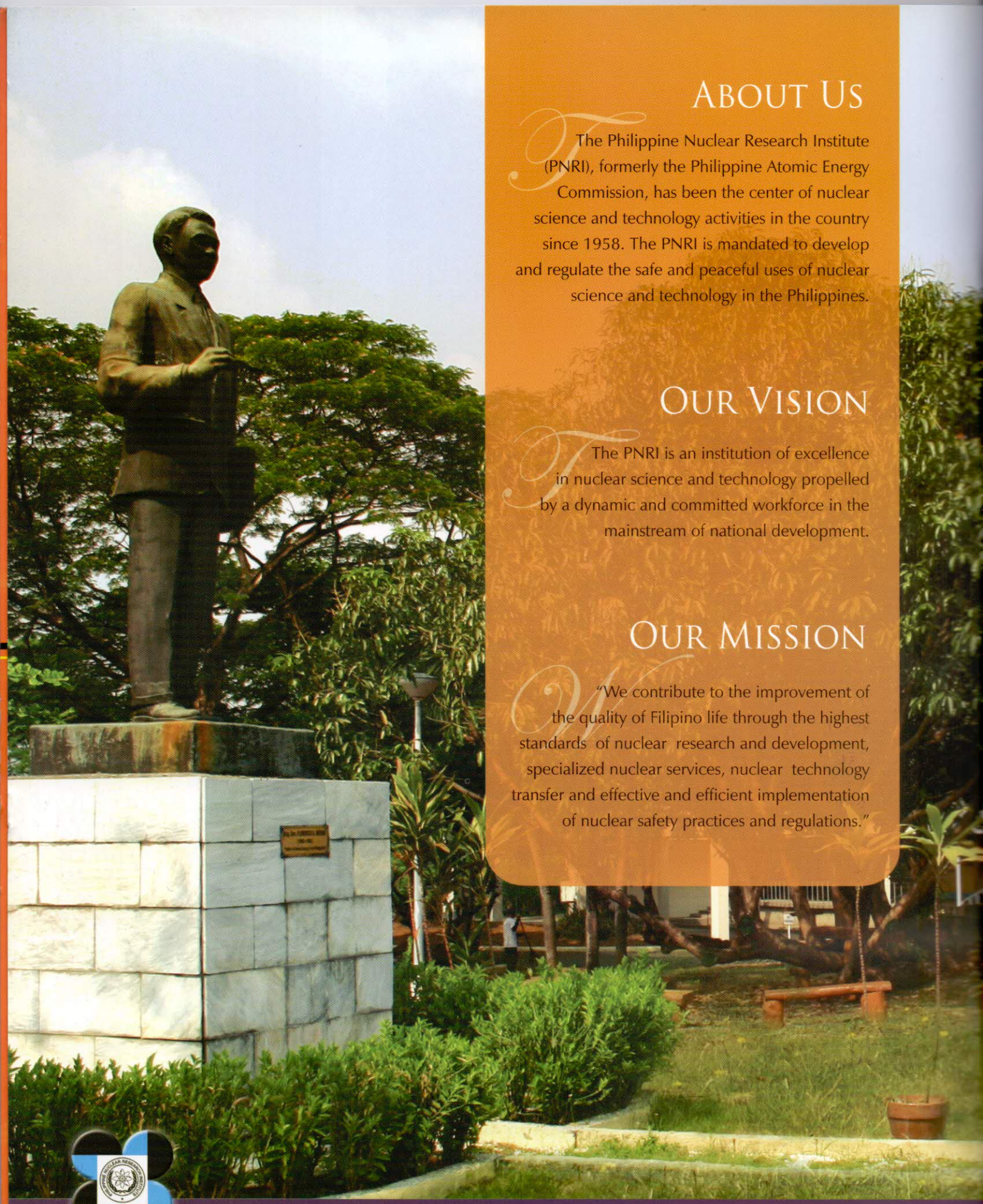
Philippine Nuclear Research Institute

ANNUAL REPORT 2006



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.

Our Mission

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

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DOST

MESSAGE FROM THE SECRETARY

I congratulate the Philippine Nuclear Research Institute (PNRI) for its noteworthy accomplishments in 2006.

As the country's center for nuclear science and technology, your accomplishments clearly embodied the high standard of services the PNRI extends to the government and to private sector, as the Institute performs its mandate to develop and regulate the technology's safe and peaceful uses.

Now, more than ever, during this period of urgent international concerns on nuclear issues, the PNRI's role is indeed valuable. I take special note of the competence shown by PNRI in rising up to the challenges to nuclear security and safety. I am confident that through the high quality of research and services rendered by your dynamic and committed men and women, you will be able to continuously demonstrate to the general public the safe and peaceful uses of nuclear energy which are essential to national development.

May you continue the committed performance of your functions to be able to help our government realize its quest to uplift the lives of our people and to attain our country's economic growth.

ESTRELLA F. ALABASTRO
Secretary

PNRI

MESSAGE FROM THE DIRECTOR

On behalf of the officials and staff of the Philippine Nuclear Research Institute (PNRI), I am pleased to present our Annual Report for 2006. Let me cite some highlights.

The agriculture and environmental sectors are major beneficiaries of the nuclear-based science and technology performed by PNRI and its collaborators. Using N-15 tracer, our scientists obtained a quantitative measure of the nitrogen balance in a rice paddy, and concluded on the best organic-inorganic fertilizer combination that will redound to less fertilizer cost to the farmer. The PNRI's Sterile Insect Technique Laboratory has gained the recognition of the IAEA for providing training and practical experience to IAEA fellows in the field as well as dispatching PNRI scientists as experts to other Member States. The Department of Agriculture availed of said facility and the expertise of PNRI scientists in establishing the extended hot water dip treatment protocol that paved the way for the approval of the export of Philippine mango to China. PNRI scientists continue to provide air pollution data to the Department of Environment and Natural Resources. A greater number of end-users particularly the local government units have sought the PNRI's assistance in air pollution-related concerns. In another application, the PNRI uses radiotracers and stable isotopes to study the possible migration of leachate from landfills to the groundwater. Radiotracer data showed that the groundwater samples taken near the San Mateo landfill were found negative of the tracer. This study is being replicated in Montalban using stable isotopes as tracers to establish benchmark data on which to base future evaluation of the Montalban landfill facility.

More SMEs have become aware of and availed of our nuclear services because of the distinct advantages offered by radioisotopes and nuclear techniques to solve problems in their operations. From its nuclear and regulatory services, the PNRI has generated an income of Php 17 million. Further, the PNRI has generated about Php 62 million of foreign as well as local grants for its R & D, nuclear services, regulatory and security activities.

The full implementation of the PNRI internal regulatory control program was realized in 2006, which has enhanced our radiological safety policy. I commend the collective efforts of the facility operators and users through the Radiation Safety and Security Board and the regulatory staff in implementing the program. Likewise, the PNRI has made significant progress in ensuring radiation safety and security among its licensees. We take pride in the successful implementation of our nuclear security plan and strategies.

I thank each and every staff for his/her contribution in the fulfillment of our mandate. I enjoin all to strive for higher heights of excellence for PNRI and for your own professional development. We have a formidable task to perform in the future.

ALUMANDA M. DELA ROSA, Ph.D.
Director

Diffusion of Knowledge and Technologies

A wide range of members of the public became recipients of various sources of information on nuclear science and technology—especially their safe and peaceful uses—through the nuclear education, information dissemination and communication program of PNRI, among others.

Nuclear Training

The PNRI, through its Nuclear Training Center (NTC), conducts training courses for various groups and sectors for capability building in the field of nuclear science and technology. This year, the NTC conducted 34 training courses which were participated in by 703 professionals and technicians from different government and private institutions/agencies. Ten courses were on radiation safety for various users of radioactive materials and radiation devices while four were on radiological emergency management, awareness and preparedness, including a course on radiation source search methods. Two courses on radioisotope techniques for medical and radiopharmaceutical applications were also offered. In collaboration with the Philippine Society for Nondestructive Testing, Inc. (PSNT), fifteen courses on Nondestructive Testing were offered, which were attended by local and overseas workers who expressed appreciation for the courses. (See Table on page 7 for list of PNRI Training Courses conducted in 2006).

Practical exercise during a Radiographic Testing course

As part of the human resources development in nuclear science and technology in the high school and undergraduate levels, the PNRI accepted a total of 56 students for on-the-job training in the various laboratories and facilities at PNRI and 18 students for thesis advisorship. (See Table on page 6).

Information Services

The PNRI implements various information and communication strategies to increase the awareness and enhance knowledge and understanding of different stakeholders regarding nuclear science and technology as well as nuclear safety and security.

Development/Distribution of Information Materials. The Institute developed new information materials for distribution to the public. These materials were: (1) three flyers on Nuclear Training Courses, Radiation Protection Services and Developing New Varieties of Ornamental Crops by Radiation Technology, (2) a 12-page pamphlet on "Use, Safety and

New information materials on safety and security of sealed radioactive sources: poster (left), pamphlet (top right) and bookmark

Security of Radioactive Sources in the Philippines", (3) a poster entitled "BABALA" (Warning) for posting in junk/ metal scrap yards, and (4) bookmarks containing information on safety and security of radioactive sources. Seven flyers on various topics were also updated. Around 33,000 of these materials, including the 2005 PNRI Annual Report, were distributed to 15,700 clients. The PNRI also developed ten exhibit materials in the form of banners and posters which were exhibited during national and international events. The banners/posters for the 17th DOST Annual Science and Technology Fair were developed with partial financial assistance from the Technology Application and Promotion Institute. The PNRI-developed multimedia educational CD-ROM "The Atom, Radiation and Radioactivity", which was promoted during nuclear awareness seminars and special events, was availed of by 459 clients, mostly teachers and students.

Participation in Special S & T Events. More than 12,000 clients gained awareness and knowledge on the beneficial uses of nuclear science and technology through PNRI's participation in the following national and school events: (1) First Aquatic Technology Competition and Marketplace, January 29-30 at the Philippine Council for Aquatic and Marine Research and Development in Los Baños, Laguna; (2) Science Week celebration, February 10, St. Mary's College, Quezon City; (3) Go Negosyo Expo, February 24-25, Market! Market! in Taguig, Metro Manila; (4) 27th National Conference of Employers Confederation of the Philippines, May 22-23 at the Manila Hotel; (5) 17th DOST Annual Science and Technology Fair, July 17-21 at the Philippine Trade and Training Center; (6) University-Wide Science Exhibit and Fair, September 27, University of Rizal System-Morong Campus; (7) Science and Math month celebration, October 5 at St. Paul University, Quezon City; and (8) 34th Atomic Energy Week celebration, December 11-15 at the PNRI Compound in Diliman, Quezon City.

PNRI exhibit during the 17th Annual DOST Science and Technology Fair at the Philippine Trade and Training Center

Educational Tours and Nuclear Awareness Seminars. Around 8,700 visitors, composed mostly of students, were provided with information on nuclear science and technology through lectures, film showings and guided tours of PNRI facilities during their educational trips to PNRI. The PNRI Information Services Group, in cooperation with the Nuclear Training Center and selected PNRI technical staff, conducted 31 nuclear awareness seminars for 12 high schools and colleges in Metro Manila. A total of 2,732 students, teachers and school administrators participated in these seminars.

High school students of Angelicum College listen attentively during a nuclear awareness seminar conducted by PNRI Information Services Group.

Nuclear S & T Promotion Through Media Linkages. The public gained information and knowledge about various topics on nuclear science and technology through the print, broadcast and cyber media. The topics that were featured in the media, through radio and TV interviews of PNRI officials and staff, media releases and reports, were the following: (1) PNRI nuclear research and development activities and services, (2) food irradiation technology, (3) special events such as PNRI's participation in the National Science and Technology Week celebration and DOST Technology Fair, (4) nuclear science education, (5) Atomic Energy Week celebration, and (6) effects in the Philippines of the North Korea nuclear weapons testing.

PNRI Director Alumanda M. dela Rosa (second from left) being interviewed in the Inside Insight TV program of RPN 9.

The PNRI Library Services provides assistance to student researchers, among others.

Library Services

To provide support to the research requirements of both PNRI and non-PNRI clients, the PNRI, through the Library Services Group, continued its active participation in the following:
(1) DOST Science and Technology Information System or SciNet (http:// www.scinet.dost.gov.ph),
(2) the Philippine eLibrary, and
(3) the International Nuclear Information System (INIS) which can be accessed via the internet (http://www.iaea.org / inisnkm).

Use of Open Source Web Development Tools in Improving the Nuclear Knowledge Portal for the PNRI

This new project of the PNRI aims to create the Institute's online knowledge repository capable of supporting the storage, retrieval and utilization of nuclear knowledge that will be shared with other commercial or research organizations in the field of nuclear science and technology. The project's initial activity is the improvement of the PNRI Intranet to provide for a repository of nuclear knowledge in the Institute. Information technology tools will be developed using open sources to capture knowledge; analyze and organize knowledge domains; and develop taxonomy for the knowledge in different activities in the nuclear field.

The following are the types of knowledge targeted in this project: national/international nuclear regulations and standards; knowledge acquired during attendance to national/ regional/international trainings, seminars and/or workshops and participation and collaboration in national/regional/international projects; processes and procedures used in the conduct of routine work in the Institute; outcomes and results of research projects conducted; lessons learned from all of these venues; a list of owners of certain knowledge, expertise and competencies; tacit knowledge that sits in researchers' minds; and links to other knowledge bases.

