rosales, Best PNRI Employee for 2002, poses with PNRI Acting Director Alumanda M. dela Rosa and DOST Undersecretary for R&D Rogelio A. Panlasigui.

PNRI COMMENDATION

- For the conduct of physical inventory of PNRI properties and equipment, preparation of comprehensive inventory program for database of PNRI properties and improvement in the process of recording/monitoring of properties in the Property and Accounting Units

Catherine V. Villa
Normita C. Lim
Conrado M. De Guzman
Susan S. Pascual
Ana N. Villanueva
Bernard M. de Lara

- For helping foster improvement in health care services in Metro Manila through the collection, processing and distribution of radiation-sterilized amnion membranes to hospitals

Levelyn Mitos M. Tolentino
Luzviminda M. Ignacio
Mila A. Manalo
Edgardo E. Poblete
Zenaída M. De Guzman

- For preparation of ID for all PNRI personnel that resulted to lots of savings

Grace M. Carlos

- For successfully demonstrating the usefulness of liquid scintillation spectrometry for the detection of glacial acetic acid adulteration of vinegar and for conducting a nationwide survey, covering 14 cities of the Philippines, which established the percentage of local brands with adulterated products

Gloria R. Jimenez
Danilo A. Cuyco
Raymond D. Suggang
Rosalina V. Almoneda
Luz V. Esguerra
Soledad S. Castañeda
Flora L. Santos



- For repairing the gammacell 220 (GS 220) gamma irradiator which resulted in savings of at least Php 500,000.00

Abelardo A. Inovero
Remigio H. Sarmiento, Jr.
Jose N. Calaycay
Jay F. Nacianceno
Jerry F. Mandinguido
Ruben P. Dacoco
Oliver V. Luz
Eligio L. Abrigana
Archimedes J. Andres
Allan L. Neri
Ernesto J. Andres

- For providing solution to the long-time problem of disposal of unserviceable PNRI properties.

John M. Marquez
Danilo D. Diaz
Allan L. Flores

Finance & Administrative Division also provides administrative, financial and auxiliary services for the successful implementation of the Institute's programs.

Diosdado A. Quiambao

Javier M. Eduardo

Hilarion E. Mamaril

Evangelista L. Borromeo

Conrado M. De Guzman

Benedicto E. Marifosque

Marie Agnes T. Reyes

Emma L. Cancino

- For putting his life on the line for PNRI employees/ pedestrians crossing Commonwealth Avenue

Renato F. Fortes (*Veterans Security Agency, Inc.*)

- For the first successful decommissioning of Cobalt-60 source head of Davao Medical Center, Davao City

Erlinda N. Veracruz

Demetrio S. Salom

Ramoncito F. Sulit

Ruben P. Dacoco

Jerry F. Mandinguado

Oliver V. Luz

Jay F. Nacianceno

Eligio L. Abrigana

Allan B. Neri

Archimedes J. Andres

Ernesto J. Andres

Renato T. Bañaga



- For successful repair work on the ball and mortar pulverizer of the Nuclear Materials Research Group resulting in considerable savings of about Php 400,000.00 to the Institute.

Eduardo T. Cabildo

Randy V. Salazar

Sofronio B. Enrriquez

Erlinda N. Veracruz

Dennis C. Aquino



- For unrelenting, dedicated and committed efforts to hasten and enhance public awareness on the benefits of peaceful applications of nuclear energy, specially the programs and activities of the PNRI

Simplicio V. Bayron

Marcelo G. Bautista

Justina S. Cerbolles

Rhodora R. Leonin



S&T Linking & Networking

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

Local & International Networking

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 project 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 Comprehensive Nuclear Test Ban Treaty Organization (CTBTO), the Forum for Nuclear Cooperation in Asia (FNCA) and a host of organizations through bilateral agreements/understanding with countries such as the United States, Australia, Canada and Korea.



CTBTO Executive Secretary Wolfgang Hoffmann visited the Philippines on April 21-23 to deepen understanding of the issues involved in implementing the Comprehensive Nuclear Test Ban Treaty.



Dr. Katzuo Sato, adviser to the Japanese Nuclear Safety Research Association visited PNRI on January 14 to February 22.



The FNCA project leaders and participants of the workshop on Human Resources Development in the Nuclear Field from eight Asian countries pose with DOST Secretary Dr. Estrella F. Alabastro (seated at the middle), PNRI Acting Director Dr. Alumanda M. dela Rosa (3rd from left) and Dr. Shinya Takeuchi (seated, 3rd from left) of the Ministry of Education, Culture, Sports, Science and Technology of Japan.

Special S&T Event

The PNRI spearheaded the 30th Atomic Energy Week (AEW) Celebration on December 9–13 at the PNRI compound in Diliman, Quezon City.

The guiding theme for the 2002 celebration was “Opportunities and Challenges of Nuclear Technology for Nation Building”.

The keynote speaker for the opening ceremonies was DOST Secretary Dr. Estrella F. Alabastro.

DOST Secretary Estrella F. Alabastro delivers her keynote address during the AEW Opening Ceremonies at PNRI.

Around 7,000 visitors viewed the AEW exhibits and were given guided tours to PNRI facilities and laboratories, video showing and lecture demonstrations during the open house celebration.

*The winners of the 2002 AEW Science Quiz. 1st Place: Antonio D. Onido, Jr., Ulysses P. Edianel, Jr. (Ramon Magsaysay H.S. Manila)
2nd Place: Francis P. Gayon, Carlos Vincent E. Josue (Quezon City H.S.)
3rd Place: Arjin C. Lerit of Pedro E. Diaz H.S. and Jerome Ramirez of Muntinlupa Science H.S.*



DOST Secretary Estrella F. Alabastro, IAEA Technical Cooperation Project Officer Dr. Reyad Kamel and AEW Executive Committee chairperson Edilberto A. Caballin view the AEW Technical Exhibits.

Around 7,000 visitors viewed the AEW exhibits on the beneficial uses of nuclear technology and were given guided tours to PNRI facilities and laboratories, video showing and lecture demonstrations during the open-house celebration. The visitors also participated in the radioactive source hunting game which involved the use of radiation detection instruments. A science

The annual convention and general membership meeting of the Philippine Society for Nondestructive Testing was held during the AEW Celebration.

quiz for 4th year high school students in Metro Manila was also held on December 11. The winners of the contest were the following: First Place- Antonio D. Onido, Jr. and Ulysses P. Edianel, Jr. (Ramon Magsaysay High School); Second Place- Francis P. Gayon and Carlos Vincent E. Josue (Quezon City Science High School); and Third Place- Arjin C. Lerit (Pedro E. Diaz High School) and Jerome Ramirez (Muntinlupa Science High School).

Scientific sessions were held on December 10 to 12. The sessions were conducted in cooperation with professional organizations such as the Philippine Association for Radiation Protection (PARP) and the Radioisotope Society of the Philippines, Inc. (RSP). A technical session was also held during the 13th annual convention and general membership meeting of the Philippine Society for Nondestructive Testing (PSNT) on December 10. The resource speakers for the session at the PSNT convention

The beneficial uses of nuclear technology were highlighted during the celebration of the 30th Atomic Energy Week (AEW) on December 9 to 13 at the PNRI compound. The guiding theme for the 2002 celebration was “Opportunities and Challenges in Nuclear Technology for Nation Building”.



Dr. Reyad Kamel of IAEA, one of the resource speakers during the technical sessions.

Dr. Rogelio A. Panlasigui DOST Undersecretary for R&D delivers his message during the closing ceremonies.

Contestants on Radioactive Sources Hunting are briefed on the use of survey meter.

Students look for the radioactive source using the survey meter.

Atomic Energy Week Celebration

were James F. Porter of FILCONFAB, Inc; and Alejandro J. Mateo of PNRI's Inspection and Enforcement Group.

The speakers at the PARP session on December 10 were Dr. Agnette Peralta (Director, Bureau of Health Devices and Technology - Department of Health); and Eulinia M. Valdezco (Head of PNRI's Radiation Protection Services).

The resource speakers for the RSP session on December 12 were Soledad

Castañeda, PNRI; International Atomic Energy Agency (IAEA) Technical Cooperation Programme Officer Dr. Reyad Kamel; Dr. Fernando Sajona of the Mines and Geosciences Bureau; and Blesilda Verin of Bureau of Animal Industry.

The guest speaker for the closing ceremonies was DOST Undersecretary Rogelio A. Panlasigui.