NUCLEAR S & T TRAINING FOR UNDERGRADUATES

ON-THE-JOB-TRAINING

FIELD OF TRAINING	PNRI UNIT/SECTION	SCHOOL	COURSE	NO. OF STUDENTS
Mutation Breeding and Nursery Management, Embryo Culture of Orchids and Other Agricultural Crops; and Fruit Fly Rearing	Agricultural Research	University of Rizal; Philippine Normal University; University of Sto. Tomas(UST); University of the Philippines(UP)- Diliman; Rizal Technological University; New Era University	BS Biology BS Biochemistry	17
Amnion Processing; Microbiological Analysis of Food and Medical Products; Biochemistry; and Basic Molecular Techniques	Biomedical Research	Rizal Technological University; UP-Diliman; UP- Visayas; New Era University	BS Biology BS Chemistry	6
Red Tide Sedimentation Studies: Lead-210 Dating and Water Chemistry	Chemistry Research	UP-Diliman; UP-Visayas and Polytechnic University of the Philippines (PUP)	BS Chemistry	5
Liquid Scintillation Spectrometry	Analytical Measurements Research	UP-Los Baños	BS Chemistry	2
X-ray Diffraction Studies of Aluminum-Doped Rare Earth Yttrium Garnets; Device-Fabrication for Thin-Film Coating on Solid Substrates	Applied Physics Research	PUP; UP-Los Banos	BS Physics BS Applied Physics	6
Radiation Dosimetry	Irradiation Services	UP-Diliman; Eulogio Amang Rodriguez Institute of Science and Technology (EARIST)	BS Chemistry BS Applied Physics	2
High Dose Dosimetry; Radiation Protection Operations; and Routine SSDL Procedure	Radiation Protection Services	PUP; EARIST	BS Physics	4
Data Encoding of Radiation Protection Services	Radiation Protection Services	Far Eastern University (FEU) – Fern; PUP	BS Business Administration; BS Information Technology; BS Industrial Engineering	4
Data Encoding	Nuclear Training Center	New Era University	BS Biology	2
Data Encoding of PNRI ComputerServices Activities	Computer Services	STI College	BS Information Technology	1
Clerical Work and Data Encoding	Finance and Administrative Division, Property and Procurement Unit; Auditing; and General Services	FEU-Fern; PUP; St. Joseph College	BS Business Administration; BS Computer Science; BS Information Technology;BS Industrial Engineering; BS Information Mgt.	7

THESIS / RESEARCH ADVISORSHIP

FIELD OF TRAINING	PNRI UNIT/SECTION	SCHOOL	COURSE	NO. OF STUDENTS
Radiosensitivity of Three Species of Ground Orchids	Agricultural Research	Central Luzon State University	Management BS Agriculture	1
Comparative Analysis on the Shelf-life Extension of Roundscad with the Influence of Salting	Biomedical Research	De La Salle University	BS Medical Physics	2
The Feasibility of Using NP Hydrogels as Dye Absorbing Agents to Prevent Water Pollution	Chemistry Research	Philippine Science High School	4th year High School	3
Removal of Fe (111) Ions from Water by Irradiated Methylated Kappa-Carrageenan.	Chemistry Research	UST	BS Chemistry	1
X-Ray Diffraction Studies of $A1^{+3}$ Doped Rare Earth Yttrium Garnets	Applied Physics	PUP	BS Physics	4
Intercomparison of Calcium Flouride as a Substitute Raw Material on Lithium Flouride for Thermoluminiscence Dosimeter	Radiation Protection Services	PUP	BS Physics	4
Use of Zeolite Mineral as a Component for Shielding Radiation	Engineering Services	UST	BS Chemical Engineering	3

TECHNICAL TRAINING COURSES CONDUCTED IN 2006

TITLE OF TRAINING	TRAINING VENUE / LOCATION	NO. OF PARTICIPANTS	INCLUSIVE DATES CONDUCTED	FUNDING SCHEME
RADIOISOTOPE TECHNIQUES				
Radioisotope Techniques Training Course (Medical)	PNRI Diliman, Quezon City	44	August 7 – September 1	Individual fee-paying
Basic Training Course on Radiopharmaceuticals	PNRI	24(15**)	March 28–31	Individual fee-paying
NUCLEAR SCIENCE FOR TEACHERS				
Seminar in Nuclear Science for High School Science Teachers	PNRI	20	April 24–May 26	PNRI-sponsored
Nuclear Technology for College Faculty	PNRI	6	April 24–May 26	PNRI-sponsored
RADIATION SAFETY				
Safety in the Use of Tritium for Tracer Application	PNRI	12	April 3–7	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course	PNRI	10	April 3–7	Individual fee-paying
Radiation Safety Course for Non-Technical Personnel	PNRI	20	June 5–13	PNRI-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course	PNRI	11	July 3–7	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course	PNRI	4	July 17–21	Company-sponsored
Radiation Safety Course of International Rice Research Institute (IRRI) Staff	PNRI	9	July 31–August 4	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course	PNRI	9	September 4–8	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course	PNRI	40	September 18–22	Individual fee-paying
Radiation Safety Course for Commercial Sale and Distribution of Radioactive Material (1st Session)	PNRI	11	November 6--8	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course	PNRI	5	December 18–22	Company sponsored
EMERGENCY AWARENESS AND PREPAREDNESS				
PNRI Emergency Awareness Seminar	PNRI	101	April 18	PNRI sponsored
Training Course on Emergency Preparedness	Rapu-Rapu Processing Inc. Legazpi City, Albay	24	June 1–4	Company sponsored
Emergency Management Workshop	PNRI	32	July 3– 7	PNRI sponsored
Radiation Sources Search Methods and Equipment Familiarization Workshop	PNRI	19	August 24 – 25	PNRI sponsored
NONDESTRUCTIVE TESTING (NDT) COURSES *(in cooperation with the Philippine Society for Nondestructive Testing, Inc. or PSNT)*				
Surface Methods - Level 2	PNRI	13	January 9–24	Individual fee-paying
Radiographic Testing – Level 2	PNRI	29(1**)	February 6–21	Individual fee-paying
Ultrasonic Testing - Level 2	PNRI	28	February 27– March 14	Individual fee-paying
Surface Methods - Level 2	PNRI	11	March 20–April 4	Individual fee-paying
Radiographic Testing - Level 2	PNRI	19	May 8–23	Individual fee-paying
Ultrasonic Testing – Level 2	PNRI	29	June 19–July 4	Individual fee-paying
Ultrasonic Testing – Level 3	PNRI	1	June 19–July 4	Individual fee-paying
National Training Course on NDT of Concrete Structures*	PNRI	17 (8**)	July 31 – August 11	Individual fee-paying
Ultrasonic testing –Level 2	PNRI	10 (2**)	September 4–19	Individual fee-paying
Surface Methods - Level 2	PNRI	26	October 12 – 27	Individual fee -paying
Radiographic Testing – Level 2	PNRI	27	October 12 – 27	Individual fee-paying
Surface Methods - Level 2	PNRI	20 (2**)	November 6–22	Individual fee-paying
Ultrasonic Testing –Level 2	PNRI	10	November 23– December 2	Individual fee-paying
Ultrasonic Testing –Level 2	PNRI	26(1**)	December 4–19	Individual fee-paying
National Training Course on the Fundamentals of NDT (PT. MT, UT, RT, ET)	PNRI	10(1**)	December 4--8	Company-sponsored
SPECIAL COURSE				
Workshop on Safety Assessment (for preparation of documents to authorize the operation of PNRI radiation facilities)	PNRI	26	January 16–27	PNRI sponsored

* Conducted in cooperation with the International Atomic Energy Agency
**PNRI employee – non-paying

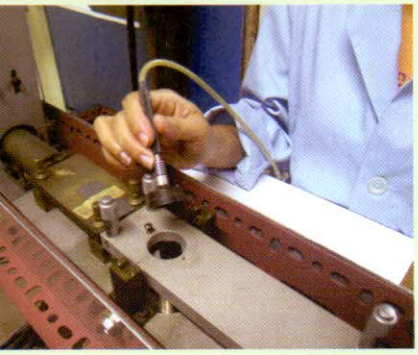
Generation of New Knowledge and Technologies

True to its mission, the PNRI continued to help improve the quality of products, human lives and the environment through its new and ongoing researches. It has registered advances in basic research, agriculture, health and medicine, industry and environment.

BASIC RESEARCH

High Technology Materials Development

The PNRI Applied Physics Research Group is conducting studies using X-ray spectroscopic techniques to develop metal-adsorbing ultrathin films for use as active component of heavy-metal preconcentrators. Heavy-metal preconcentrators can be used in the effective determination of heavy-metal pollutants in water systems.

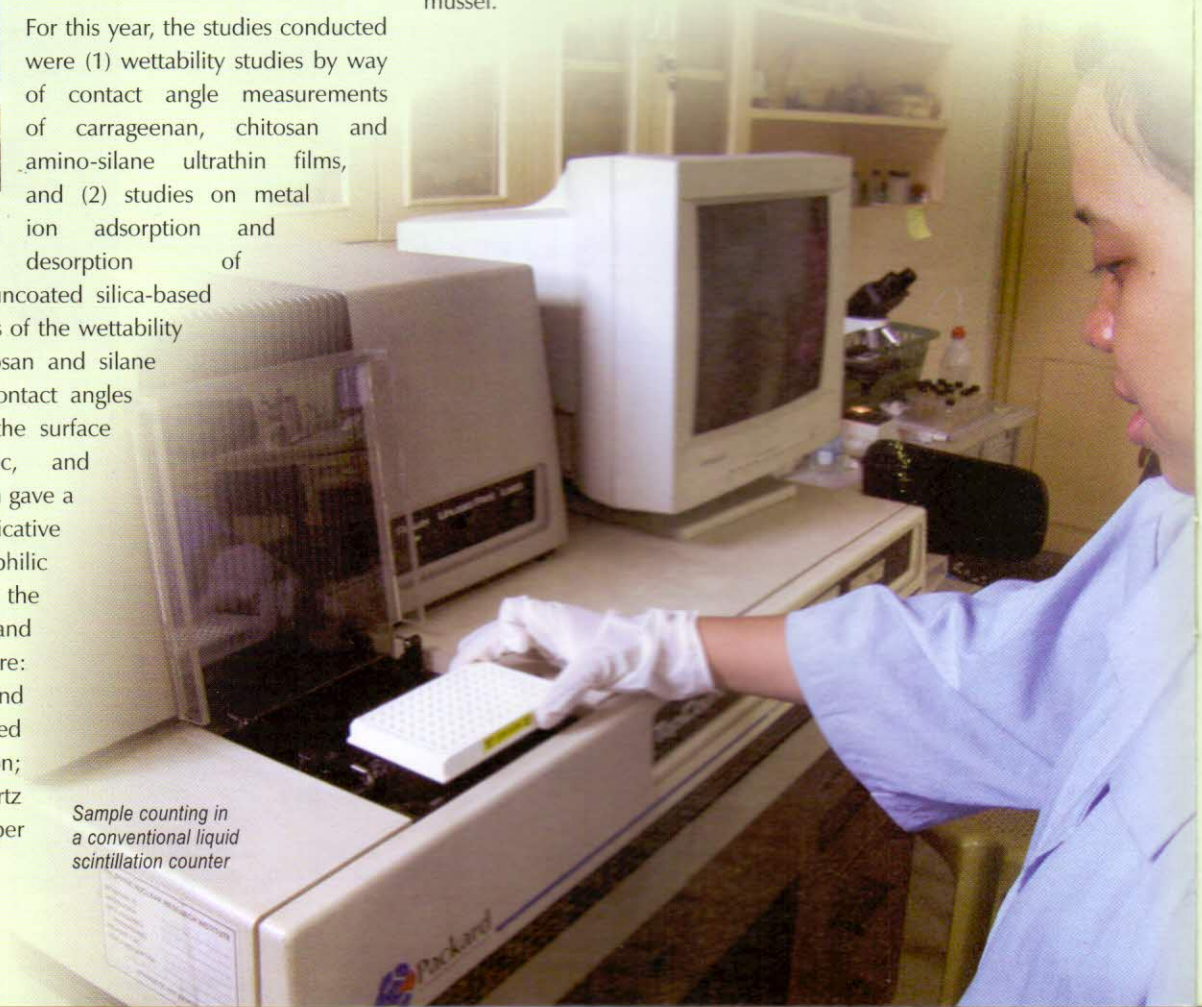


The total reflection x-ray fluorescence spectrometer set-up for development of high technology materials

For this year, the studies conducted were (1) wettability studies by way of contact angle measurements of carrageenan, chitosan and amino-silane ultrathin films, and (2) studies on metal ion adsorption and desorption of different coated and uncoated silica-based glass substrates. Results of the wettability studies were: (1) chitosan and silane films showed large contact angles which indicated that the surface becomes hydrophobic, and (2) the carrageenan film gave a contact angle of 10° indicative of a strong hydrophilic surface. Results of the metal ion adsorption and desorption studies were: (1) the bare borofloat and B270 substrates showed slight copper adsorption; (2) the BK7 and quartz did not show copper adsorption, and (3) the B270 with an ultrathin film of chitosan showed strong copper adsorption.

Kinetics of Paralytic Shellfish Poisoning (PSP) Uptake in Mussel

The PNRI, in collaboration with the Bureau of Fisheries and Aquatic Resources and the Marine Science Institute-University of the Philippines, has been undertaking studies on the use of nuclear techniques to assist in the management of red tide or harmful algal bloom (HAB) in some important aqua culture areas in the country. One study involves the measurement of the uptake and release rates of saxitoxin in mussel.



Sample counting in a conventional liquid scintillation counter

The study on the uptake of saxitoxin is being conducted in Juag Lagoon in Sorsogon. This lagoon is a natural laboratory for saxitoxin uptake studies because it is experiencing recurring harmful algal bloom. The study involved the exposure of uncontaminated mussels to natural harmful algal concentrations in the lagoon water. Mussel toxicity was measured by radiometric receptor binding assay. The results indicated that the exposure of uncontaminated mussels in low cell density (<1000 cells/l) of PSP-causing dinoflagellate for nearly three days did not increase the toxicity level above the Philippine regulatory limit of 40 ug/100g. Saxitoxin is also being labeled with radioactive carbon biosynthetically for its application in uptake studies under controlled conditions in the laboratory.