Financial Statements

STATEMENT OF FINANCIAL OPERATIONS

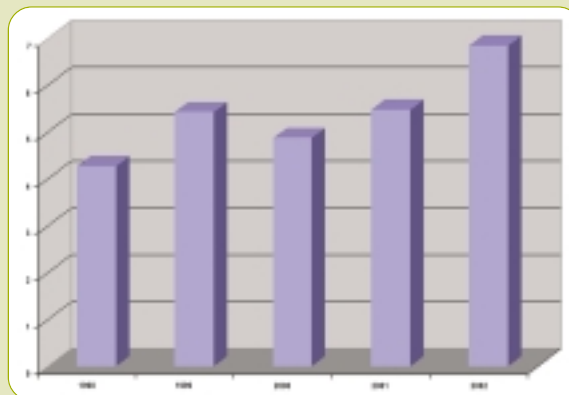
January to December 2002

	Allotment	Obligations	Savings*
General Administration and Support			
General administration and support services	29,193,485.00	29,193,485.00	—
SUBTOTAL	29,193,485.00	29,193,485.00	—
Support to Operations			
Supportive to nuclear activities	3,511,000.00	3,510,999.91	0.09
SUBTOTAL	3,511,000.00	3,510,999.91	0.09
Operations			
Nuclear Research, Technology Development and Application	29,971,000.00	29,971,000.00	—
Nuclear Services and Training	24,406,250.00	24,406,250.00	—
Nuclear Regulations, Licensing and Safeguards	12,073,000.00	12,061,313.64	11,686.36
SUBTOTAL	66,450,250.00	66,438,563.64	11,686.36
Special Allotment Release (SARO) MPBFer	1,531,938.00	1,531,938.00	—
GRAND TOTAL	100,686,718.00	100,675,031.55	11,686.45*

*Continuing Appropriations



APPROPRIATIONS



INCOME

STATEMENT OF ACTUAL INCOME

January to December 2002

Government Service

Licensing fees, etc.

Php 986,108.20

SUBTOTAL	986,108.20
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Government Business Operations

Sale of radioisotopes (Iodine-131)

604,835.00

Sale of experimental samples (white mice)

10,750.00

Sale of Phil. Nuclear Journal, Information

3,260.00

Packages (Nuclear Regulations) and
radioactive material stickers

Repair/rental of nuclear instrument

7,200.00

SUBTOTAL	626,045.00
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Others - Service Fees for

Cytogenetic Laboratory Services

Cytogenetic analysis

24,300.00

Microscopy services

1,200.00

Microbiological Tests of Food/Medical Products

77,900.00

Radioactivity Analysis

Gammametric analysis

130,425.00

Gross radioactivity (alpha and beta) analysis

125,200.00

Radiological Analysis

26,600.00

Nuclear-Based Analytical Services

Mass determination of samples

40,405.00

Liquid scintillation counting

102,815.00

X-ray fluorescence (XRF) analysis (ex. air filters)

174,778.00

X-ray diffraction (XRD) data analysis

55,425.00

Radiation Protection Services

Calibration of radiation protection instruments

261,475.00

Leak test of sealed radioactive sources

296,885.00

Smear/swipe tests for radioactive contamination

7,150.00

Monitoring of films and cassettes (film/TLD badges)

2,931,579.63

Radiation monitoring of scrap metals

3,000.00

Radioactive waste storage/disposal

113,448.00

Use of Cobalt-60 Irradiation Facility

581,610.00

Tracer and Sealed Source Applications

Flowrate analysis

190,000.00

Gamma Column Scanning

80,000.00

SUBTOTAL	5,224,195.63
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Fines and penalties

Surcharge

9,595.00

SUBTOTAL	9,595.00
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GRAND TOTAL	6,845,943.83
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Appendices

TABLE 1. IAEA RESEARCH CONTRACTS¹

RESEARCH PROJECT	CHIEF INVESTIGATOR	AGENCY
• Support for the Foot and Mouth Disease Control and Eradication Programme in the Philippines	Blesilda Verin	Phil. Animal Health Center - Bureau of Animal Industry
• Evaluation of the Practical Applicability of Methods of Analysis for Aflatoxin in Imported and Exported Philippine Foods	Luz Padilla	Food Dev't Center
• The Study of the Relationship Between Lower Respiratory Tract Infection, Gastroesophageal Reflux and Bronchial Asthma in Children in the Philippines	Jose Rondain	Makati Medical Center
• Prospective Randomized Trial for the Evaluation of the Efficacy of Low Versus High Dose of Iodine-131 for Post-Operative Remnant Ablation in Differentiated Thyroid Cancer	Emerita Barrenechea	Veterans Memorial Medical Center
• Management of Liver Cancer Using Radionuclide Methods with Special Emphasis on Early Diagnosis, Locoregional Therapy and Internal Dosimetry	Orestes Monzon	Philippine Heart Center
• Nitrate-Augmented Myocardial Perfusion Imaging for the Assessment of Myocardial Viability	Jerry Obaldo	Philippine Heart Center
• Health and Environmental Impact of Mercury	Nelia Maramba	College of Medicine, U.P.
• Comparative Evaluation of Radiopharmaceuticals for Radiosynovectomy in the Philippines	Emerita Barrenechea	St. Luke's Medical Center

TABLE 2. IAEA TECHNICAL COOPERATION PROJECTS²

RESEARCH PROJECT	COUNTERPART	AGENCY
• Human Resource Development and Nuclear Technology Support	Pilar C. Roceles	PNRI
• Neonatal Screening for Congenital Hypothyroidism	Carmencita Padilla	UP- Nat'l Institute of Health
• Establishment of a Large-Scale Gamma Irradiation Facility	Estelita G. Cabalfin	PNRI
• Isotope Hydrology Application in Water Resources Management	Soledad S. Castañeda	PNRI
• Nuclear Techniques to Study Red Tide Problems	Alumanda M. Dela Rosa	PNRI
	Rhodora Azanza	Marine Science Institute, U.P.
	Manuel Ogena	PNOC-Energy Development Center
• Gas Isotope Geochemistry for Geothermal Resources Development		

TABLE 3. GRANTS-IN-AID FROM OTHER AGENCIES

PROJECT TITLE	PROJECT LEADER (PNRI)	FUNDING AGENCY
• Advocacy Program on Food Irradiation in Mindanao	Zenaida M. De Guzman	Technology Application and Promotion Institute (TAPI)
• The Use of Cesium-137 in Estimating Soil Erosion and Sedimentation for Conservation and Sustainable Production	Crispina M. Rosales	Bureau of Soils and Water Management
• Integrated Fruit Fly Management Program in Guimaras	Glenda B. Obra	Dept. of Science and Technology (DOST)
• Radiation Processing of Carrageenan for Health Care Application	Alumanda M. Dela Rosa	Phil. Council for Advanced Science and Technology Research and Development (PCASTRD)
• Sedimentation Studies in Red Tide Using Isotope Techniques	Elvira Z. Sombrito	Phil Council for Aquatic and Marine Research and Development (PCAMRD)
• Synthesis of Tritium Labelled Saxitoxin	Elvira Z. Sombrito	PCAMRD
• Physical Protection of Radiation Facilities and Radiological Emergency	Teofilo V. Leonin, Jr.	DOST
• Fabrication of Exhibit Materials for the 2002 National S & T Week (NSTW) Technology Fair	Rhodora R. Leonin	TAPI

¹ 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 of U.S. \$5,000.00 per year.

² 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 4. EXPERTS/MISSIONS

FIELD/PURPOSE	NAME	DATE
• Nuclear Safety Research Association (NSRA) Expert Dispatch	Dr. Kazuo Sato	14 Jan – 22 Feb '02
• Measuring the Effectiveness of Multinutrient Supplementation – RCA	Dr. G.V. Iyengar and Siripone Chueinta	16 – 19 Jan '02
• First Audit Inspection QA/QC of Nuclear Analytical Techniques	Dr. Klaus Hoppstock	21 – 22 Jan '02
	Dr. Annareddy V.K. Reddy	
• Pre- Project Mission: Enhancing Agricultural Productivity in Mindanao Through Radiation Technology – IAEA	Dr. Gary Luckman	26 Jan – 2 Feb '02
• Licensing and Operation of Medical Cyclotron – NSRA Expert Dispatch	Dr. Shoji Futatsuwaka	28 Jan – 1 Feb '02
	Dr. Yoshihiro Saitoh	
• Radiation Application and Development Association (RADA)	Dr. Hideshi Yasuda	14 – 15 Feb '02
• Health Care Project Proposals –RCA	Dr. Stephen Groth	22 – 26 Feb '02
	Dr. Wiharto	
• Pre-Project Planning Mission on “Siting of a Near-Surface Radioactive Waste Disposal Facility” – IAEA	Dr. Ramesh Dayal	11 – 15 Mar '02
• National Training Workshop on Cyclotron-PET in Clinical Practice – IAEA	Mr. Homer Macapinlac	18 – 22 Mar '02
• Radiometric Dating of Sediment Cores – IAEA	Dr. John Smith	6 – 10 May '02
• Red Tide Publication – IAEA	Dr. David Kinley	25 – 29 Mar '02
• Comprehensive Nuclear Test Ban Treaty Organization (CTBTO)	Mr. Wolfgang Hoffmann	21 – 23 Apr '02
• Tritium Labelling of Saxitoxin – IAEA	Dr. Onofre De Jesus	27 – 31 May '02
• Hardware Repair of Personal Earth Station – CTBTO	Engr. Peter Maxwell	26 – 27 Jun '02
• Student Assessor Training Workshop -- RCA	Ms. Heather Patterson	15 – 17 Jul '02
• Elemex Network Consultancy	Mr. Hideaki Takeda	14 Aug '02
	Mr. Shuji Hatano	
• National Symposium on Radionuclide Therapy – RCA	Dr. Zhonyun Pan	5 – 7 Sep '02
	Dr. Jean – Luc Raoul	5 – 7 Sep '02
	Dr. Douglas Howarth	
• Backstopping Application of Cesium –137 Technique – RCA	Dr. Robert Loughran	16 – 20 Sep '02
• Dam Seepage – RCA	Dr. Paston Sidauruk	23 – 27 Sep '02
• Quality Systems and Site Inspection – RCA	Dr. James Versalovic	1 – 5 Oct '02
• Air Pollution Advisory Task – RCA	Dr. Stanislaw Plorek	7 – 11 Oct '02
• Physical Security – IAEA	Dr. Brian Dodd	4 – 5 Nov '02
	Mr. John Wheatley	
	Mr. William Meehan	
• Quality System in Veterinary Testing Laboratory – IAEA	Mr William Doughty	4 – 8 Nov '02
• Safeguards Inspection – IAEA	Ms. R. Ianiri	27 – 28 Nov '02
	Mr. R. Zaruchi	
• Mass Spectrometer Operation and Maintenance – RCA	Dr. Ishaq Sajjad	25 Nov – 6 Dec '02
• Facilitating Project Implementation – RCA	Dr. Peter Roberts	2 – 3 Dec '02
• Upstream Work as Country Officer – IAEA	Dr. Reyad Kamel	9 – 14 Dec '02
• LDR and HDR Brachytherapy (RAS/6/035)	Dr. B. Vikram	22 – 24 Oct '02