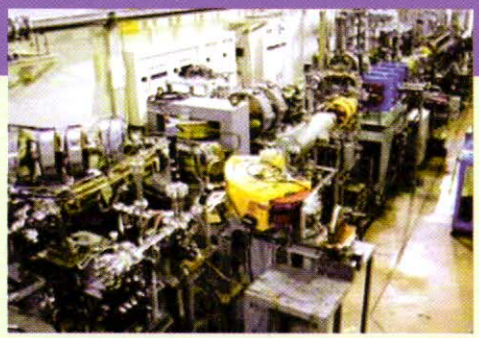
Synthesis and Radiation Crosslinking of Carboxymethyl Kappa-Carrageenan

Kappa-carrageenan is a natural polymer that typically undergoes chain scission reactions when exposed to high-energy radiation, thus a chemically crosslinked hydrogel cannot be obtained from κ-carrageenan using radiation techniques. But based on recent studies, cellulosic ethers like carboxymethyl cellulose can be successfully crosslinked when irradiated under paste-like conditions. The most probable crosslinking site was attributed to the carboxymethyl side chain, specifically on the alpha- carbon due to the stability of the free radical formed in that site. This concept makes it possible to produce pure natural polymer-based hydrogels, without admixture of other polymers or without addition of low-molecular-weight crosslinking agents. Thus, kappa-carrageenan was treated to multi-step carboxymethylation process to produce carboxymethylayed products with different degrees of substitution.

Carboxymethyl-κ carrageenan hydrogels were successfully crosslinked at concentrations 20 percent and above. Gel fractions varied from 1 to 70 percent depending on the concentration and radiation dose. Swelling in deionized water reached as high as 400 x (20 percent CMκC-3S, irradiated at 10 kGy) and as low as 6x (40 percent CMκ-4S). With these properties, new applications for these materials can be explored such as drug delivery matrix, superabsorbent material (for high swelling hydrogels) and metal adsorbent or protein recovery resin (for low swelling hydrogels).

Pulse Radiolysis Studies of Carrageenan

To support applied researches on radiation processing of carrageenan, PNRI has been conducting basic research studies on pulse radiolysis of carrageenan since 2005. Pulse radiolysis is a method of studying fast chemical reactions (nano or microsecond level) in which a sample is subjected to a pulse of ionizing radiation, and the products formed by the resulting reactions are studied spectroscopically.



Pulse radiolysis experiments were performed by a PNRI researcher using the linear accelerator facility of the Department of Nuclear Engineering and Management Graduate School of Engineering at the University of Tokyo, Japan.

Results reported previously indicated that the rate constant of OH• reaction with κ-carrageenan decreased when κ-carrageenan was irradiated at doses of 25 to 125 kGy in air but did not vary with increasing radiation doses. This observation was attributed to a possible ring opening of the galacto-pyranose ring as a result of oxidation reactions, thus, reducing the number of reactive sites. This year, pulse radiolysis experiments were performed on kappa carrageenan samples irradiated in vacuum at varying doses of 25 to 200 kGy to prevent oxidation reactions. Results showed that the rate constants of reaction of OH• with irradiated κ-carrageenan (in vacuum) are slightly higher than non-irradiated κ-carrageenan. These could imply that changes in the number of reactive sites have a greater influence on the rate constant of OH• reaction with irradiated κ-carrageenan than the decrease in viscosity.

AGRICULTURAL PRODUCTION AND TECHNOLOGY

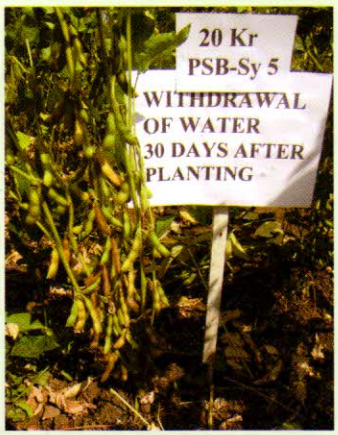
Induction of Beneficial Mutation Through Irradiation for Crop Improvement

Rice – This year, the Institute conducted yield trials at the PNRI experimental field of four PNRI-developed rice mutant lines derived from crosses between Azmil x Bengawan mutant, IR8 x Denorado mutant 1, Denorado mutant 1 and Azucena mutant. These varieties were identified in 2005 as the top four highest yielding rice mutant lines among 14 mutant selections evaluated. Results obtained from the yield trials showed that Azucena mutant was the top yielder (4.75 tons per hectare (tons/ha), followed by the control, PSBRc18 (4.0 tons/ha), IR8 x Denorado mutant 1 (3.82 tons/ha) and Denorado mutant (3.57 tons/ha). The lowest yielder was Azmil x Bengawan mutant with a mean yield of 3.25 tons/ha. Further yield trials will be conducted in farmers' fields to confirm these results.

Mungbean - The PNRI Agricultural Research Group obtained a new mutant variety from the crosses of the PNRI-developed PAEC 2 and PAEC 10 mutants with high yielding varieties evaluated in the IAEA/RCA Project on Regional Mutants Multilocation Trials (RMMT), and with some varieties recommended by the National Seed Industry Council (NSIC). The new mutant, named PAEC 12, has larger seeds and longer pods as compared with PAEC 2 and PAEC 10. This new mutant will be subjected to further evaluation to compare its yield and other agronomic traits with the other varieties evaluated in the RMMT and the varieties released by NSIC for planting by farmers.

From PNRI's research work on genetic diversity enhancement in mungbean using gamma irradiation, a total of 111 putative mutants were produced in the M5 generation: Out of these mutants, 32 have early maturity, 45 have high yields, 8 have large seeds and 26 with long pods.

Soybean – Selected mutant lines in the fifth (M5) and sixth (M6) generations of irradiated local soybean varieties (PSB-Sy4, BPI-Sy4 and PSB-Sy5) and soybean varieties from Vietnam (DT-95, DT-84 and AKO-6) were evaluated for drought tolerance and high yielding ability at the PNRI experimental field.



Most number of seeds were produced from PSB-Sy5, a local soybean variety irradiated with 200 Gy.

Among the local varieties, results of the evaluation were: (1) the number of pods was not significantly different among the mutant lines of the three varieties and their respective control subjected to irrigation withdrawal 20 days after planting (DAP), (2) as compared with its control and the other two varieties, mutants of BPI-Sy4 had a significant increase in the number of pods at irrigation withdrawn 30 DAP, and (3) PSB-Sy5 irradiated with 200 Gy had the most number of seeds, followed by BPI-Sy4 irradiated with 250 Gy.

The results for the varieties from Vietnam were: (1) the M5 generation mutant lines of DT-95 variety, which were

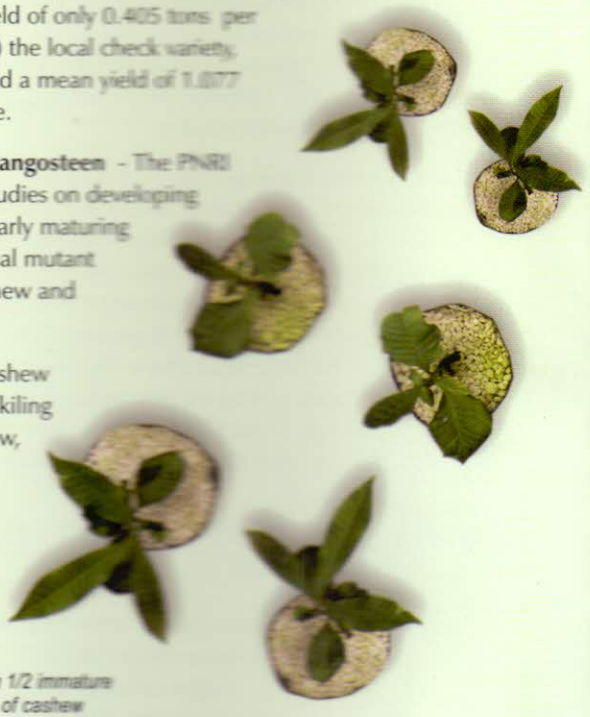
The PNRI continued to use gamma radiation coupled with tissue culture and molecular techniques to develop new crop varieties with improved characteristics.

subjected to irrigation withdrawal 20 DAP were significantly taller than the other varieties from Vietnam and had the most number of pods, (2) withdrawal of irrigation at 20 DAP did not significantly affect the number of seeds and the size of the seeds per plant of the selected mutant lines of the three varieties, and (3) AKO-6 at 200 Gy gave a higher yield than the control.

Peanuts – Seeds of ten mutant varieties of peanuts obtained from participating countries in the 2005 IAEA/RCA Project on Regional Mutants Multilocation Trials were planted at Bulacan Agricultural State College. The trials had the following results: (1) the mutant variety from Indonesia, AH 1781, was the best in rank in terms of yield per hectare. This variety had a computed yield of 1.633 tons per hectare; (2) the second top yielders were Binachina badam2 (from Bangladesh) and V-79 (from Vietnam) which both yielded 1.17 tons/ha; (3) the poorest variety was Dhaka (from Bangladesh) which had a yield of only 0.405 tons per hectare; and (4) the local check variety, NSIC Pn-10, had a mean yield of 1.077 tons per hectare.

Cashew and Mangosteen - The PNRI continued its studies on developing high yielding, early maturing and non seasonal mutant varieties of cashew and mangosteeen.

Ninety-nine cashew seedlings of Makiling variety of cashew, which were irradiated with 100 to 300 Gy dose of gamma



Plants derived from 1/2 immature cotyledon embryos of cashew

radiation in March 2006, were transplanted at a cooperator's orchard in Morong, Bataan. These cashew seedlings belong to the second batch of irradiated cashew plants being studied for mutation breeding. Thirty unirradiated plants were also transplanted in Morong as control. In the first batch of irradiated plants transplanted at PNRI, one plant flowered and developed into a fruit. The seed was planted in a pot as second generation mutant plant.

Irradiated mangosteen seedlings were given to farmer-cooperators in Lucban, Quezon through the municipal agriculturist. These seedlings were transplanted for preliminary growth performance evaluation under field conditions.

Ornamentals - The National Seed Industry Council (NSIC) of the Bureau of Plant Industry approved the registration of the PNRI-developed mutant *Cordilyne terminalis* 'Medina' as a new/improved ornamental plant in June 2006. *Cordyline* 'Medina' has glossy green leaves with irregular creamy white, purple and red-violet stripes. It is a chlorophyll mutant from *Cordilyne terminalis* 'Itchy Red' that has purple leaves marked with dark pink to red-violet especially when young. The mutant plants are now being commercialized.

Mutation breeding studies of other ornamental plants such as chrysanthemum, cattleya and *Freycinetia multiflora* were also continued. Results of these studies are under evaluation.

The PNRI developed mutant Cordilyne terminalis "Medina" is a new/improved variety from Cordyline terminalis "Itchy Red" commonly known as Ti plant.

Fertilizer Nitrogen and Crop Residue Management in Rice-Based Cropping System

The PNRI conducted a residual field demonstration trial in Talisay, Camarines Norte in the dry cropping season of 2006. The residual field trial determined the yield response of different treatments of organic-inorganic fertilizer combinations to succeeding rice crop. For this experiment, PSB RC 18 rice variety was planted in mid-January and was harvested in April 2006.

The results of the field demonstration trial were: (1) rice straw compost combined with commercial nitrogen fertilizer like ammonium sulfate is a promising alternative source of nitrogen fertilizer. The yield response to succeeding rice plant was higher in rice straw compost + ammonium sulfate (with a ratio of 2:1 that corresponds to 60 kgN straw compost + 30 kgN $(NH_4)_2SO_4$ as compared to treatments based on farmers' practice in the area (1:3 urea + 14-14-14 complete fertilizer) and treatments with ammonium sulfate only, and (2) even without fertilizer application during the second residual cropping season, the rice plant can sustain its requirements for nitrogen coming from the rice straw compost applied during the first cropping season. This indicates that the nitrogen coming from the compost was made available for plant use.

(Left) Harvesting of corn for quantification of nitrogen fixation of Bio-N with carrier (soil and charcoal) sterilized through gamma irradiation
(Right) Radiation dose labeling of Bio-N carrier prior to gamma irradiation sterilization

Use of Nuclear Techniques in the Assessment of Bio-N Fertilizer as Seed Inoculant for Corn

PNRI studied the comparative effects of irradiation and heat-autoclave sterilization of biofertilizer carrier (soil and charcoal) on nitrogen-fixing capacity of Bio-N on corn. Bio-N is a biofertilizer which is capable of fixing atmospheric nitrogen and turning it into form usable by crops.

Sterilization of Bio-N carrier either by heat autoclave or irradiation has no effect in general on nitrogen fixing capacity of Bio-N on corn. Inoculation of Bio-N, regardless of sterilization methods of the carrier, also has no effect on growth and dry matter yield of corn. Nitrogen capacity of Bio-N can however be enhanced with the addition of inorganic nitrogen.

A cassava-cultivated farm at the Angat Watershed in Bulacan is one of the study areas of PNRI's studies on soil redistribution and soil/water quality.

Sustainable Land Use Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality

The PNRI has been conducting studies to assess soil erosion rate and land-use management practice in agricultural landscapes using cesium-137 (^{137}Cs) and naturally occuring radionuclides. The technique involves the measurement of ^{137}Cs in soil samples using a radiation detector. These measurements are then converted to estimates of soil erosion/ sedimentation rates using calibration models.

This year, additional studies using ^{137}Cs and natural lead-210 (^{210}Pb) isotopes were conducted in selected areas in the Angat Watershed in Bulacan and the Inabanga Watershed in Bohol. The reference inventory values were obtained for both sites and these values were used to compare erosion and deposition areas within the field. The reference inventories obtained are in good agreement with the predicted values using model calculations that are based on geographical location (latitude, longitude) and amount of rainfall.

The data showed that some portions of the study area in Bohol experience erosion while some portions experience deposition. This type of information cannot be obtained using the conventional method of soil erosion measurement. Such information is valuable in putting in place soil conservation measures for optimum agricultural productivity. Soil nutrients such as carbon, nitrogen and phosphorus move together with the soil and thus nutrients in soil are also being measured. The data are being evaluated for correlation with ^{137}Cs and natural ^{210}Pb contents.