TABLE 5. PNRI HOSTINGS

FIELD	ORGANIZER	VENUE	DATE
• Regional Training Workshop on Radiation Protection in Nuclear Medicine	IAEA, PNRI	PNRI	22 – 26 Jul '02
• Regional Training Course on Nuclear Oncology	IAEA, JRRMMC, PNRI	JRRMMC	5 – 9 Aug '02

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

FIELD	NAME	AGENCY/INSTITUTE	PLACE OF FELLOWSHIP	DATE	SPONSOR
<i>On-the-Job Training</i>					
• Groundwater Hydrology	Nelson Bernal Cortes	Colombia Ministry of Mines and Energy	PNOC - Energy Development Corporation	21 Oct – 20 Dec '02	IAEA
• Nuclear Medicine	Hahmad Swalay Goolam Dustagheer	Mauritius Health Ministry	St. Luke's Medical Center	4 Nov – 3 Dec '02	IAEA
• Nuclear Medicine	Md. Haroun-or-Rashid	(Bangladesh) Bangabandhu Sheikh Mujib Medical University	National Institute of Health, U.P.	10 Mar – 27 Apr '02	IAEA
<i>Scientific Visit</i>					
• Soil Science, Irrigation and Plant Nutrition	M. Raisul Alam	Bangladesh Agricultural University	Farming Systems and Soil Resources Institute	4 – 8 Feb '02	IAEA
• Animal Production and Fisheries	Kassim Gharib Juma	(United Republic of Tanzania) Ministry of Agriculture, Livestock and Natural Resources	National Dairy Authority	7 – 18 Oct '02	IAEA
• Soil Science, Irrigation and Plant Nutrition	Yang- Ho Park	Korea National Institute of Agricultural Science and Technology	International Rice Research Institute	23 – 27 Sep '02	IAEA

TABLE 7. NON-PNRI MANPOWER DEVELOPMENT (FOREIGN)

FIELD	NAME	AGENCY	VENUE	DATE	SPONSOR
<i>On-The-Job Training</i>					
• Animal Production and Fisheries	Rolando Cuevas	National Dairy Authority	Sri Lanka	5 Feb – 4 Apr '02	IAEA
• Groundwater Hydrology	Francis Edward Bayon	PNOC- Energy Development Corporation	Italy	8 Apr – 7 Jul '02	IAEA
• Diagnosis and Molecular Characterization of Rinderpest, FMD and other Epizootics	Blesilda Verin	Phil. Animal Health Center	Austria	15 Apr – 21 Oct '02	IAEA
• Trans-Arterial Radioconjugate Therapy for Hepatocellular Carcinoma	Butch Magsombol Raymund Conlu	Philippine Heart Center – do –	France	5 May – 15 Jun '02	IAEA
• Groundwater Hydrology	Joel Diaz	Davao City Water District	Canada	3 Jun – 24 Aug '02	IAEA
• ELISA and Molecular Methods for Diagnosis	Renato Distrajo	Department of Agriculture	Kenya	1 Jul – 31 Aug '02	IAEA
• Gamma Camera and SPECT Quality Control	Emmanuel Mercado	Davao Medical Center	U.K.	26 Aug – 25 Nov '02	IAEA
• Group Fellowship on QA and Nuclear Techniques in Pesticide Residue Analysis	Bernadette Ibarra	Bureau of Plant Industry	USA	2 – 14 Sep '02	IAEA
• Isotope Hydrology for Water Resource Management	Cynthia Iblan	Manila Water Company	Austria	2 Sep – 4 Oct '02	IAEA
• Mass Spectrometry	Ramon Calasagsag Ma. Victoria Olivar	PNOC- Energy Development Corporation – do –	Pakistan	1 – 31 Oct '02	IAEA
<i>Training Course</i>					
• Introduction to QA/QC Measures in Pesticide Residue Analytical Laboratories	Merlyn Sadicon	Department of Agriculture	Malaysia	4 – 29 Mar '02	IAEA
• Delivery of Distance Learning Curriculum to Tissue Bank Operators (1 st Phase)	Ma. Corazon Dionisia Paredes	St. Luke's Medical Center	Singapore	1– 12 Apr '02	IAEA
• 7 th International Data Center Training Course	Erlinton Antonio Olaver	PHIVOLCS	Austria	4 May – 31 Aug '02	CTBTO
• Advanced Analysis of Domestic Greenhouse Gas (GHG) Mitigation Options with Consideration to Nuclear Power	Herminio Ariola Flaviana Hilario Elma Karunungan	Department of Energy	Indonesia	6 – 24 May '02	IAEA
• On-Site Inspection (OSI) Introductory Course	Ishmael Narag	PHIVOLCS	Austria	6 –10 May '02	IAEA
• Radiation Protection and Safety in Diagnostic and Interventional Radiology	Nestor Elequin Jocelyn Cuyos	Jose Reyes Memorial Center – do –	Malaysia	17 – 28 Jun '02	IAEA
• Organization and Implementation of Nuclear Regulatory Program for the Control of Radiation Sources	Monica Bacaling	Bureau of Health Devices and Technology	Indonesia	24 Jun – 5 Jul '02	IAEA
• Clinical Aspects of Brachytherapy in Uterine Cervix Cancer	Benjamin Abesamis Andres Bayona	St. Luke's Medical Center Western Visayas Medical Center	Japan	1 – 5 Jul '02	IAEA
• Group Training on Irradiation as a Critical Control Point to Ensure Microbiological Safety of Food	Almueda David	Bureau of Food and Drugs	USA	5 – 16 Aug '02	IAEA
• Assessment of Occupational Exposure Due to External Sources of Radiation (Including Seminar for Head of Dosimetry Services)	Nieva Lingatong	Bureau of Health Devices and Technology	Vietnam	28 Oct – 8 Nov '02	IAEA
• Interventional Nuclear Medicine for Nuclear Physicians	Imelda Lee Rivera Emelito Tan	Philippine Heart Center Jose Reyes Memorial Medical Center	India	11 – 15 Nov '02	IAEA
• Advanced Technique in Application of Isotopes and Radiotracer to Geothermal Reservoir Management	James Nogara Danilo Dacillo	PNOC- Energy Development Corporation	Mexico – do –	24 Nov – 7 Dec '02	IAEA
• Proficiency Testing in RT and UT of Welded Test Pieces	Faustino Busine, Jr. Sesinando Abulencia	Industrial Inspection (International) Inc. Welders Testing	Korea	9 – 13 Dec '02	IAEA

FIELD	NAME	AGENCY	VENUE	DATE	SPONSOR
Workshop/Seminar					
• Radiometric Dating/Cysts Analysis Techniques for Harmful Algal Bloom Management	Rhodora Azanza	College of Science, University of the Philippines	Thailand	7 – 10 Jan '02	IAEA
• FNCA 2002 Workshop on Radiation Oncology	Miriam Joy Calaguas Rey de los Reyes	St Luke's Medical Center Jose Reyes Memorial Medical Center	Malaysia	14 – 19 Jan '02	MEXT, Japan
• Use of Irradiation to Ensure Microbiological Safety of Food	Ma Carmen Lulu	Food Development Center	India	4 – 8 Feb '02	IAEA
• Radiation Protection in Industrial Radiography	Ernesto Relunia, Jr. Alfonso Favis	SUNTECH Technology Corporation Bureau of Health Devices and Technology	India	11 – 15 Feb '02	IAEA
• 15 th Seminar for Nuclear Administrators	Jocelyn Alvarado	Dept. of Science and Technology	Japan	12 – 20 Mar '02	MEXT, Japan
• Public Information Seminar on Nuclear Energy and Sustainable Development in Asia	Corazon Santiago Angelina Resurreccion	Dept. of Education TODAY Newspaper	Vietnam	26 – 28 Mar '02	IAEA
• Use of ¹⁵ N Technique for Identifying Management Practice for Efficient Use of Nitrogen Fertilizers in Wetland Rice Soils	Celso Bersabe	Bureau of Soils and Water Management	Malaysia	8 – 12 Apr '02	IAEA
• Application of Advanced Data Analysis Methods to Ambient Aerosol Compositional Data	Khervin Cheng Chua	Manila Observatory	New Zealand	8 – 12 Apr '02	IAEA
• Dissemination of Information on Use of Isotope in Dam Safety and Dam Sustainability	Manuel Monteverde	National Power Corporation	Korea	15 – 19 Apr '02	IAEA
• Evaluation of Breeding Bulls and Semen	Ferdinand Moneda	National Dairy Authority	Pakistan	22 – 26 Apr '02	IAEA
• Accident Management and Emergency Response for Research Reactor	Agnes Palacio	Office of Civil Defense	Korea	29 Apr – 3 May '02	IAEA
• Isotope and Geochemical Techniques for Sustainable Development of Geothermal Research	Manuel Ogena Noel Salonga	PNOC-Energy Development Corporation – do –	China	20 – 25 May '02	IAEA
• Cardiovascular Nuclear Medicine	Jerry Obaldo	Phil. Heart Center	China	27 – 31 May '02	IAEA
• Use of ¹³⁷ Cs Techniques for Establishing Soil Redistribution and its Relationship to Soil Quality Parameters	Dante Margate	Bureau of Soils and Water Management	China	3 – 9 Jun '02	IAEA
• Radionuclide Treatment of Liver Cancer	Francis Gerard Estrada Angelito Tingcungco	St. Luke's Medical Center – do –	Vietnam	9 – 13 Sep '02	IAEA
• Validation of Low-Activity and Portable Nucleonic Gauges for Optimization of Coal and Mineral Resources Recovery	Ariel Bien	Mines and Geosciences Bureau	Vietnam	16 – 20 Sep '02	IAEA
• Quality Systems Management Workshop	Florencio C. Dizon	Research Institute for Tropical Medicine	Vietnam	23 – 27 Sep '02	IAEA
• Tracer Demonstration with Particular Emphasis on Dam Safety	Manuel Monteverde	National Power Corporation	Sri Lanka	14 – 19 Oct '02	IAEA
• Isotope Use in Managing and Protecting Drinking Water (Executive Management Seminar)	Noelito Abesamis	Manila Water	Malaysia	24 – 25 Oct '02	IAEA
• Standards on Codes of Practice in Medical Radiation Dosimetry	Nieva Lingatong	Bureau of Health Devices & Technology	Austria	25 – 28 Nov '02	IAEA
• Final Workshop on Reviewing Project Results of Regional Rice Mutants Multilocation Trials	Thelma Padolina	Philippine Rice Research Institute	Vietnam	9 – 13 Dec '02	IAEA
Meeting/Scientific Visit					
• Project Coordinators' Meeting on Sustainability of Geothermal Resources and Management of Environment Through Isotopes in Africa, Asia and Latin America	Rowena Isidro Jose Seastres., Jr.	PNOC- Energy Development Corporation – do –	Kenya	4 – 8 Apr '02	IAEA

FIELD	NAME	AGENCY	VENUE	DATE	SPONSOR
• Project Coordinators Meeting on LDR and HDR Brachytherapy in Treating Cervical Cancer	Miriam Joy Calaguas	St. Luke's Medical Center	Thailand	22 – 26 Jul '02	IAEA
• Scientific Visit - Cobalt-60 Facilities	Romeo Domingo Jolan Wedingco	National Development Center	Malaysia and Thailand	21 – 29 Aug '02	IAEA
• Scientific Visit – Nuclear Power Engineering	Leodegario Pruna	Tarlac State University	Canada	13 – 26 Oct '02	IAEA
• Project Coordination and Planning Meeting on Congenital Hypothyroidism: QA and Validation	Juanita Basilio	Department of Health	China	14 – 18 Oct '02	IAEA
• Final Meeting and Executive Management Seminar on Isotope Use in Managing and Protecting Drinking Water	Joel Diaz	Davao City Water District	Malaysia	21 – 25 Oct '02	IAEA
• Expert Group Meeting on Industrial Application of Thin Layer Activation Techniques	James Porter	PHILCONFAB	China	28 – 31 Oct '02	IAEA
• 3 rd Forum for Nuclear Cooperation in Asia (FNCA) Meeting	Estrella Alabastro	Department of Science and Technology	Korea	30 – 31 Oct '02	MEXT, Japan

TABLE 8. PNRI MANPOWER DEVELOPMENT (FOREIGN)

FIELD	NAME	COUNTRY	DATE	SPONSOR
<i>On-the-Job Training</i>				
• Plant Breeding and Genetics	Ana Maria S. Veluz	Austria	4 Feb – 3 May '02	IAEA
• Programming and Implementation of Technical Cooperation Projects	Mylene M. Espinal	Austria	3 Feb – 2 Aug '02	IAEA
• Chemical Separation of Uranium and Thorium	Marilyn K. Castillo	Romania	1 – 31 Mar '02	IAEA
• Analytical Chemistry	Lorna Jean H Palad	Korea	1 Apr – 31 Jul '02	IAEA
• Industrial Pollution Studies and Non-Radioactive Effluent Disposal	Albert G. Dizon	New Zealand	8 Apr – 31 May '02	IAEA
• Regulatory and Operational Aspects of Medical Cyclotron Facilities	Teresita G. De Jesus	Australia	8 Apr – 31 May '02	IAEA
• Nutritional and Health – Related Environmental Studies	Flora L. Santos	Austria	3 Jun – 2 Aug '02	IAEA
• Groundwater Hydrology	Ma. Luz M. Ascaño	New Zealand	16 – 27 Jul '02	IAEA
• Radiation Protection	Jose N. Calaycay	Japan	30 Jul – 30 Oct '02	IAEA
• Isotope Hydrology	Soledad S. Castañeda	Austria	1 Oct '02 – 31 Mar '03	IAEA
<i>Training Course</i>				
• NDT In-Service Inspection in Petroleum Industries	Renato T. Bahaga	Korea	21 – 25 Jan '02	IAEA
• Technologies for Facility Radiation Control	Rizalina G. Osorio	Japan	4 – 15 Mar '02	IAEA
• Physical Protection of Nuclear Facilities and Materials	Sylvia S. Busine	USA	28 Apr – 16 May '02	IAEA
• Regional Workshop/Training Course on Core Management for Improved Utilization of Research Reactors	Leonardo L. Leopando	Korea	13 – 24 May '02	IAEA
• Train the Trainers Course on Nuclear Safety	Corazon C. Bernido Vangelina K. Parami Raquel E. Grijaldo Lorena A. Del Castillo	USA	3 – 28 Jun '02	IAEA
• Regulators on Organization and Implementation of National Regulatory Programme for the Control of Radiation Sources	Corazon M. Garcia	Indonesia	24 Jun – 5 Jul '02	IAEA
• Practice –Oriented Training in Quality Management of Radioactive Waste	Editha A. Marcelo Demetrio S. Salom	Malaysia	5 – 16 Aug '02	IAEA
• Radiation Protection Aspects - Radioactive Waste Management	Rosita R. Daroy Joselito M. Dela Cruz	Indonesia	5 – 16 Aug '02	IAEA
• QA/QC of Nuclear Analytical Techniques	Flora L. Santos & Luz V. Esguerra	Malaysia	12 – 16 Aug '02	IAEA
• Assessment of Occupational Exposure Due to External Sources of Radiation and Seminar for Heads of Dosimetry Services	Estrella S. Caseria	Vietnam	28 Oct – 8 Nov '02	IAEA
• Mutant Germplasm Characterization Using Molecular Markers	Alejandro Q. Nato	Austria	4 – 29 Nov '02	IAEA
• State Systems of Accounting for and Control of Nuclear Materials	Nelson P. Badinas	Japan	18 Nov – 6 Dec '02	IAEA
<i>Training Workshop</i>				
• Radiometric Dating/Cysts Analysis for Harmful Algal Bloom Management	Elvira Z. Sombrito	Thailand	7 – 10 Jan '02	IAEA
• In-Service Inspection of Research Reactors	Lopito A. Caluag	India	21 Jan – 1 Feb '02	IAEA
• FNCA Workshop on Application of Electron Accelerator	Estelita G. Cabalfin	Japan	28 Jan – 1 Feb '02	MEXT, Japan
• RCA Workshop to Review Results of the Participatory Evaluation Exercise	Nydia C. Medina	Austria	11– 15 Mar '02	IAEA