Integrated Approach for Improving Livestock Production Using Indigenous Resources

PNRI is using nuclear techniques in its new project, started in 2005, on the development of an integrated approach to improve livestock productivity through better nutritional and reproduction strategies while conserving the environment.

For the nutrition component, the nuclear techniques will involve the use of nitrogen-15 for measuring microbial protein production and nitrogen leakage from manure into the environment; carbon-14 for in vitro methane production; molecular probes; iodine-125 for tannin assay; and phosphorus-32 for measurement of phosphorus leakage into the environment. Iodine-125 radioimmunoassay kits will be used for evaluation of selected nutritional and management strategies for their impact on reproductive efficiency; and phosphorus-32 for genetic screening and characterization.

PNRI conducts studies on integrated approach to improve the production of dairy cattle.

The following were accomplished for this year: (1) continued feeding trials in the study group of dairy cows using locally-available feed resources, including monitoring on productive and reproductive responses; (2) conduct of better manure management, both for the study and the control groups. A repeat study on nutrient cycling of cow manure was started after the project site in San Ildefonso, Bulacan was hit by typhoon Milenyo; and (3) explored possible collaboration with the Dairy Training Research Institute for study on methane measurements.

Improvement of Mass Rearing Methods and Sterile Male Performance of Oriental Fruit Fly for SIT Programs

The Institute continued to undertake research studies on improvement of mass rearing methods for Oriental fruit flies *Bactrocera philippinensis* and improvement of the mating competitiveness of the sterile male fruit flies. These studies are part of the sterile insect technique (SIT) program for controlling the population of fruit flies, which are pests that infest mangoes.

For the mass rearing studies, results were the following: (1) sugarcane bagasse, powdered yellow corn and rice straw diet formulations can be substituted for the sweet potato

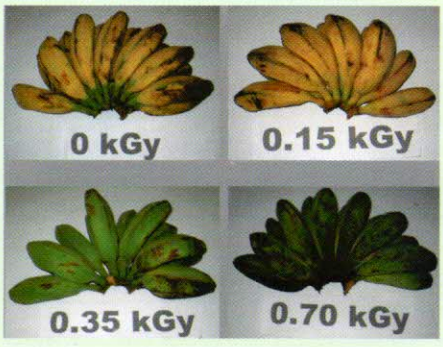
standard diet of fruit flies, (2) larger number of eggs was collected on aluminum screen cage with three and five egg collection tubes compared with the standard aluminum screen cage, and (3) different colors of egging device such as green, blue and pink can be used as substitutes for the yellow standard egging device in the mass production of Oriental fruit flies.

Results of the study on the improvement of the performance of the sterile male fruit flies were: (1) exposure to synthetic methyl eugenol was found to increase the mating performance of *B. philippinensis* in field cage experiments, and (2) natural sources of methyl eugenol such as sweet and holy basil were found comparable to synthetic methyl eugenol in increasing the mating competitiveness of *B. philippinensis*. Analysis of the essential oil of the two basil species by gas chromatography revealed that the methyl eugenol content in the sweet basil was higher than in holy basil.

Food Irradiation

As part of the Institute's advocacy program on food irradiation technology in Luzon and in Visayas, the Biomedical Research Group (BMRG), in cooperation with the Information Services Group, developed information materials (brochure, pamphlet and exhibit poster/banner) on food irradiation. The PNRI also established linkages with 10 regional offices of the Department of Agriculture (seven in Luzon and three in Visayas). The regional offices signed a Memorandum of Agreement with the PNRI on the conduct of the food irradiation advocacy program in their regions.

PNRI conducted research and development studies on the use of irradiation for prolonging the shelf-life of fresh frozen fish (roundscad) and for delaying the ripening of Saba bananas. Results of microbial analysis of roundscad showed that the combination treatment of salting, freezing and irradiation with 1, 3 and 5 kGy inhibited the growth of microorganisms thereby prolonging the shelf life up to four weeks. The quality as well as the physico-chemical properties of the irradiated and non-irradiated roundscad did not vary considerably. Initial results of the physico-chemical tests of irradiated and non-irradiated Saba bananas indicated that there are no considerable differences in the pH, total acidity and total soluble solid. There was also no considerable change in the sensory quality of the irradiated samples as compared to the non-irradiated samples. Delay of ripening of Saba bananas by three to four days was observed at doses between 0.15 kGy and 0.35 kGy.



Delay of ripening of Saba bananas was found to be in between 0.15 kGy and 0.35 kGy.

PNRI researcher measures the viscosity of irradiated honey samples.

PROTECTION AND IMPROVEMENT OF HUMAN HEALTH

Development of Honey Wound Dressing for Health Care Management

The PNRI pursued its studies on the development of wound dressing from radiation-sterilized honey for health care management. Two trials on the rheological (viscosity) properties of collected honey samples were conducted. The result of the analysis of the effect of irradiation on the viscosity of honey showed that irradiation up to a maximum dose of 25 kGy does not significantly affect the viscosity of honey samples. The results of the second trial of the microbiological analysis of irradiated and non-irradiated honey were the following: (1) among the seven kinds of honey collected, unifloral coconut honey has the greatest inhibitory action when tested against three test microorganisms *(S. aureus, M. luteus and P. vulagaris)*, (2) both irradiated and non- irradiated honey samples were found to be effective in inhibiting the growth of all the three test organisms, and (3) a dose of 15kGy is effective in completely eliminating the microbial load of unifloral coconut honey.

Radiation Modification of Chitosan for Biomedical Applications

The Urology Section under the University of Sto. Tomas Hospital's Department of Surgery continued its animal studies of the polyvinyl pyrolidone (PVP) – chitosan injectable hydrogel developed by PNRI through radiation crosslinking technology. This injectable implant can be used for the cure of primary vesicoureteral reflux (VUR). VUR is the common urologic anomaly in children associated with urinary tract infection.

(Left) Chitosan-PVP injectable gel (Right) Chitosan-PVP injectable gel passing through gauge-26 needle

The results of the studies showed that the chitosan-PVP hydrogel has properties of a good tissue augmenting implant comparable to that of Deflux, a commercially available imported surgical implant. The PNRI-developed gel has enough viscosity to pass through a gauge-26 needle used in endoscopy while maintaining its stability with very minimal changes in volume of implant. The hydrogel can be considered biocompatible and non-migratory. Histologically, the gel was observed to have minimal local inflammatory reaction with absence of granulation tissue, foreign body reaction, and scar formation. In terms of producing fewer histologic findings of local inflammatory response, Deflux is still superior than the chitosan-PVP hydrogel implant. However, the PNRI-developed alternative implant is a lot cheaper than Deflux because resources used in the production of this implant are locally available.

Establishment of Protocol for the Elemental Analysis of Blood Using TXRF Spectrometry

The PNRI has initiated a project on developing a protocol for the determination of the concentrations of elements in human blood samples using the total-reflection X-ray fluorescence (TXRF) technique. This project aims to provide the Philippine health community with a good alternative to the current techniques of determining the elemental composition of the patients' blood samples for diagnostic as well as for research purposes.

The most important part of this project is in determining the best sample preparation method that will yield an ideal spectrum for TXRF quantitative analysis. For this year, the Applied Physics Research Group conducted preliminary experiments on sample preparation and sample loading of blood for TXRF analysis. The spectra from these activities were collected, processed and are being analyzed.

Analysis of Cigarettes for Polonium-210 Concentrations

The PNRI Health Physics Research Group started a project on the analysis of the levels of polonium-210 (^{210}Po) in tobacco of different brands of imported and locally -manufactured cigarettes and in leaves of tobacco grown in farms at the Ilocos region. This project is being undertaken as part of PNRI's radiation monitoring and surveillance program for the health and safety of the public. Tobacco and cigarettes are known to contain radioactive elements, particularly ^{210}Po. Polonium-210 emits alpha radiation, a type of ionizing radiation which is hazardous to health when ingested or inhaled such as in smoking.

INDUSTRY AND ENERGY

Radiotracer and Sealed Source Applications in Industry

Feasibility study on the use of americium-241 to measure wood density was started. A laboratory set-up was constructed to measure changes in gamma attenuation with changes in thickness and/or density of wood.

Tracing Future Sustainable Paths through Nuclear and Other Energy Options in the Philippines

A final report on this IAEA/RCA Project has recommended that the inclusion of a 1000- megawatt nuclear power plant in 2020 onwards is a possible energy alternative that is economically and environmentally sustainable. The study report was submitted to the International Atomic Energy Agency (IAEA) in 2006 by the Philippine national team composed of representatives from the Department of Energy, National Power Corporation and the PNRI. Other measures recommended to ensure social, economic and environmental sustainability in the future are: (1) minimize the use of

Representatives from 10 Asian countries participated in the Regional Meeting to Finalize Indicators for Energy Sustainable Development and Review Interim Report on National Studies hosted by PNRI on October 2-6, 2006.

fossil-fueled resources to reduce the greenhouse gases emission, and (2) aggresively implement the power sector reform to eventually reduce electricity cost. The study used the Indicators for Energy Sustainable Development proposed by the IAEA, United Nations Department of Economic and Social Affairs, International Energy Agency, Statistical Office of the European Communities (EUROSTAT) and the European Environment Agency.

CARE OF THE ENVIRONMENT

Urban Waste Management

PNRI's Isotope Techniques Research Group continued the study on the possible migration of leachate from the San Mateo landfill into groundwater using tritium as radioactive tracer. Eleven years after the injection of the radiotracer into the landfill, the groundwater samples were found negative of the tracer, an indication that the groundwater contains insignificant or undetectable levels of leachate. Results of tests on chemical oxygen demand and conductivity supported this finding.

Receptor Binding Assay of Saxitoxin for Red Tide Monitoring

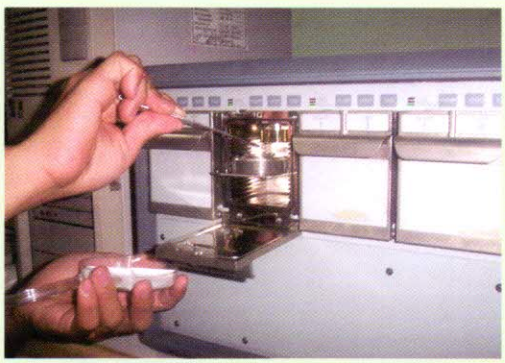
The PNRI is recognized as an IAEA/RCA Regional Resource Unit for receptor binding assay (RBA) in the East Asia and the Pacific region. RBA is a useful tool for measuring the toxicity of shellfish during the occurrence of harmful algal bloom (red tide) and for the regular monitoring of shellfish to prevent paralytic shellfish poisoning cases.

To enable the transfer of this technology to the regulatory agency, the following activities were done: (1) on-the-job training on RBA of three staff of the Monitoring Unit of the Bureau of Fisheries and Aquatic Resources who are involved in conducting the mouse bioassay; and (2) continuing RBA of samples that have been analyzed by mouse bioassay method for intercomparison purposes. Results showed data comparability.

Historical Profile of Harmful Algal Cysts and Antrhopogenic Inputs in Sediment Using Isotopic Techniques

The historical profile of harmful algal cysts in sediments is being established with the help of isotopic tracers that have undergone the same physical processes as the cysts deposited in the sediment. One such tracer is lead -210 (^{210}Pb), a naturally occurring radioactive element belonging to the uranium series. It can date sediment layers deposited in the last 100 years. This isotope can also give the sedimentation rate in the area and can assist in elucidating the sedimentation processes that may contribute to increased risk of harmful bloom occurrences.

The activities undertaken under this project were: (1) establishment of a procedure for the measurement of supported ^{210}Pb concentration by alpha spectrometry to complete the ^{210}Pb dating capability of the laboratory. The procedure is in the process of validation, (2) dating of the sedimentation cores from Malampaya Sound though no pyrodinium cyst was deposited in the sediment layer. The sedimentation rates obtained will be useful in confirming bathymetry and hydrodynamic studies in the area, and (3) validation of sedimentation rates obtained in Bolinao using cesium-137. Good agreements were obtained.



Counting of sample in an alpha spectrometer

Counting of radioactivity levels of phosphate rock samples from Philphos using HPGe detector

Radiological Assessment for Release of TENORM into the Environment

PNRI has an on-going project entitled "Management of Technologically Enhanced Naturally-Occurring Radioactive Materials (TENORM) in the Environment at the Philippine Phosphate (PHILPHOS) Fertilizer Plant in Isabel, Leyte". As part of this project, the PNRI Health Physics Research specialists continued to assess the presence of naturally occuring radioactive materials (particularly radium-226 and radium-228) in samples of phosphogypsum and phosphate rock obtained from PHILPHOS. In fertilizer production, phosphate rock is used as a raw material while phosphogypsum is considered as a waste material.

This year, analysis of three types of phosphate rock samples from PHILPHOS showed that radium-226 radioactivity level ranged from 707 to 1907 becquerel per kilogram (Bq/k) while radium-228 ranged from 9 to 70 Bq/k. For the three types of phosphogypsum samples, radium -226 activity level ranged from 513 to 935 Bq/k while radium-228 ranged from 28 to 43 Bq/k. The data generated under this project will be very useful in determining the appropriate approach for the safe management of phosphogypsum and for screening phosphate rocks with low radioactivity content. Low radioactivity phosphate rock is a safer raw material for fertilizer manufacture.

Management of CTBTO Stations in the Philippines

The PNRI is now operating and maintaining the PHP52 (RN52) radionuclide monitoring station in Tanay, Rizal. PHP52 is one of the three monitoring stations in the Philippines that form part of the International Monitoring System (IMS) of the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO).The purpose of the IMS is to detect and identify nuclear weapons explosions prohibited under the Comprehensive Nuclear Test Ban Treaty. The PHP52 station is managed by the Health Physics Research Group.

A high volume air sampler is used to collect air particulates in the atmosphere on a 24-hour basis at the PHP52 monitoring station. The air particulates collected on the filter are measured using HPGe gamma detector. Measurements are transmitted directly to the CTBTO Headquarters in Vienna, Austria via satellite communications network.

The PHP52 station was used to monitor the North Korean nuclear test bomb explosion in October. The Health Physics Research Group also did radiological surveillance of gamma radiation fallout in ten areas in Metro Manila. The data obtained in the surveillance activities supported the data from the PHP52 station that there was no gamma radiation fallout in the Philippines as a result of the North Korean nuclear weapons test.

A Germanium detector inside the CTBTO PHP52 station in Tanay, Rizal is used for counting of radioactivity levels of air filter samples.

Particulate Matter Monitoring and Source Apportionment by Nuclear and Related Analytical Techniques

PNRI continued to monitor particulate matter in the PM10 range using the Gent sampler at three sites in Metro Manila, with two stations co-located with those of the Environmental Management Bureau. Through this activity, the PNRI was able to contribute data for coarse and fine PM10 to the 2005 National Air Quality Status Report and continues to do so for the 2006 Report. The monitoring is being done to identify the major sources of air pollution and to estimate the contribution of these sources to air pollution. PNRI's unique expertise in the field of particulate matter monitoring has been recognized by a greater number of end users who sought the Institute's assistance in air pollution-related concerns. PNRI organized a training activity for PM10 monitoring in Davao City under the Energy and Clean Air Project of the United States Agency for International Development. In addition, the Institute extended assistance to the local government of Puerto Princesa, Palawan in evaluating their air samples and in providing general information on air particulate pollution.

Isotope and Chemical Techniques Application in Water Resources Management

Delineation of Recharge Zones for the Bacolod City Groundwater System. PNRI obtained preliminary information on the evolution of groundwater in Bacolod City from the result of the isotopic and chemical analyses of samples collected from different water sources in the city. The initial results from this IAEA technical cooperation project, being undertaken by PNRI in collaboration with Bacolod City Water District (BACIWA), has already been found to be useful for water resources management. The data will help BACIWA in its decision whether or not to continue the development and operation of three production wells estimated to cost around Php 6M (USD 120,000) for each well. Salinity of the water from the well indicates that a salt formation has been tapped underneath.

The following were the preliminary results of the isotopic and chemical analyses of different water sources:
(1) water chemistry of Bacolod City groundwater indicates that the groundwater is predominantly sodium-magnesium-bicarbonate (HCO_3) water; (2) recharging water becomes sodium- dominated as it travels along its path, indicating slow but active recharge; (3) salinity of shallow groundwater near the coast is due to seawater intrusion while salinity of deep groundwater in the Feliza wells is due to connate formation; (4) tritium levels in the groundwater indicate recharge before the 1950s, with some wells located near the coasts potentially receiving contribution from modern recharge, possibly from seawater or leakage from the shallow aquifer; and (5) water chemistry and stable isotope data indicate that the deep groundwater in the city comes from the same recharge but undergoes slight changes as it travels along the path. The feasible source of active recharge aside from rainfall will be the Loygoy River, a major river upstream of the production wells.

Collection of water samples and measurement of parameters from a barangay well in Bacolod City

Analysis of major ions in water by ion chromatography

Groundwater Contamination Studies from Rodriguez (Montalban) Landfill. PNRI, in collaboration with the Manila Water Company Inc,. continued its studies on the water resources of Rodriguez (formerly Montalban) and San Mateo, Rizal. Analysis of the trace element concentrations in the water samples collected from groundwater and surface water in these places showed that the trace metals, generally, were below the regulatory limit for drinking water and surface water. The data obtained from this study will serve as reference for future evaluation of effectivity of leachate management in the Montalban landfill facility.

Characterization of the stable isotopes of water from different sources (deep and shallow groundwater, surface water and leachate) showed that these water sources are isotopically distinct. The significant differences between the isotopic signatures of leachate run-off and the water sources in Rodriguez and in San Mateo would facilitate detection of contamination from leachate run-off to the surface water, and eventually, to the groundwater.

Radon Monitoring of the Valley Fault System

The PNRI, through the Nuclear Materials Research (NMR) Group, is pursuing its radon monitoring activity along the Valley Fault System (VFS), formerly known as the Marikina Valley Fault System, for possible seismic activity. The VFS is comprised of two northeasterly tending faults, the west Marikina Valley Fault (WMVF) and the East Marikina Valley Fault (EMVF). The use of radon, a naturally-occurring radioactive gas, as an earthquake precursor, is based on the positive relationship between high radon concentration and seismic activity. An impending earthquake is usually preceded by a sudden increase in radon level.

This year, 20 monitoring stations were established along the WMVF and EMVF. Radon measurements were taken in soil and groundwater. The results obtained in 2006 were relatively low which indicate the absence of subsurface activity that may indicate ground movement.

RESEARCH AND DEVELOPMENT PROJECT IMPLEMENTED IN 2006							
Title of R&D Project	Socio-Economic Objective	Project Duration		Project Leader		2006 Project Funding	
		Start	End	Name	E-mail Address	Actual Expenditures	Funding Source
1. Induction of Beneficial Mutation through Irradiation for Rice Varietal Improvement	Agricultural production and technology	1988	_[1]	Alfonso O. Grafia	aografia@pnri.dost.gov.ph	492,686.97	Own budget
2. Induction and Evaluation of Beneficial Mutation in Asexually Propagated Crops: Pineapple	Agricultural production and technology	1995	2010	Avelina G. Lapade	aglapade@pnri.dost.gov.ph	398,220.17	Own budget
3. Mutation Breeding of Priority Agricultural Crops: Ornamentals	Agricultural production and technology	1997	2010	Avelina G. Lapade	aglapade@pnri.dost.gov.ph	628,973.25	Own budget
4. Fertilizer N and Crop Residue Management in Rice-Based Cropping System in the Philippines	Agricultural production and technology	2001	2006	Faye G. Rivera	fgrivera@pnri.dost.gov.ph	433,812.18	Own budget
5. Drought Tolerance of Soybean (Glycine max L.) in the Philippines	Agricultural production and technology	2002	2007	Alfonso O. Grafia	aografia@pnri.dost.gov.ph	467,480.68	Own budget
6. The Use of Nuclear Techniques in the Assessment of Bio-N Fertilizer as Seed Inoculant for Corn	Agricultural production and technology	2002	2006	Richard M. Balog	rmbalog@pnri.dost.gov.ph	438,970.94	Own budget
7. Enhancement of Genetic Diversity in Food, Pulses and Oil Crops and Establishment of Mutant Germplasm Network	Agricultural production and technology	2002	2007	Alfonso O. Grafia	aografia@pnri.dost.gov.ph	367,591.81	Own budget
8. Enhancing Agricultural Productivity through Nuclear Technology in Mindanao	Agricultural production and technology	2003	2013	Avelina G. Lapade	aglapade@pnri.dost.gov.ph	711,717.41 $37,039.00	Own budget IAEA
9. Improvement of Sterile Male Performance of Oriental Fruit Fly, Bactrocera Philippinensis, for SIT Programmes	Agricultural production and technology	2004	2009	Glenda B. Obra	gbobra@pnri.dost.gov.ph	605,688.53 $5,000.00	Own budget IAEA
10. Improvement of Mass Rearing Methods for Oriental Fruit Fly, Bactrocera philippinensis	Agricultural production and technology	2004	2009	Sotero S. Resilva	ssresilva@pnri.dost.gov.ph	605,688.53 $5,000.00	Own budget IAEA
11. Integrated Approach for Improving Livestock Production Utilizing Indigenous Resources and Conserving Environment	Agricultural production and technology	2005	2008	Celia O. Asaad	coasaad@pnri.dost.gov.ph	719,671.93	Own budget
12. Development of Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality	Agricultural production and technology	2005	2008	Adelina D. Bulos	ambulos@pnri.dost.gov.ph	540,532.91	Own budget
13. Efficacy of Gamma Radiation for the Sterilization of American Foul Brood (AFB)	Agricultural production and technology	2006	2008	Zenaida M. De Guzman	zmdeguzman@pnri.dost.gov.ph	523,360.55 $72,620.00	Own budget IAEA
14. Radiation Modification of Natural Polymers for Biomedical and Other Applications	Protection and improvement of human health	1997	_[3]	Alumanda M. Dela Rosa	amdelarosa@pnri.dost.gov.ph	900,707.35	Own budget
15. Comet Assay: A Microgel Electrophoretic Technique for the Detection of DNA Damage and Repair in Individual Cells	Protection and improvement of human health	1998	2006	Juana S. Gregorio	jsgregorio@pnri.dost.gov.ph	501,394.53	Own budget
16. Development of Honey Wound Dressing for Health Care Management	Protection and improvement of human health	2005	2007	Zenaida M. De Guzman	zmdeguzman@pnri.dost.gov.ph	982,643.58	Own budget
17. Semi-Commercial Production of PVP-Carrageenan Hydrogel for Wound Dressing and Bedsore	Protection and improvement of human health	2006	2009	Lucille V. Abad	lvabad@pnri.dost.gov.ph	348,528.83	Own budget

18. Comparative Analysis of Locally Manufactured Cigarettes and Imported Cigarettes for Polonium-210 Content	Protection and improvement of human health	2006	2010	Ma. Teresa Y. Nazarea	mtynazarea@pnri.dost.gov.ph	889,824.23	Own budget
19. Establishment of Protocol for the Analysis of Blood By Total-Reflection X-Ray Fluorescence Spectrometry	Protection and improvement of human health	2006	2008	Lorena A. Del Castillo	ladelcastillo@pnri.dost.gov.ph	415,285.32	Own budget
20. Air Pollution Source Apportionment by Nuclear and Related Analytical Techniques	Control and care of the environment	1996	2010	Flora L. Santos	flsantos@pnri.dost.gov.ph	868,972.45	Own budget
21. Isotope Techniques Application in Water Resource Management and Protection	Control and care of the environment	1999	2008	Soledad S. Castaneda	sscastaneda@pnri.dost.gov.ph	639,726.56 289,225.00 $4,914.00	Own budget BACIWA IAEA
22. Radiological Assessment for Release of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) Into the Environment	Control and care of the environment	2003	_[4]	Ma. Teresa Y. Nazarea	mtynazarea@pnri.dost.gov.ph	834,829.65 1,190,192.00	Own budget DOST
23. PSP Toxicity Risk Assessment: Accumulation and Elimination of Saxitoxin in Green Bay Mussels Using Nuclear Techniques	Control and care of the environment	2004	2009	Elvira Z. Sombrito	ezsombrito@pnri.dost.gov.ph	638,934.82	Own budget
24. Production of Radiolabelled Compounds for Receptor Binding Assay	Control and care of the environment	2005	2007	Elvira Z.Sombrito	ezsombrito@pnri.dost.gov.ph	623,438.20 584,921.90	Own budget PCAMRD
25. Technology Transfer of Receptor Binding Assay to Regulatory Setting	Control and care of the environment	2005	2007	Elvira Z. Sombrito	ezsombrito@pnri.dost.gov.ph	403,728.53 582,715.05	Own budget PCAMRD
26. Historical Profile of Harmful Algal Cyst and Anthropogenic Inputs in Sediment Using Isotopic Techniques	Control and care of the environment	2005	2007	Elvira Z. Sombrito	ezsombrito@pnri.dost.gov.ph	391,363.58 471,068.00	Own budget PCAMRD
27. Management of CTBTO Stations in the Philippines: NDC-PH and PHP-52	Control and care of the environment	2006	_[5]	Ma. Teresa Y. Nazarea	mtynazarea@pnri.dost.gov.ph	989,898.47 1,024,080.00	Own budget CTBTO
28. Hydrogeochemical Process Studies / Environmental Surveillance	Control and care of the environment	2002	_[6]	Christina A. Petrache,	capetrache@pnri.dost.gov.ph	798,323.28	Own budget
29. Urban Waste Management	Control and care of the environment	1994	_[7]	Linda L. Leopando	llleopando@pnri.dost.gov.ph	620,907.09	Own budget
30. Dam Leakage Studies	Control and care of the environment	2001	2006[8]	Linda L. Leopando	llleopando@pnri.dost.gov.ph	503,092.73	Own budget
31. Food Irradiation	Industrial production and technology	1989	2007	Zenaida M. De Guzman	zmdeguzman@pnri.dost.gov.ph	833,257.94 13,982,874.00	Own budget DA-BPI[9]
32. Radiotracer and Sealed Sources Applications in Industry	Industrial production and technology	1986	_[10]	Linda L. Leopando	llleopando@pnri.dost.gov.ph	1,334,488.78	Own budget
33. High Technology Materials Development	Industrial production and technology	1986	_[11]	Virginia S. Calix	vscalix@pnri.dost.gov.ph	534,650.90	Own budget
34. Development and Applications of Nuclear-Based and Related Analytical Techniques	Industrial production and technology	1986	_[12]	Flora L. Santos	flsantos@pnri.dost.gov.ph	1,356,853.54	Own budget
35. Survey for Nuclear and Other Industrial Minerals	Industrial production and technology	2000	2006	Christina A. Petrache	capetrache@pnri.dost.gov.ph	1,290,137.99	Own budget
36. Development of Thermoluminescent Dosimeters health	Protection and improvement of human	2006	2009	Neil Raymund D. Guillermo	nrdguillermo@pnri.dost.gov.ph	370,850.10 1,190,192.62 $61,311.00	Own budget DOST IAEA
37. Applications of X-Ray Spectroscopic Techniques in the Characterization of Advanced Materials	Industrial production and technology	2004	_[13]	Pablo P. Saligan	ppsaligan@dost.gov.ph	552,615.03	Own budget
38. Siting Study and Nuclear Fuel Cycle	Industrial production and technology	2005	2010	Christina A. Petrache	capetrache@pnri.dost.gov.ph	1,172,150.59	Own budget

[1]Long-term to include different varieties
[2]Could be discontinued due to the scheduled shutdown of irradiation facility
[3]Long-term to explore other applications
[4]Long-term for annual monitoring
[5]Long-term as an international commitment
[6]Long-term to explore different locations
[7]Long-term for continuous monitoring
[8]Could be discontinued pending approval of assistance from external funding source
[9]For the program "Enhancing the Export Competitiveness of the Fresh Philippine Super Mangoes" which provides for the implementation of "Establishment of Radiation Dose for Quarantine Treatment of Mango Pulp Weevil,Sternochetus frigidus (Fabr.) in Philippine Carabao Mangoes; "Quality Evaluation of Philippine Super Mangoes Irradiated at Maximum Tolerable Dose"; "Upgrading of Pilot Scale Gamma Irradiation Facility"; and "Advocacy Program on Food Irradiation Technology (Luzon and Visayas)"
[10]Long-term to include different applications
[11]Long-term to explore other materials/applications
[12]Long-term to include different applications
[13]Long-term to include different applications

Provision of Quality S & T Services

Mandated to develop and regulate the safe and peaceful uses of nuclear science and technology in the country, the PNRI provided nuclear and allied services, as well as regulatory services. The Institute's clients from industry, business, academic and research institutions, hospitals and government benefited from these services.