FIELD	NAME	COUNTRY	DATE	SPONSOR
• Fruit Fly Control Cooperation in the Asia - Pacific Region	Alumanda M. Dela Rosa Glenda B. Obra	Japan	18 –23 Mar '02	Ministry of Foreign Affairs, Japan
• Application of Advanced Data Analysis Methods to Ambient Aerosol Compositional Data	Luz V. Esguerra	New Zealand	8 –12 Apr '02	IAEA
• Use of N-15 Techniques for Identifying Management Practices for Efficient Use of Nitrogen Fertilizers in Wetland Rice Soils	Faye G. Rivera	Malaysia	8 – 12 Apr '02	IAEA
• Third Regional Training Workshop on Safety Analysis Methodology and Computer Code Utilization	Carl M. Nohay	Korea	22 Apr – 3 May '02	IAEA
• Accident Management and Emergency Response for Research Reactors	Graceta DL. Cuevas Flora L. Santos Ma. Visitacion B. Palattao	Korea	28 Apr – 4 May '02	IAEA
• Physical Protection and Material Security to Combat Illicit Trafficking	Edilberto A. Cabalfin Julietta E. Seguis	Indonesia	6 – 8 May '02	IAEA
• Application of Radioisotopes for Sediment Transport Studies	Efren J. Sta, Maria	India	20 –25 May '02	IAEA
• Estimation of Rumen Microbial Protein Supply from Urinary Purine Derivatives	Azucena C. de Vera	Malaysia	10 – 21 Jun '02	IAEA
• Process Optimization Using Tracers in Petrochemical Industries	Alvin L. Lagmay	Korea	2 – 11 Jul '02	IAEA
• Radiation Protection of Natural Polymers for Healthcare Applications	Alumanda M. Dela Rosa	Malaysia	22 –26 Jul '02	IAEA
• Forum for Nuclear Cooperation in Asia (FNCA) Joint Workshop on Mutation Breeding and Bio-Fertilizer	Avelina G. Lapade Apolinar B. Asencion Crispina M. Rosales	China	20 –23 Aug '02	MEXT, Japan
• Prompt Gamma Neutron Activation Analysis Applications in On-line Bulk Processing	Lourdes G. Fernandez	China	9 – 13 Sep '02	IAEA
• Validation of Low Activity and Portable Nucleonic Gauges for Optimization of Coal and Mineral Resources Recovery	Albert G. Dizon	Vietnam	16 – 20 Sep '02	IAEA
• Radiation Safety in Radioisotope Production	Louie R. del Castillo Franklin A. Pares	China	23 – 28 Sep '02	IAEA
• On Tracer Demonstration Technique in Isotope Hydrology with Particular Emphasis on Dam Safety	Silvestre L. Abaya	Sri Lanka	14 – 19 Oct '02	IAEA
• Safety Analysis Methodology and Computer Code Utilization	Carl M. Nohay	Korea	21 Oct – 1 Nov '02	IAEA
• Occupational Radiation Protection and Safety	Arlean L. Alamares Fe M. Dela Cruz	Japan	28 Oct – 1 Nov '02	IAEA
• Safety of Radiation Sources and Security of Radioactive Materials	Julietta E. Seguis	Japan	11 – 15 Nov '02	IAEA
• Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Radioactive Waste Management	Eulinia M. Valdezco Editha A. Marcelo	Korea	18 – 22 Nov '02	MEXT, Japan
• Leadership in Business Management for Nuclear Institutions	Elvira Z. Sombrito Reynaldo P. Jacinto	China	18 – 22 Nov '02	IAEA
• Radiological Emergency	Corazon C. Bernido Teofilo V. Leonin, Jr.	Australia	2– 13 Dec '02	IAEA
• Forum for Nuclear Cooperation in Asia (FNCA) 2002 Workshop on Application of Electron Accelerator	Estelita G. Cabalfin	Japan	16 – 20 Dec '02	MEXT, Japan
Seminar				
• Regional Public Information Seminar on Nuclear Energy and Sustainable Development in Asia	Rhodora R. Leonin	Vietnam	26 – 28 Mar '02	IAEA
• Int'l Seminar on Nuclear Safety: Course on Safety Analysis	Rosalino B. Rejas	Japan	30 Sep – 11 Oct '02	MEXT, RADA
• Int'l Seminar on Nuclear Safety: Course on Facility Management	Gonzalo G. Madera	Japan	11 – 22 Nov '02	MEXT, RADA
Meeting				
• Project Formulation Meeting on Harmonization of Radiation Protection	Eulinia M. Valdezco	Bangladesh	3 – 7 Feb '02	IAEA
• Project Formulation Meeting on Measuring Soil Erosion Sedimentation and Pesticide Contamination	Elvira Z. Sombrito Crispina M. Rosales	China	25 Feb – 1 Mar '02	IAEA
• FNCA Project Formulation Meeting for the Multilateral Research Program on "Drought Tolerance in Sorghum, Sugarcane and Soybean"	Avelina G. Lapade	Indonesia	25 Feb – 1 Mar '02	MEXT, Japan
• Third Coordinators' Meeting under the Forum for Nuclear Cooperation in Asia (FNCA)	Alumanda M. Dela Rosa Pilar C. Roceles	Japan	5 – 8 Mar '02	MEXT, Japan
• Final Project Coordinators' Meeting on Radiation Processing of Chitin/Chitosan	Lucille V. Abad	Thailand	18 – 20 Mar '02	IAEA
• Project Coordinators' Meeting on Enhancement of Genetic Diversity in Food, Pulses and Crops	Alfonso O. Grafia	China	18 – 22 Mar '02	IAEA

FIELD	NAME	COUNTRY	DATE	SPONSOR
• 24 th RCA Meeting of National Representatives	Alumanda M. Dela Rosa	Korea	25 – 29 Mar '02	IAEA
• Workshop and Project Formulation Meeting on Refurbishment of Nuclear Instruments (Phase II)	Eduardo T. Cabildo	Sri Lanka	15 –21 Jun '02	IAEA
• Meeting on the Techniques and Approaches to Development of Interactive Training Packages in Radiation Protection	Antonio E. Refre	Austria	22 Jul – 2 Aug '02	IAEA
• Regional Project Review Meeting and Workshop on Strategic Planning for Research Reactors	Leonardo S. Leopando	Malaysia	30 Sep – 4 Oct '02	IAEA
• Consultants' Meeting in the Framework of Project RAS/0/025: Technical Cooperation Among Developing Countries	Antonio E. Refre	Austria	7 – 11 Oct '02	IAEA
• FNCA Project Leaders' Meeting on Public Information of Nuclear Energy and the International Nuclear Conference	Edilberto A. Cabalfin	Malaysia	15 – 17 Oct '02	MEXT, Japan
• Final Project Assessment Meeting and Executive Seminar on Isotope Use in Managing and Protecting Drinking Water	Soledad S. Castañeda	Malaysia	21 – 25 Oct '02	IAEA
• Experts' Group Meeting on Thin Layer Activation Techniques	Reynaldo V. Pedregosa	China	28 – 31 Oct '02	IAEA
• Third Meeting of the Forum for Nuclear Cooperation in Asia	Alumanda M. Dela Rosa Pilar C. Roceles	Korea	30 –31 Oct '02	MEXT, Japan
• Project Committee Meeting and Conference of Project Participants and End-Users for Air Pollution Project	Flora L. Santos	China	11 – 15 Nov '02	IAEA
• Project Review and Planning Meeting on Improving Animal Productivity and Reproductive Efficiency	Celia O. Asaad	China	11 – 15 Nov '02	IAEA
• First Research Coordination Meeting for the CRP on Application of Safety Assessment Methodologies for Near-Surface Radioactive Waste Disposal Facilities	Ma. Visitacion B. Palattao	Austria	11– 15 Nov '02	IAEA
• Technical Meeting to Review Progress and Future Activities of the ExtraBudgetary Programme on the Safety of Nuclear Installations in the Southeast Asian and Far East Countries and Preparatory Meeting on the Asian Nuclear Safety Network	Alejandro J. Mateo	Austria	18 – 21 Nov '02	IAEA
• RCA Midterm Review Meeting on Restoration of Soil Fertility and Sustenance of Agricultural Productivity	Crispina M. Rosales	Thailand	18 – 22 Nov '02	IAEA
• Technical Meeting on the International Database on Discharges of Radioactive Material to the Environment	Ma. Teresa Y. Nazarea	Austria	25 –29 Nov '02	IAEA
• Project Coordinators' Meeting on Electronic Networking Outreach	Antonio E. Refre Ana Elena L. Conjares	India	2 – 6 Dec '02	IAEA
Conference/Congress				
• International Youth Nuclear Congress 2002	Custer C. Deocarís	Korea	16 – 20 Apr '02	IAEA
• 7 th Biennial South Pacific Environmental Radioactivity Association (SPERA) Conference	Emerenciana B. Duran Elvira Z. Sombrito	Australia	13- 17 May '02	SPERA
• Int'l Conference on Occupational Radiation Protection – Protecting Workers Against Exposure to Ionizing Radiation	Eulinia M. Valdezco	Switzerland	26 – 30 Aug '02	IAEA
• 46 th IAEA General Conference and 31 st RCA General Conference	Alumanda M. Dela Rosa	Austria	16 –20 Sep '02	IAEA
• International Nuclear Conference 2002 (INC '02)	Rolando Y. Reyes Custer C. Deocarís	Malaysia	15 – 18 Oct '02	INC '02 Committee
• First Asian and Oceanic Congress for Radiation Protection (AOCRP)	Eulinia M. Valdezco	Korea	20 –24 Oct '02	AOCRP – Organizing Committee
• International Conference on Wider Adherence to Strengthened IAEA Safeguards	Alumanda M. Dela Rosa	Japan	9 – 10 Dec '02	IAEA
Scientific Visit				
• Organizational and Operational Aspects of Calibration Services	Estrella S. Caseria	Korea & Austria	8 –1 9 Apr '02	IAEA
• Application of Nuclear Techniques to Address Harmful Algal Bloom Concerns	Elvira Z. Sombrito	Canada & USA	2 – 26 Jul '02	IAEA
• Near-Surface Disposal of Radioactive Waste	Ma. Visitacion B. Palattao	Australia	21 Oct – 1 Nov '02	IAEA
• Japan Society for the Promotion of Science (JSPS) Study Visit	Custer C. Deocarís	Japan	4 – 26 Nov '02	JSPS
Degree Course / Researchers Exchange Program				
• M.S. Nuclear Engineering (Monbukagakusho Scholarship)	Ryan Olivares	Japan	1 Oct '02 – 31 Mar '04	Monbukagakusho
• MEXT Nuclear Researchers Exchange Program – Environment-Friendly Polymers by Radiation Processing	Lorna S. Relleve	Japan	21 Oct – 19 Apr '02	MEXT, Japan

TABLE 9. PNRI MANPOWER DEVELOPMENT (LOCAL)

FIELD	NAME	VENUE	DATE
<i>Training Course</i>			
• Cleaner Production Assessment Training (CPAT)	Estrella D. Relunia	Dept. of Science and Technology	26 – 28 Feb '02
• National Training Course on PET-Cyclotron Applications in Medicine	Estelita G. Cabalfin, Elvira Z. Sombrito Eulinia M. Valdezco, Corazon M. Garcia Lynette B. Cayabo, Ma. Teresa A. Salabit Merrian C. Tangonan	St. Luke's Medical Center	18 – 22 Mar '02
• Basic Disaster Management Training Course	Eulinia M. Valdezco, Renato T. Bañaga	Camp Aguinaldo	23 – 27 Sep '02
• Radiographic Testing Level-2 Course	Guisappe Filam Dean, Randy Salazar Alfonso Singayen, Ramoncito Sulit	PNRI	23 Oct – 8 Nov '02
• Entrepreneurial Awareness/Appreciation Training Course	Estrella S. Caseria, Editha A. Marcelo Lopito A. Caluag	DOST	3 – 6 Dec '02
• Orientation/Training of S & T Media Service Online Content Development and Management	Rhodora R. Leonin, Justina S. Cerbolles	Science and Technology Information Institute	28 – 29 Nov '02
<i>Seminar / Workshop/Meeting</i>			
• Seminar-Workshop on Online Course Development	Estrella D. Relunia	Polytechnic University of the Philippines	24 – 25 Jan '02
• Seminar on E-Governance	Isabel M. Amiscaray, Justina S. Cerbolles	Dept. of Science and Technology (DOST)	15 Feb '02
• Seminar on the Role of Technology in Student Centered Learning	Estrella D. Relunia, Justina S. Cerbolles	DOST	8 Mar '02
• Workshop on National Program on Economically Empowering Women Through Science and Technology	Emma L. Cancino	TESDA, Taguig Metro Manila	22 Mar '02
• Seminar on E-Commerce	Graceta DL. Cuevas	National Computer Center	15 –16 Aug '02
• Regional Disaster Council IV Seminar	Teofilo V. Leonin, Jr., Erlinda S. Natera	Calamba City	15 – 17 May '02
• Stakeholder Workshop to Design an Asian Regional Air Quality Training Consortium	Flora L. Santos	Asian Devt. Bank	28 – 31 May '02
• Workshop on Gender Equity in Science and Technology (GEST)	Emma L. Cancino	National Research Council of the Phil.	27 Jun '02
• Workshop of DOH-Technical Working Group on PNS for Drinking Water	Fe M. Dela Cruz	Angat River Hydroelectric Electric Plant	4 – 5 Jul '02
• Workshop on Gender Equity in Science and Technology (GEST)	Emma L. Cancino		27 Jun '02
• Seminar on Food Safety: What is the Future of Irradiated Foods	Estelita G. Cabalfin, Zenaida M. Guzman	Los Baños, Laguna	5 Jul '02
• National Youth Commission's Workshop	Corazon C. Bernido	Calamba, Laguna	6 – 8 Nov '02
• Human Resource Planning Workshop	Nydia C. Medina	Manila Galleria	7 – 8 Nov '02
• Seminar/Workshop on Safety Culture	Corazon C. Bernido, Estelita G. Cabalfin Virginia S. Calix, Avelina G. Lapade Leonardo S. Leopando, Linda L. Leopando Teresa Y. Nazarea, Pilar C. Roceles Christina A. Petrache, Lucille V. Abad Juana S. Gregorio, Alfonso O. Grafia Rhodora R. Leonin, Juliet E. Seguis Soledad R. Del Castillo, Alma S. Pinera	PNRI	19 – 20 Nov '02
• EU-ASEAN Workshop – Export Enhancement Through the Use of Intellectual Property Rights	Virginia S. Calix	Heritage Hotel	14 – 15 Nov '02
• National Seminar on Integration of Environmental and Quality Management Systems	Virginia S. Calix	Food and Nutrition Research Institute	18 – 20 Nov '02
• Workshops on Introduction to Reactor Theory for Scientists and Engineers	Corazon C. Bernido, Renato T. Bañaga Lopito A. Caluag, Corazon M. Garcia Christina A. Petrache, Estrella D. Relunia Lynette B. Cayabo, Jocelyn L. David, Guisappe Filam Dean, Joselito M. Dela Cruz, Albert G. Dizon, Sofronio O. Enriquez, Luz V. Esguerra Michael Fernandez, Raquel, E. Grijaldo, Luvimina G. Lanuza, Gonzalo G. Madera, Carl M. Nohay Preciosa Pabroa, Reynaldo V. Pedregosa Randy Salazar, Alfonso Singayen, Ramoncito Sulit Arnold Valenzuela	PNRI	25, 27, 29 Nov '02; Dec '02
• Seminar on Commercialization of Inventions	Luvimina G. Lanuza, Lucia J. Marbella	Taft Central Exchange	22 – 23 Nov '02

FIELD	NAME	VENUE	DATE
Meeting			
• SciNET-Phil Consultative Meeting	Isabel M. Amiscaray	Science and Technology Information Institute (STII)	29 Jan '02 ; 7 Feb '02 18 Jun '02; 4 Sep '02
• National Academy of Science and Technology (NAST) Annual Meeting	Teresa Y. Nazarea, Alejandro Q. Nato, Jr. Custer C. Deocaris, Carol B. Coloma, Ana Elena L. Conjares, Isabel M. Amiscaray	Manila Hotel	7 Aug '02
• Information Systems Planners Group and Infrastructure Group Meeting	Angel B. Anden	Science and Technology Information Institute (STII)	6 – 8 Nov '02
Symposium/Forum			
• Public Sector Workers Forum for Collective Negotiation Agreement (CAN) Benefits, Issues and Challenges Towards Productivity	Victoria Fe O. Medina, Soledad R. del Castillo	Occupational Safety and Health Center	15 Aug '02
• Public Forum/Consultation on the Revised Healthcare Waste Management Manual	Eulinia M. Valdezco	National Kidney Institute	28 – 29 Nov '02
Convention/Congress/Conference			
• First PsciJourn National Congress	Justina S. Cerbolles	Los Baños, Laguna	11– 12 Apr '02
• 4 th National Conference on Public Service Workers: Partners of Government for Effective Governance	Eulinia M. Valdezco	Baguio City	8 – 11 May '02
• Samahang Pisika ng Pilipinas Physics Congress	Valerie Ann Innis	Naga City	23 – 25 Oct '02
• 8 th National Occupational Safety and Health Congress	Erlinda S. Natera	OSHS. Quezon City	23 – 24 Oct '02
• 39 th Annual Convention of the Philippine Society of Animal Science	Custer C. Deocaris	Cebu City	22 – 26 Oct '02
• 39 th Annual Convention of the Philippine Association of Food Technologists	Zenaida M. De Guzman	World Trade, Pasay City	23 Nov '02

TABLE 10. LIST OF TECHNICAL PAPERS

Papers Published

Deocaris, Custer C., Maria Cereza R. Velasco, Earl Louis Sempio, Junie B. Billones and Alejandro Q. Nato, Jr. "An Evolutionary Perspective on the Possible Involvement of Plasminogen in the Pathology of Bovine Spongiform Encephalopathy". *Phil J Vert Med Anim Sci.* (28)2: 58 – 68, 2002

Deocaris, Custer C. "Nuclear Technology in the Age of Biotechnology". In: *Proceedings of the International Nuclear Conference*, Putra World Trade Center, Kuala Lumpur, Malaysia, 15 – 18 October 2002, pp. 83 – 90.