NUCLEAR AND ALLIED SERVICES

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

(Left) The multipurpose gamma irradiation facility
(Right) The Gammacell-220

Gamma Irradiation Services

PNRI offers gamma irradiation services to various clients from industry, research institutions and schools using the Gammacell-220 and the multipurpose gamma irradiation facility.

This year, a total of 1,104 samples from 27 clients were irradiated using the Gammacell-220. Samples irradiated for mutation breeding and research purposes included the following: ornamental plants, seeds and cuttings, kamias, seeds of mangosteen, mungbean, oil crop, palay, tamarind, tomato, okra, pumpkin anthers, shallot onions, water fern, yeast solution, fruit fly pupae and mice.

A total of 7,441 samples from 57 clients (40 from industry) were irradiated at the multipurpose gamma irradiation facility. Products irradiated for industry for sterilization/ decontamination included spices and dehydrated vegetables, frozen fruits, nuts, frozen bone grafts, orthopedic implants, cosmetic raw materials and accessories, ethanol and animal feeds. Samples irradiated for research purposes were saba banana, mango (carabao variety) , bee pollen, Bio-N substrate, amnion, glass/crystal, carrageenan hydrogel wound dressing, hemostat and injectable gel.

Preparation of samples prior to irradiation

A staff from the Radiation Protection Services sets up a survey meter for response tests and calibration at the PNRI Secondary Standards Dosimetry Laboratory.

Radiation Protection Services

The PNRI, through the Radiation Protection Services, provided the following services to authorized users of radiation and radioactive materials in medical, industrial and research institutions throughout the country: (1) monitoring of radiation exposures of 8,119 personnel from various institutions through the national film badge and thermoluminescent dosimetry services; (2) calibration of 628 radiation protection instruments at the PNRI Secondary Standards Dosimetry Laboratory; (3) leak testing of 217 sealed radiation sources; (4) collection and management of 28 disused radiation sources ; 6 cubic meters solid wastes; and 93 liters liquid wastes generated by licensed users of radioctive materials all over the country; and (5) other services such as radiation hazards evaluation of radiation facilities. 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.

Computer Services

The Fiber Optics Group composed of the Computer Services staff and personnel from other PNRI units completed the fiber optics Local Area Network (LAN) connection of most of the Institute's buildings to the PNRI network and the internet. The Computer Services accomplished the following: (1) improved and enhanced the PNRI webmail; (2) enhanced, maintained and managed the PNRI website and intranet; (3) completed the 'new look' of the ASEAN Nuclear Safety Network (ANSN) Philippine National Center website; (4) set-up a 'Help Desk' which assists employees with various computer-related (software and hardware) problems; (5) set up wireless LAN / Internet connections in the Administration building and Atomic Research Laboratories; and (6) continued its participation in the DOST Tests, Analyses and Calibration Information System (TACIS) project. This project aims to provide interactive services which immediately and efficiently addresses queries and concerns on testing, analysis and calibration services through the internet.

Engineering Services

The PNRI, through the Engineering Services Group, fabricated four radiation survey meters for the Philippine Ports Authority using parts and components provided to the Institute by the client. The estimated total cost of the fabricated survey meter, including the Php 5,000 PNRI service fee for each survey meter, is Php 40,000. The cost of survey meters, which are manufactured abroad, range from Php 80,000 to Php120,000 each.

The Group also provided support in the decommissioning of two nuclear facilities: a nuclear thickness gauging machine at Reynolds (Philippines) Corporation in Dasmariñas, Cavite, and a Cobalt-60 Radiotherapy Unit at Hermano (San) Miguel Febres Cordero Medical Education Foundation, Inc.at Dela Salle University, Dasmariñas, Cavite.

In support of the PNRI research and service activities, the following were also completed: (1) 77 jobs on the repair of nuclear instruments for PNRI and non-PNRI clients, mostly from the medical and industrial sectors and (2) 81 repair jobs and 29 fabrication work of equipment and facilities used for nuclear research and training.

Cytogenetic Analysis

The PNRI, through the Cytogenetics Group, extended the following services: (1) determination, through blood sample analyses, of the radiation exposure of two workers who work in a radiation facility abroad; (2) determination/ confirmation of the presence or absence of genetic disorder (Down Syndrome) in five newborn babies. These PNRI clients were referred to PNRI by doctors and medical officers from hospitals and medical centers.

Nuclear-Based Analysis

Analytical services involving nuclear and related techniques were provided by the PNRI's Analytical Measurements Research Group (AMRG) and the Applied Physics Research Group (APRG) to a total of 83 clients.

The AMRG provided the following services: (1) determination of radioactivity in food products and water as basis for certifying to conformance to standards of non-radioactivity. Gammametric analysis was used for the food product samples (consisting of milk, seafood, pre-mixed baking products, fruit flavors and juices, coconut carrageenan, tobacco) and for the environmental samples while gross alpha-beta analysis was used for the bottled water and well water samples; (2) evaluation of vinegar for acetic acid adulteration by carbon-14 assay; (3) particulate mass determination of air as a collaborative activity with UP-Natural Sciences Research Institute; (4) elemental analysis of samples such as paint shavings, soil, air particulate; and (5) other services using the liquid scintillation counter.

The APRG determined the characteristics, composition and structural form of different samples using X-ray diffraction (XRD), X-ray fluorescence (XRF) and total reflection X-ray fluorescence (TXRF). Samples analyzed by XRF and TXRF include gemstones, seashells, rice hull, ash, airborne dust and particulates, and carrageenan foams. Through the use of XRD, the structural form of elements in the following samples was determined: sediments, clay, thin films, shells, limestones, PVC pipe and gemstones.

Regulatory Services

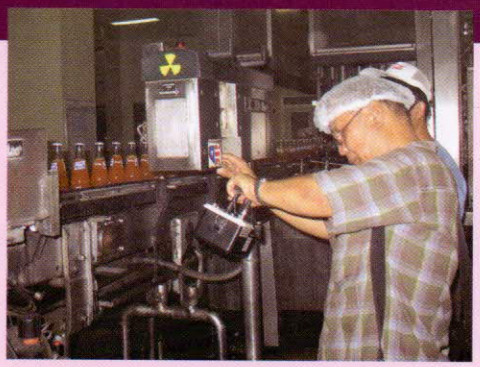
The PNRI, as mandated by law, promulgates and enforces nuclear regulations to ensure that the use of radioactive materials is carried out safely and in accordance with international safety standards and best practices. An effective regulatory control program is firmly established such that the use of radioactive materials for peaceful applications would not pose unnecessary risk to the general public, to patients subjected to diagnostic and therapeutic procedures involving the use of radioisotopes, and to workers occupationally exposed to radiation.

Pre-licensing verification inspection of a fumehood in a commercial facility

Licensing Review and Evaluation

The Licensing Review and Evaluation Section (LRES) evaluates applications for radioactive material licenses and various submissions for purposes of determining compliance to regulatory requirements, among others. On the basis of their evaluation and recommendation, PNRI issued a total of 310 radioactive material licenses (21 new, 250 renewed and 39 amended) to the following: (1) 40 commercial establishments to engage in the sale and distribution of radioactive materials; (2) 81 clinics and hospitals to use radioactive materials in the diagnosis and treatment of diseases; (3) 168 companies/ institutions for industrial purposes such as industrial radiography, level gauging, thickness gauging, among others; (4) 21 institutions for research purposes; (5) and one medical accelerator. A total of 424 Evaluation Reports and 208 response letters were prepared for this activity. The distribution of licensees according to regions in the Philippines and categories of practices is shown on page 23. Pre-licensing verification inspection activities were also conducted to confirm the applicant's and licensee's commitments in license applications.

The PNRI also issued 503 Certificates of Release to the Bureau of Customs to ensure that shipments of imported radioactive materials are released only to PNRI licensed users and/or suppliers.



Radiation monitoring of a nuclear level gauge installed at the bottling line of Coca-Cola Bottlers Phils., Inc., a PNRI licensee.

Inspection and Enforcement

The Inspection and Enforcement Section (IES) conducted scheduled regulatory inspections and audit of 165 licensed radioactive materials and facilities and carried out unannounced inspections of two radiography companies and two hospitals. These inspections were done to verify licensees' compliance with PNRI regulations and specific requirements relative to safety and security of radioactive sources. Eighty-eight evaluation reports were generated from the licensee's proposed corrective actions on the items of non-compliance found and reported by PNRI inspectors during the scheduled inspections.

Upon the recommendation of the IES, the PNRI issued "Notices of Violation" and "Cease and Desist Orders" to three licensees who have been reported to have serious non compliances to regulatory safety requirements. Follow up inspections to verify the implementation of corrective measures to address the non compliances were undertaken which finally resulted in the lifting of the regulatory enforcement actions. The PNRI also issued a total of 2,657 "Authority to Transport" Certificates to licensees for the transport of radioactive materials to authorized locations in the country and for the shipment of disused sealed sources back to the original supplier and/or foreign consignees.

Standards Development

The PNRI continued to develop regulations, standards, guides and bulletins to further enhance its nuclear regulatory functions and to highlight the safety and security requirements in the use of nuclear materials. For this year, the PNRI, through the Standards Development Section (SDS), developed and facilitated the publication of two Codes of PNRI Regulations (CPR) and three Administrative Orders (AO) in the Official Gazette. The two CPRs are: CPR Part 25, "Licenses for Commercial Providers of Nuclear Technical Services" and CPR Part 22, "Fees and Charges for Radioactive Material Licenses and Other Related Regulatory Services". The AOs are: AO No. 1 Series of 2006, "Amendment of Administrative Order No. 1, Series of 1994, "Establishing the Code of PNRI Regulations"; A.O. No.2, "Adoption of IAEA Code of Conduct on the Safety and Security of Radioactive Sources, IAEA Guidance on the Import and Export of

Radioactive Sources"; and A.O. No. 3, "Amendments to CPR Part 22".

SDS also continued to develop and compile INFOPACs (Information Packages) consisting of the regulations, regulatory guide and model procedures for four CPRs, namely, (1) CPR Part 13, " Licenses for the Medical Use of Radiopharmaceuticals"; (2) CPR Part 17, "Licenses for Commercial Sale and Distribution of Radioactive Materials"; (3) CPR Part 18, "Licenses for Use of Radioactive Material in Research and Education"; and (4) CPR Part 19, "Licenses for Use of Radioactive Material in In-Vitro Clinical and Laboratory Testing".

Safeguards and Security

The PNRI, through the Safeguards Section (SGS), managed the implementation of the Megaports Initiative Project which is being implemented under the Second Line of Defense Program of the United States. This project involves the installation of radiation detection system at the Ports of Manila, among others. The activities undertaken for this project were the following: (1) conduct of surveys vital to the construction and installation of the radiation detection system such as engineering, communications and background radiation; (2) drafting of the Memorandum of Agreements (MOAs) between the implementing agencies such as the PNRI; Bureau of Customs; Philippine Ports Authority; Asia Terminal, Inc.; and Manila International Container Terminal; and (3) drafting of the Training Management Plan which aims to establish a sustainable competency necessary to operate the radiation detection system.

Survey of background radiation is one of the activities undertaken under the Megaports Initiative Project.

DISTRIBUTION OF LICENSED USERS ACCORDING TO GEOGRAPHICAL LOCATION AND CLASSIFICATION AS OF DECEMBER 2006

REGION	MATERIAL LICESEES				FACILITY LICENSEES		TOTAL
	Commercial	Medical	Industrial Radiography	Research	Industry	Radiation Producing Accelerator	
I					1		1
II		1					1
III		6	1	1	25		33
IV	1	5	1	2	39		48
V					3		3
VI		4		1	4		9
VII		6		2	5		13
VIII					2		2
IX		1			3		4
X					6		6
XI		4			3		7
XII				1	2		3
XIII *(Caraga)*					3		3
CAR		2		1	3		6
ARMM							
NCR	39	52	21	13	46	1	172
TOTAL	40	81	23	21	145	1	311

As part of the PNRI project on security upgrades of critical infrastructures being funded under the Radiological Threat Reduction Program of the United States, the installation of the access control/daily time record system at the PNRI main gate was completed in December. The system will use biometric identification and key badge for access control.

The SGS prepared three accounting reports for submission to the IAEA following the annual conduct of physical inventory verification inspections at the Philippine Research Reactor (PRR-1) and the Bataan Nuclear Power Plant (BNPP)

Radiological Impact Assessment

The Radiological Impact Assessment (RIA) Section assessed the potential public health and safety concerns involving the reported loss of two rods containing Cesium -137 pellets. These pellets were used in conjunction with a nucleonic device employed by a PNRI licensee as a mould level controller in the steel industry. Possible internal and external exposure scenarios to an individual resulting from possible direct contact with these radioactive sources were determined and evaluated. The PNRI regulatory group used the assessment results in recommending appropriate regulatory actions by the PNRI.