Nato, Alejandro, Jr. Q., Shiela C. Sajise and Custer C. Deocaris. "Radioactive PTT as Part of Screening Protocol for Prospecting Radiation Workers". *Proceedings of the International Youth Nuclear Congress 2002*, Daejeon, Korea, 16 – 20 April 2002.

Reyes, Rolando Y., Christina A. Petrache, Nardo Q. Garcia, Estrellita U. Tabora, Julie G. Juson, Teofilo Y. Garcia and Alejandro Q. Nato, Jr. "The Application of Vehicle-Borne and Ground Gamma Ray Spectrometry in Environmental Radioactivity Survey and Monitoring: Examples from the Philippines". *Proceedings of the International Nuclear Conference on Environment, Waste and Safety*. Kuala Lumpur, Malaysia, INC'02, pp. 17 – 26.

Sombrito, Elvira Z. "Establishment of a National Capability for Nuclear-Based Receptor Binding Assay for Marine Biotoxins". *Proceedings of the IAEA Regional Technical Workshop on Radiometric Dating/Cysts Analysis and Receptor Binding Assay to HAB Management* (CI-RAS/8/076-9009-01), Thailand, 7 – 10 January, Chhevaporn, V and EZ Sombrito (eds).

Papers Presented

Asencion, Apolinar B., Avelina G. Lapade, Alfonso O. Grafia, Adelaida C. Barrida, Ana Maria S. Veluz and Lucia J. Marbella. "Status Report on FNCA Multilateral Research Program (MRP-1) – Mutation Breeding for Drought Tolerance in Soybean". Beijing, People's Republic of China, 20 –23 August 2002.

Bernido, Corazon C. "Country Report - Philippines". Presented during the 2002 Activities and the 4th Workshop of the Human Resources Development Project in the Forum for Nuclear Cooperation in Asia (FNCA), Japan Atomic Energy Research Institute (JAERI), 2002.

Bernido, Corazon C., Vangelina K. Parami, Raquel E. Grijaldo and Lorena A. del Castillo. "Nuclear Education, Training and Resources in the Philippines". Paper presented during the Train the Trainers Course in Nuclear Safety. Argonne National Laboratory, Argonne, Illinois, USA, 3 – 28 June 2002.

Bernido, Corazon C., Vangelina K. Parami, Raquel E. Grijaldo and Lorena A. del Castillo. "General Course on Nuclear Safety (Training to Upgrade Competency of Regulators and Operators); Training Course in Nuclear Science and Technology for University Faculty;

Seminar in Strategic Approach to Training (SAT) from Trainers from the Philippine Nuclear Research Institute (PNRI)". Papers presented during the Train the Trainers Course in Nuclear Safety. Argonne National Laboratory, Argonne, Illinois, USA, 3– 28 June 2002.

Cabalfin, Estelita G. "Utilization of Electron Accelerator in the Philippines". Paper presented at the Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Application of Electron Accelerator ". Takasaki, Japan, 27 January – 2 February 2002.

Cabalfin, Estelita G. "Status of Radiation Treatment of Liquid Samples in the Philippines". Paper presented at the Forum for Nuclear Cooperation in Asia (FNCA) 2002 Workshop on Application of Electron Accelerator for Liquid Samples. Takasaki, Japan, 16 –20 December 2002.

Castañeda, Soledad S. "Application of Environmental Isotope Techniques in the Assessment of Groundwater Recharge and Its Vulnerability to Pollution". Paper presented during the World Water Day Celebration at Hotel Rembrandt in Davao City, 18 March 2002 and during the Davao City Watershed Management Forum, 21 March 2002.

Castañeda, Soledad S., Angelito F. Ramos, Lourdes G. Fernandez, Luz M. Ascaño, Lorena Del Castillo, Elena L. Conjares, H. Mapinas, E. Calonzo, J. Diaz, and E. Regalado. "Applications of Isotope and Chemical Techniques in the Study of the Davao City Groundwater Resources". Paper presented and submitted during the Final Project Assessment Meeting for the IAEA/RCA Project on Access to Clean Drinking Water. Kuala Lumpur, Malaysia, 21– 25 October 2002.

Castañeda, Soledad S. "Application of Environmental Isotope Techniques for Improved Groundwater Resource Management and Protection". Paper presented during the Technical Sessions, Atomic Energy Week (AEW) 2002 Celebration. PNRI, Diliman, Quezon City, Philippines, December 2002.

Cohen, David D., David Garton, Edward Stelcer, Tao Wang, Steven Po Jiyoung Kim, Sung Nam Oh, Hye-Joung Shin, Mi Young Ko, Flora L. Santos, Luz V. Esguerra, Vuong thu Bac, Pham D. Hiens, Mit Uematsu. "Characterization of PM2.5 and PM10 Fine Particle Pollution in Several Asian Countries". Paper presented during the 16th International Clean Air Conference. Christchurch, New Zealand, 18 – 22 August 2002.

Deocaris, Custer C., "Prospects for Anti-Tumor Milk Development for the Dairy Industry". Presented during a Seminar at the National Dairy Authority (NDA), NDA Building, 21 March 2002.

Deocaris, Custer C., "Benefits and Dangers of the Human Genome Project". Presented during the Interscholastic Science Congress, 5th Youth Math, Science and Technology Festival. Philippine Science High School, Diliman Quezon City, 7 February 2002.

- Deocaris, Custer C., "Opportunities in Biotechnology for Nuclear Energy Development". Presented during the International Youth Congress. Daejeon, Korea, 16 – 20 April 2002.
- Deocaris, Custer C., Gavino Rommel A. Cureg and Rolando A. Camba. "Suppression of Liquid Crystalline Assembly in Canine Brain by the Rabies Virus *In Vivo*". Paper presented during the 29th Annual Convention of the Philippine Society for Biochemistry and Molecular Biology, SEARCA Auditorium, University of the Philippines, Los Banos, College Laguna, 5 – 6 December 2002.
- Deocaris, Custer C. "Rapid Detection of Radiation Treatment in Frozen Meat by Analysis of its Liquid Scintillation State". Paper presented during the 14th Annual Convention of the Philippine Association of Food Technologists (PAFT). Manila Galleria Suites, Robinson's Galleria, EDSA Mandaluyong City, Philippines, 20 – 22 November 2002.
- Deocaris, Custer C., Alejandro Q. Nato, Jr. and Apolinario D. Nazarea. "Design of a Synthetic Vaccine Against the Anthrax Toxin". Paper presented during the 39th Annual Convention of the Philippine Society of Animal Science (PSAS). Marriot Hotel, Cebu City, Philippines, 23 – 25 October 2002.
- Deocaris, Custer C., Gavino Rommel A. Cureg and Rolando A. Camba. "Liquid Crystal Characterization of Brain Lipids from Rapid Dogs". Presented during the 39th Annual Convention of the Philippine Society of Animal Science (PSAS). Marriot Hotel, Cebu City, Philippines, 23 – 25 October 2002.
- Deocaris, Custer C., Azucena C. De Vera, Teodoro D. Baluca, Celia O. Asaad and Alumanda M. Dela Rosa. "Manipulating *In Vitro* Ruminant Fermentation Using Radiolyzed Carrageenan". Presented during the 39th Annual Convention of the Philippine Society of Animal Science (PSAS). Marriot Hotel, Cebu City, Philippines, 23 – 25 October 2002.
- Garcia, Teofilo Y. "Generating Acceptability of PNRI Environmental Radioactivity Monitoring Studies at the Former Ammunition Dump Area in Clark Special Economic Zone". Paper presented in the PNRI Seminar at Barangay Village, Mabalacat, Pampanga, November 2002.
- Grafia, Alfonso O. "Current Status of Food Pulses and Oil Crops Research Using Induced" Mutations in the Philippines". Paper presented in the IAEA/RAS/5/040 Project Formulation Meeting. Beijing, People's Republic of China, 18 – 22 March 2002.
- Milare, Jean M., Gavino Rommel Cureg, Benelyn D. Dumelod, Zenaida Domingo, Ma. Edlyn Ambas and Custer C. Deocaris. "Thermotropic Behavior of Lipids Extracted from Irradiated Pork Meat". Paper presented during the 39th Annual Convention of the Philippine Society of Animal Science (PSAS). Marriot Hotel, Cebu City, Philippines, 23 – 25 October 2002.
- Nato, Alejandro, Jr. Q., and Custer C. Deocaris. "Radioactive PTT as Part of Screening Protocol for Prospecting Radiation Workers". Paper presented during the International Youth Nuclear Congress, Daejeon, Korea, 16 – 20 April 2002.
- Nato, Alejandro, Jr. Q., Shiela C. Sajise and Custer C. Deocaris. "Bayesian Probability Modeling for BRCA1 Mutation Among Early-Onset and Familial Filipino Breast Cancer Cases". Presented during the 29th PSBMB Annual Convention, SEARCA Auditorium, U.P. Los Banos, College, Laguna, Philippines. 5 – 6 December 2002.
- Nazarea, Teresa Y., Alejandro Q. Nato, Jr. and Carol B. Coloma. "AFLP-based Characterization of Ornamental Crops and Foliage Plants with their Relation-Induced Variants". Short presentation during the FAO/IAEA Interregional Training Course on Mutant Germplasm Characterization Using Markers I". FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf, Austria, 4 – 29 November 2002.
- Obra, Glenda B., Sotero S. Resilva, Alumanda M. Dela Rosa, S.A. Covacha, H.G. Bignayan, N.F. Zamora, E.G. Gaitan and H.G. Golez. "Integrated Fruit Fly Management Program in Guimaras Island". Paper presented during the Workshop on Fruit Fly Control Cooperation in the Asia-Pacific Region, Japan International Convention Center, Okinawa, Japan, 18 – 23 March 2002.
- Palattao, Maria Visitacion B. "Siting of a Near-Surface Radioactive Waste Repository in the Philippines". Paper presented - International Project on Application of Safety Assessment Methodologies for Near-Surface Radioactive Waste Disposal Facilities (ASAM). IAEA, Vienna Austria, 11– 15 November 2002.
- Reyes, Rolando Y., Christina A. Petrache, Nardo Q. Garcia, Estrellita U. Tabora, Julie G. Juson, Teofilo Y. Garcia, and Alejandro Q. Nato, Jr. "The Application of Vehicle-Borne and Ground Gamma Ray Spectrometry in Environmental Radioactivity Survey and Monitoring: Examples from the Philippines". Paper presented at the International Nuclear Conference 2002, Putra World Trade Center, Kuala Lumpur, Malaysia, 14 – 18 October 2002.
- Reyes, Rolando Y. "Gamma Ray Spectrometric Surveys of Marinduque Island and the San Antonio Porphyry Copper Deposit, Marinduque, Luzon, Philippines". Paper presented at the 4th Regional and National S & T Fora and Competitions in Industry and Energy Research and Development. Philippine Council for Industry and Energy Research and Development, Department of Science and Technology, Bicutan, Taguig, Metro Manila, 4 – 5 March 2002.
- Rosales, Crispina M. "Measuring Soil Erosion/Sedimentation and Pesticide Contamination (Part 2). Paper presented during the Project Formulation Meeting on Restoration of Soil Fertility and Sustenance of Agricultural Productivity (RAS/5/035)". Beijing, People's Republic of China, 25 February to 1 March 2002.
- Santos, Flora L., Luz V. Esguerra, Corazon Preciosa Pabroa, Katheryn S. Mandap, Annalie Berganos and Rose V. Almoneda. "Metro Manila Pollution Characterization and Source Identification - Updates". Paper presented during the Project Coordination Meeting, RCA/IAEA Subproject on Isotope and Related Techniques to Assess Air Pollution. Beijing, People's Republic of China, 11– 13 November 2002.
- Sombrito, Elvira Z., Adelina M. Bulos, E.F. Furio, E. Sta. Maria and M. Honrado. "Historical Record of Harmful Algal Bloom Occurrence Using ²¹⁰Pb-derived Sedimentation Rate". Paper presented during the 7th South Pacific Environmental Radioactivity Association Conference. Sydney, Australia, 13 – 17 May 2002.

TABLE 11. LIST OF TECHNICAL POSTER PRESENTATIONS

- Lanuza, Luvimina G., Haydee M. Solomon, Aurelio L. Maningas, Gonzalo G. Madera Jr., Franklin A. Pares, Francisco S. Pancho Jr., Geoffrey O. Tranquilan, Amaldo R. Valenzuela. "Let's Gamma Together". Technical poster presented during the 2002 Atomic Energy Week (AEW) celebration, PNRI, Diliman, Quezon City, Philippines, 9 – 13 December 2002. (Second Prize, Technical Poster Contest, 2002 AEW Celebration, PNRI, Diliman, Quezon City).
- Osorio, Rizalina G., Ma. Teresa A. Salabit and Ma. Teresa L. Borrás. "Clinical Applications of Iodine-131, Making a Difference". Technical poster presented during the 2002 Atomic Energy Week (AEW) celebration, PNRI, Diliman, Quezon City, Philippines, 9 – 13 December 2002. (Third Prize, Technical Poster Contest, 2002 AEW Celebration, PNRI, Diliman, Quezon City).
- Obra, Glenda B. and Sotero S. Resilva. "Mass Production and Irradiation of Sterile Oriental Fruit Fly". Technical poster presented during the 2002 Atomic Energy Week celebration, PNRI, Diliman, Quezon City, Philippines, 9 – 13 December 2002. (First Prize, Technical Poster Contest, 2002 Atomic Energy Week Celebration, PNRI, Diliman, Quezon City).
- Palattao, Maria Visitacion B. "Siting of a Near-Surface Radioactive Waste Repository in the Philippines". Technical poster presented in the IAEA First Research Coordinators' Meeting on Application of Safety Assessment Methodologies". Vienna, Austria 11 – 15 November 2002.
- Sajise, Sheila C., Alejandro Q. Nato, Jr., Custer C. Deocaris and Cynthia P. Saloma. "Mutation Screening in Exon 15 of the Adenomatous Polyposis coli (APC) Gene in Filipino FAP Patients". Technical poster presented during the 4th HUGO Pacific Meeting and 5th Asia-Pacific Conference on Human Genetics, Chonburi, Thailand, 1 – 30 October 2002.
- Sajise, Sheila C., Alejandro Q. Nato, Jr., Custer C. Deocaris and Cynthia P. Saloma. "Mutation in Codon 1309 and Early-Onset of Colorectal Cancer in Two Filipinos with FAP". Technical poster presented during the 4th HUGO Pacific Meeting and 5th Asia-Pacific Conference on Human Genetics, Chonburi, Thailand, 1 – 30 October 2002.

LIST OF ABBREVIATIONS

CTBTO – Comprehensive Nuclear Test Ban Treaty Organization	INIS – International Nuclear Information System
DOST – Department of Science and Technology	MEXT – Ministry of Education, Culture, Sports and Science and Technology, Japan
FAO – Food and Agriculture Organization	NSRA – Nuclear Safety Research Association
FNCA – Forum for Nuclear Cooperation in Asia	RADA – Radiation Application Development Association
IAEA – International Atomic Energy Agency	RCA – Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific

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ATOMIC RESEARCH DIVISION • *Agricultural Research • Biomedical Research • Health Physics Research • Applied Physics • Chemistry Research • Analytical Measurements Research • Isotope Techniques Research • Nuclear Materials Research*

NUCLEAR SERVICES AND TRAINING DIVISION • *Reactor Operations • Engineering Services • Irradiation Services • Nuclear Training • Computer Services • Radiation Protection Services • Information Services • Library Services*

NUCLEAR REGULATIONS, LICENSING AND SAFEGUARDS DIVISION • *Standards Development • Inspection and Enforcement • Licensing, Review and Evaluation • Safeguards • Radiological Impact Assessment*

FINANCE AND ADMINISTRATIVE DIVISION • 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 Jan. 02 - April 30, 2002 / Sept. 02 - Dec. 31, 2002


** Served June 10 - Aug. 30, 2002

*** Served Jan. 02 - Nov. 25, 2002

**** Served Nov. 18 - 22, 2002 / Dec. 01 - 31, 2002

philippine nuclear research institute — department of science and technology





“There is much pressure for government to address the myriad of concerns and problems besetting the Philippines. The alleviation of poverty and the reduction of pressures in the environment remain as primary thrusts of government because of the ramifications implied by such thrusts. As an agency of government, the Philippine Nuclear Research Institute engages in activities supportive of these thrusts.”

— Alumanda M. dela Rosa, PhD

Brig. Gen. FLORENCIO A. MEDINA
(1905-1990)
“Father of Atomic Energy in the Philippines”

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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 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.

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"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 ANNUAL REPORT 2002

- 2 ■ Nuclear Research & Development
- 12 ■ Nuclear & Allied Services

- 16 ■ Nuclear Safety & Regulations
- 20 ■ Administrative & Support Services
- 24 ■ S&T Linking & Networking

- 26 ■ Special S&T Event
- 30 ■ Appendices
- 40 ■ PNRI Officials & Organization