In support of the internal regulatory control program of the PNRI, the RIA Section was actively involved in the preparation of the Standard Review Plan and evaluation and review of the Inspection Checklist, including the regulatory guide for PNRI facilities. The Section also completed evaluation of application for authorization of the Research Reactor and the Radioactive Waste Management facilities of the PNRI. Identification of three facilities that were recommended for exemption from regulatory control was completed.

The meteorological characterization around the PNRI site has been updated. The data and information were used in the risk assessment involving atmospheric dispersion of radionuclide releases for PNRI facilities.

Radiological Emergency Planning and Preparedness

The Radiological Impact Assessment (RIA) Group continued to coordinate activities of the IAEA model project on radiological emergency response. These activities include the conduct of awareness seminars, lectures and drills/ exercises on radiological emergency preparedness and management/response for first responders and personnel of PNRI. As part of the continuing activities to implement the National Radiological Emergency Preparedness and Response Plan (RADPLAN), the PNRI participated in international emergency exercises (CONVEX) under the two international conventions on Early Notification of a Nuclear Accident and on Assistance in the Case of Nuclear Accident or Radiological Emergency. The national component of the CONVEX 2b exercise was also conducted with the participation of selected RADPLAN- implementing agencies such as the Office of Civil Defense/National Disaster Coordinating Council, PAGASA , Department of Interior and Local Government, Department of Environment and Natural Resources, Philippine National Police, and Department of Health. These exercises involved the exchange of messages in response to a radiological emergency scenario.

The PNRI also participated in two communication exercises conducted by the IAEA Incident and Emergency Center, namely: ConvEX 1a Exercise on Feb. 07, 2006 in conformity with the Emergency Preparedness and Response, IAEA EPR-ENATOM 2004; and Convex 2a Exercise on 23 August 2006

IAEA/RCA Project on Assessment of Radiological Risks Regional Advisory Committee Meeting in China on December 2006.

in conformity with the Proposal for a Revised Convention Exercise Regime. A parallel PNRI emergency drill was also conducted in conjunction with the participation of the country in CONVEX 2b wherein the members of the PNRI Emergency Organization took respective roles to respond to a pre-designed emergency scenario.

To test the PNRI emergency response organization and activation procedures, the following training events, drills and exercises were conducted: General Awareness Seminar followed by Emergency/Evacuation Exercise; PNRI Fire and General Evacuation Exercise; Building Earthquake Emergency/ Evacuation Drill; Emergency Management Workshop for Leaders of Emergency Organization; Radiation Sources Search Methods Workshop; and Equipment Familiarization Workshop.

Practical training exercise for PNRI emergency responders on detecting/ searching for radioactive sources using the new radiation detection equipment acquired under US DOE project

Regulatory Infrastructure Support (RIS) Program

The Comprehensive Nuclear Bill which was initially drafted by PNRI in 2005 has been revised after the conduct of a series of meetings, awareness seminar and following the second review of the revised draft by an IAEA Mission. The draft bill proposes the integration of the regulatory functions of the present PNRI and the Bureau of Health Devices and Technology of the Department of Health and the separation of these functions from the promotion activities of both organizations through the creation of a new regulatory agency. This regulatory agency is being proposed not to be placed under the Department of Science and Technology nor the Department of Health but possibly under the Office of the President to address the issue of effective independence of the regulatory from the promotional activities of both organizations.

The drafting of the Comprehensive Nuclear Bill and several other related activities are being implemented by PNRI under the general framework of the Radiological Threat Reduction

Representatives from Australia, the Philippines and the United States Department of Energy during the Regional Security of Radioactive Sources Project – Regulations Working Group Meeting in Sydney, Australia, June 2006.

Program of the US Department of Energy in cooperation with the Australian Nuclear Science and Technology Organization Regional Project on Security of Sources. Under the program, all PNRI specific activities and tasks in the different projects, including those involving other national agencies and license holders are coordinated and facilitated by the Nuclear Regulations, Licensing and Safeguards Division of PNRI.

Revisions of CPRs - Activities undertaken under this program were the drafting of a new CPR Part 26 " Security of Radioactive Sources" and revision of five CPRs directly concerning Category 1, 2, and 3 sources; namely, (1) CPR Part 11, "Licenses for Industrial Radiography and Radiation Safety Requirements for Radiographic Operations"; (2) Part 12 "Licenses for Medical Use of Sealed Radioactive Sources in Teletherapy"; (3) Part 14 " Licenses for Medical Use of Sealed Radioactive Sources in Brachytherapy"; (4) Part 15 "Licenses for Large Irradiators"; and (5) Part 16 "Licenses for the Use of Sealed Sources Contained in Industrial Devices". The review and revision of the five CPRs were done to ensure that security requirements are consistent with the new CPR Part 3 "Standards for Protection Against Ionizing Radiation", the IAEA Code of Conduct on the Safety and Security of Radioactive Sources, the Additional Guidance on Export and Import of Radioactive Sources, and the Categorization of Sources. Regulatory conferences participated in by PNRI licensees and concerned stakeholders were organized, facilitated and conducted to present the revised CPRs for their comments feedbacks and further need for clarifications. All comments were reviewed and addressed as appropriate, in the subsequent revision and finalization of the CPRs for approval of the PNRI Director.

The draft Code of PNRI Regulations Part 26 "Security of Radioactive Sources" was reviewed and finalized following the Experts and Regulatory Review Meeting held in Sydney, Australia in June 2006. A Regulatory Guide explaining how the licensees can comply with the various provisions of Part 26 was also prepared. The PNRI Director approved CPR Part 26 which was scheduled for publication in the Official Gazette in January 2007.

Typical rig set up

Site Selection and Conceptual Design of a Low to Intermediate Radioactive Waste Disposal Facility in the Philippines

The PNRI and its collaborating agencies, with the assistance of a team of private consultants, conducted a more detailed investigation on a preferred site. This investigation was undertaken to support and confirm the selection of the site, to provide the required information for preliminary safety and environmental impact assessment, and to develop the conceptual design of the proposed facility. The detailed investigation gave strong emphasis on the conduct of tests and observations in five deep boreholes which were drilled at different depths depending on the depth to groundwater. The tests conducted were: (1) Standard Penetration Tests in soft overburden materials, at every one meter interval in soil and weathered rock layers, and (2) permeability tests performed on all boreholes generally at every five-meter intervals to determine the permeability of the rock.

PNRI used the updated information from the site, in conjunction with the groundwater sources accounting model, in constructing a preliminary groundwater flow model. The GMS-MODFLOW computer software package from IAEA was used in constructing the model.

In the development of the conceptual repository design, the following activities were undertaken: (1) updating of information on projected waste inventory (currently in store and from the expected radioactive waste arising from the planned dismantling and decommissioning of the Philippine research reactor and existing regional data, (2) initial modeling of the fate and transport of potential contaminants to the environment using the AMBER computer software from IAEA. Scoping calculation was performed for selected contaminants and potential doses to humans from groundwater were estimated, and (3) preliminary safety assessment for selected radionuclides arising from the decommissioning of the research reactor, volumes, design and data generated from the site characterization study. The radiological impact from the groundwater and river pathways was analyzed and found to be negligible.

Internal Regulatory Control Program

An internal regulatory control program for PNRI facilities and laboratories was developed and implemented in 2004 through PNRI Office Order 002, as amended. This program was developed in the interest of public health and safety and to ensure the PNRI workers' safety and security in the workplace. Prior to the implementation of the internal regulatory control program, PNRI facilities and laboratories have never been subjected to compliance monitoring of safety standards, rules and regulations. One of the provisions of Republic Act 5207, the Act which created PAEC (precursor of PNRI), is that PNRI facilities are exempted from regulatory control since PNRI is the national regulatory body for radioactive material use in all fields of application.

A task force was constituted to implement an action plan indicating the important milestones towards achieving an overall goal that all PNRI radiation facilities and laboratories will be authorized at the end of 2006. The following were among the major accomplishments undertaken for the internal regulatory control program: preparation of specific regulatory requirements and procedures, development of standard review plans for the evaluation of applications of PNRI facilities and laboratories, evaluation of applications, authorization of seven facilities/laboratories, and exemption of three laboratories from regulatory requirements after evaluation of their applications and through verification inspections.

S & T Linking and Networking

As national focal agency for matters regarding nuclear science and technology, PNRI maintained and strengthened its cooperative programs with both local and international organizations. This is to further advance the conduct of research and development activities in various areas; to enhance the regulatory function of the Institute; and to better promote the beneficial uses of nuclear science and technology in the Philippines.

LOCAL Among the PNRI project collaborators for the year were the following: Philippine Council for Aquatic and Marine Research and Development; Philippine Council for Industry and Energy Research and Development; Bacolod City Water District; Bureau of Plant Industry, Department of Agriculture; Bureau of Soils; Bureau of Fisheries and Aquatic Resources; University of the Philippines (UP)-Los Baños; UP-Marine Science Institute; Manila Water; and Energy and Clean Air Project/USAID.

FOREIGN The following are the international partners of PNRI in nuclear science and technology development:

- International Atomic Energy Agency (IAEA), Vienna, Austria
- Regional Cooperative Agreement (RCA) for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific, Vienna, Austria
- Forum for Nuclear Cooperation in Asia (FNCA), Japan
- Comprehensive Nuclear Weapon Test Ban Treaty Organization (CTBTO), Vienna, Austria
- Australian Nuclear Science and Technology Organization (ANSTO)

Collaborative links that facilitate the transfer of technology information and expertise were maintained such as those with the following agencies/institutions:

- United States Department of Energy
- United States Department of Agriculture
- Ministry of Science, Technology, Education Culture and Sports of Japan
- Nuclear Safety Research Assocation of Japan

PNRI Director Dr. Alumanda M. dela Rosa presents the accomplishments of PNRI to participants of the FNCA 2006 Workshop on the Utilization of Research Reactors.

Through its ties with international institutions and nuclear science and technology organizations in other countries, the PNRI was able to avail of the following: five IAEA research contracts amounting to Php 1,930,500.00; eight IAEA technical cooperation projects equivalent to Php 20,005,867.00; the service of 27 foreign experts/ mission delegates; and 148 fellowships and travel grants for PNRI and non-PNRI personnel. Ten international events were also hosted by the Philippine Government through the PNRI. (See Appendices, pages 34-42).

Development of S & T Human Resources

The continuous development of human resources in the field of nuclear science and technology is one of the major programs of the PNRI. Several activities were conducted in support of this program.

Local This year, the PNRI, through the Nuclear Training Center, conducted 34 nuclear training courses for 703 professionals from different government and private agencies/ institutions (see page 7). For PNRI's nuclear manpower development in the undergradute level, a total of 56 students were given on-the job training in the different laboratories and facilities of the Institute and 18 students were accepted for thesis advisorship. (see page 6).

PNRI personnel were also provided with the opportunity to participate in 38 locally-sponsored/conducted training courses, seminars, workshops, meetings, symposia in support of the PNRI manpower development program in nuclear science and technology (see pages 43-44).

Under the PNRI Graduate Program, the Institute continued to support 6 of its personnel availing of local (DOST) and foreign graduate scholarships (3 PhDs and 3 MS degrees). Support was also extended to 13 PNRI staff who are pursuing graduate studies on their own. (3 PhDs, 10 MS and MA degrees) Please see Table 9 on page 44 for list of PNRI personnel pursuing graduate studies).

Foreign Through its linkages with international organizations and nuclear science and technology institutions in other countries, PNRI was able to avail of 148 training/fellowsip grants for PNRI staff and non-PNRI personnel. Fellowship grants ranged from on-the-job training to attendance at training course, seminars/workshops/ and scientific visits. (See Appendices, Tables 6 and 7 on pages 37-42).

PNRI Recognition Award Best Employee for 2005

Grace M. Carlos
Planning Officer II • Office of the Director, PNRI

Special Commendations

Certificates of Recognition for exemplary performance of duties in their respective units

- **Guiseppe Filam O. Dean**
  Inspection and Enforcement Unit • Nuclear Regulations, Licencing and Safeguards Division (NRLSD)
- **Lynette B. Cayabo**
  Licensing Review and Evaluation Unit • NRLSD

Fellowship training of three PNRI researchers at the Australian Nuclear Science and Technology Organization.

DOST Undersecretary Fortunato T. dela Peña, guest speaker for the AEW Closing ceremonies, awards the Certificate of Commendation to Grace M. Carlos. Looking on are PNRI Director Almanda M. dela Rosa (2nd from right) and PNRI Deputy Director Corazon C. Bermido (extreme right).

- **Ma. Celestina V. Honrado**
  Chemistry Research Unit • Atomic Research Division (ARD)
- **Kristine Marie D. Romallosa**
  Radiation Protection Services • Nuclear Services and Training Division (NSTD)
- **Arthur F. Salih**
  Engineering Services • NSTD
- **Hilarion E. Mamaril**
  Agricultural Research Unit • ARD
- **Erlinda M. Bague**
  Radiation Protection Services • NSTD
- **Ernesto I. Ventura, Jr.**
  General Services Unit • Finance and Administrative Division (FAD)

TECHNOLOGY COMPETITION AWARD

- **First Prize**
  "High Value Product from Modified Carrageenan"

First Aquatic Technology Competition launched by the Philippine Council for Aquatic Research and Marine Development (PCAMRD) with a Php100,000 cash prize and a trophy.
— January 31, 2006

Project Team:
Lucille V. Abad - Senior Science Research Specialist
Lorna S. Relleve - Senior Science Research Specialist
Charito T. Aranilla - Science Research Specialist II
and **Almanda M. dela Rosa, Ph.D.**- Director IV
(Scientist IV\CESO IV)

DISTRIBUTION BY PERSONNEL	
BY GENDER	
Male	110
Female	126
	236*
BY STAFF CATEGORY	
Managerial	5
Technical	172
Administrative	59
	236
BY EDUCATION	
Ph.D.	5
MS\MA	30
BS\BA	153
Below BS	48
	236
BY STAFF CATEGORY	
Research & Development	78
S & T Services	59
S & T Education	6
Regulatory	27
Administrative	66
	236

PROFILE OF R&D PERSONNEL BY POSITION IN 2006		
CATEGORY	NUMBERS	% DISTRIBUTION
TOTAL NUMBER OF R&D PERSONNEL	78	33.1%
BY POSITION		
Scientists and Engineers	60	76.9%
Technicians	7	9.0%
Auxiliary Personnel	11	14.1%

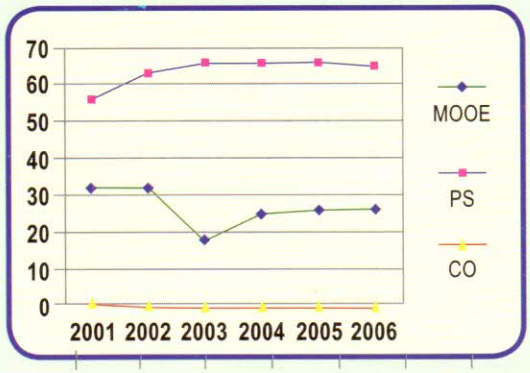
PROFILE OF SCIENTISTS AND ENGINEERS		
CATEGORY	NUMBERS	% DISTRIBUTION
TOTAL NUMBER OF R&D PERSONNEL	60	76.9%
BY SEX		
Male	21	35.0%
Female	39	65.0%
BY AGE GROUP		
20 years old and below	—	0%
21-30	7	11.7%
31-40	11	18.3%
41-50	18	30.0%
51-60	17	28.3%
61 years old and above	7	11.7
BY EDUCATIONAL ATTAINMENT		
PhD	4*	6.6%
MS\MA	19	31.7%
Post BS\BA	19	31.7%
BS\BA	17	28.3%
Post High School	1	1.7%
BY FIELD OF RESEARCH		
Natural Sciences	42	70.0%
Engineering and Technology	7	11.7%
Agricultural Sciences	9	14.9%
Medical Sciences	1	1.7%
Social Sciences	1	1.7%

* Includes two (2) personnel on detail from DOST

FINANCIAL STATEMENTS

INCOME FROM PNRI SERVICES • 2006		
NUCLEAR AND ALLIED SERVICES		
Name of Service	**No. of Clientele Served (Institutions)**	**Income Generated (in Pesos)**
Gamma Irradiation Services	85	1,051,699.00
Radioisotope Dispensing Services (Sale of radioactive sign stickers, use of dose calibrator diagnostic instrument)	1	26,260.00
Radiation Protection Services		
▪ Personnel Monitoring		
- Film badge service	2,491	10,816,404.50
- Thermoluminescent dosimetry	77	
▪ Calibration of Radiation Detection Instruments		
- Survey meter	268	740,173.00
- Pen dosimeter	66	
- Contamination meter	22	
- Dose calibrator	8	
- Teletherapy output calibration	1	
▪ Radiation Control Services		
- Leak testing of sealed radioactive sources	27	342,350.00
- Radiological support for non-PNRI clients and hazard evaluation	6	28,300.00
▪ Radioactive Waste Management		
- Solid waste	7	234,400.00
- Liquid waste	10	
- Spent sealed sources	7	
- Teletheraphy source	1	
▪ Special Services		
- Rental of survey meter	80	152,525.00
- Swipe sample counting	92	256,998.00
Engineering Services		
- Repair of nuclear instruments	26	13,900.00
- Decommissioning of radiation facilities/ equipment	2	286,900.00
- Assembly of survey meter	1	20,000.00
Analytical Services (Analytical Measurements Research Unit)		
- Gross alpha-beta analysis of water samples	51	1,080,314.00
- Gammametric analysis		
- Elemental analysis by X-ray Fluorescence Spectrometer (XRF)		
- Vinegar adulteration		
- Mass determination (air filters)		
- Other services such as use of the Liquid Scintillation Counter (LSC)		

TREND OF PNRI BUDGET 2001-2006



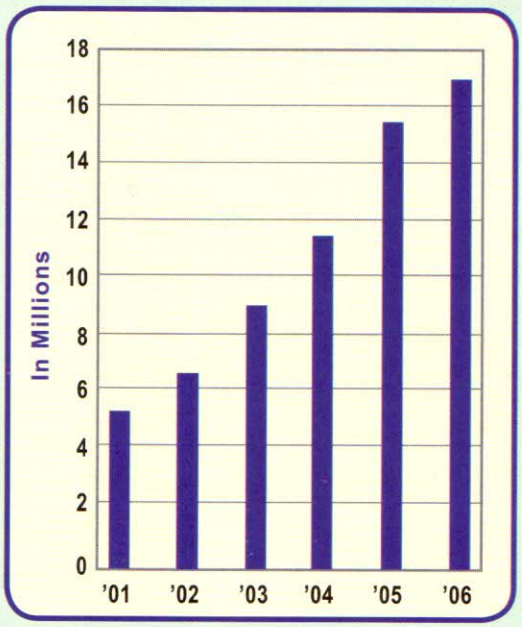
PS (Personnel Services), MOOE (Maintenance and Other Operating Expenses) and CO (Capital Outlay)

cont. **INCOME FROM PNRI SERVICES • 2006**

NUCLEAR AND ALLIED SERVICES

Analytical Services (Applied Physics Research Unit)		
- Elemental and trace element analysis using X-ray Fluorescence (XRF) and Total-Reflection X-Ray Fluorescence(TXRF) spectrometry	10	151,460.00
- Structural analysis using X-ray Diffraction (XRD) spectromet22		
Cytogenetic Service/Microscopy Services	14	15,020.00
Microbiological Tests		
- Bioburden Analysis	7	21,600.00
- Sterility Test and total plate count	11	60,600.00
- Sale of Amnion Dressing	27	16,350.00
		Sub-total: Php 15,315,253.50
NUCLEAR REGULATORY SERVICES		
Licensing Review and Evaluation		
▪ Licensing Fees	310	695,895.00
▪ Certification of Release (shipments of radioactive material)	11	115,800.00
Inspection and Enforcement		
▪ Inspection fee	165	562,410.00
▪ Authority to Transport Fee	52	530,800.00
Standards Development		
▪ Sale of CPR (Code of PNRI Regulation) Compilation for Specific Parts and Infopacs (Information Packages)	59	5,690.00
		Sub-total: Php 1,910,595.00
OTHER MISCELLANEOUS INCOME		**Sub-total: Php 22,700.00**
		GRAND TOTAL: Php 17,248,548.50

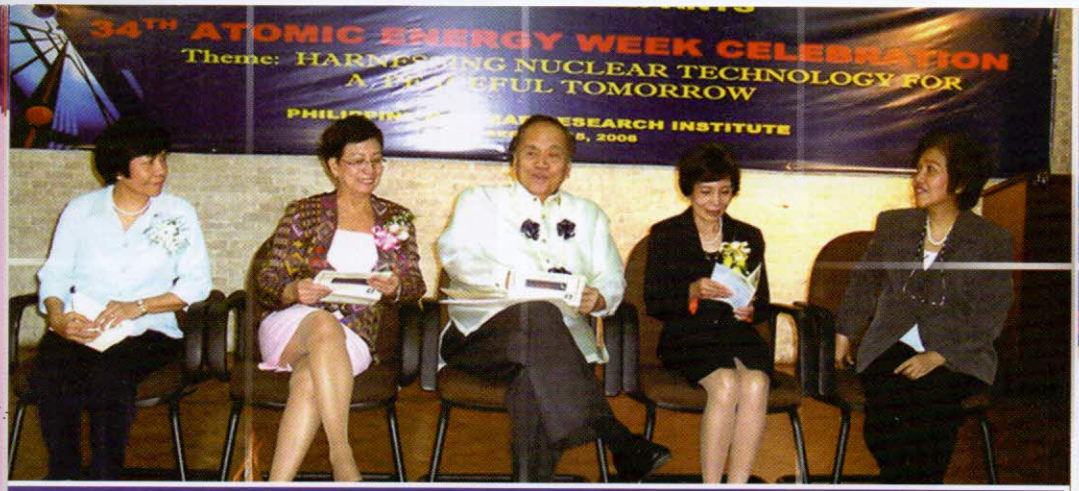
INCOME 2001-2006



ADDITIONAL RESOURCES GENERATED FROM EXTERNAL SOURCES IN 2006

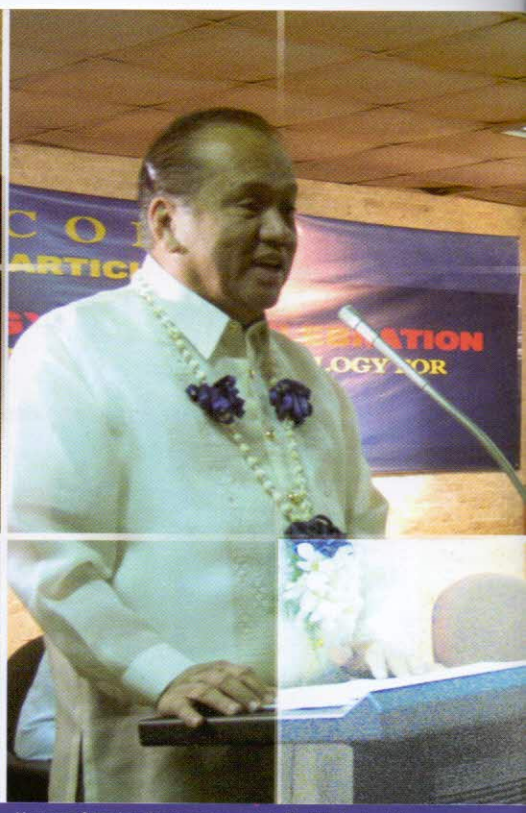
GRANT	AMOUNT
Local	Php 8,278, 921.00
Foreign	
Cooperation Agreements	32,793,273.00
IAEA Technical Cooperation Projects	20,005,867.00
IAEA Research Contracts	975,000.00
	TOTAL: Php 62,053,061.00

Note: See Appendices, Table 11 on page 46 for list of grants.



Ms. Estelita G. Cabalfin (extreme left) 2006 AEW Executive Committee Chairperson, together with DOST Secretary Estrella F. Alabastro, Congressman Luis R. Villafuerte, PNRI Director Alumanda M. dela Rosa and PNRI Deputy Director Corazon C. Bernido at the AEW opening ceremonies.

DOST Secretary Estrella F. Alabastro delivers her message



Keynote Speaker Congressman Luis R. Villafuerte, Vice Chairperson, Committee on Appropriations and Sub-committee on Science and Technology

34TH ATOMIC ENERGY WEEK CELEBRATION

Harnessing Nuclear Technology for a Peaceful Tomorrow

11-15 December 2006

The AEW exhibits on nuclear research, service and regulatory activities of PNRI

Radioactive source hunting

Exhibit viewers' quiz

Tour of PNRI facilities

Lecture series on nuclear science

Geoferson Cimaggala of General Aguinaldo High School with his poster that won the first prize

On-the-spot poster making contest for high school students in Quezon City

DOST Undersecretary Fortunato dela Peña, guest speaker at the closing ceremonies

AEW Special Awards

Creativity Award
"OH I SEE AWARD" for the Over-All look of the PNRI AEW Exhibit.

- **Reynaldo V. Pedregosa**
  Isotope Techniques Research Group, Atomic Research Division (ARD)

Best Tour Guide
"HAPPY FEET AWARD"

- **Raymond J. Sucgang**
  Analytical Measurements Research Group (AMRG), ARD
- **Ryan P. Morco**
  AMRG, ARD
- **Joseph Michael D. Racho**
  AMRG, ARD

APPENDICES

TABLE 1. LIST OF IAEA RESEARCH CONTRACTS* IMPLEMENTED IN 2006

CLIENT		TITLE/DESCRIPTION OF RESEARCH	PROJECT DURATION		NAME/E-MAIL OF RESPONSIBLE AGENCY STAFF	PROJECT COST (in Pesos)
Name of Business/Organization	Name/Tel. No./ E-mail of Contact Person		Start	End		
IAEA	Teresa Benson Tel:(431) 2600-21568	Improvement of Sterile Male Performance of Oriental Fruit Fly, *Bactrocera philippinensis*, for SIT Programs	9-15-2006	9-14-2007	Glenda B. Obra gbobra@pnri.dost.gov.ph	325,000.00
IAEA	Teresa Benson Tel: (431) 2600-21568	Improvement of Mass Rearing Methods for *Bactrocera philippinensis*	11-15-2006	11-15-2007	Sotero S. Resilva ssresilva@pnri.dost.gov.ph	325,000.00
IAEA	Teresa Benson Tel:(431) 2600-21568	Use of Open Source Web Development Tools in Improving the Nuclear Knowledge Portal for the PNRI	9-15-2006	9-14-2007	Ana Elena L. Conjares aelconjares@pnri.dost.gov.ph	325,000.00
IAEA	Teresa Benson Tel:(431) 2600-21568	Molecular Marker Techniques for Selection of Mutant Banana with Improved Post-harvest Qualities	10-15-2006	10-14-2007	Emma Sales -University of Southern Mindanao	520,000.00
IAEA	Teresa Benson Tel:(431) 2600-21568	Evaluation of a Simplified Method of Perfusion Only Lung Scan Compared to Standard V/Q and Spiral CT in Patients with Pulmonary Disease	10-15-2006	10-14-2007	Gerard Fabian Goco St. Luke's Medical Center	435,500.00

TOTAL: Php 1,930,500.00

* IAEA 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. (Grants received from the IAEA in Euro currency; Conversion: Euro 1= Php 65.00).

TABLE 2. IAEA TECHNICAL COOPERATION PROJECTS* IMPLEMENTED IN 2006

NAME OF IMPLEMENTING AGENCY	NAME/TEL. NO./E-MAIL OF CONTACT PERSON	TITLE/DESCRIPTION OF RESEARCH	PROJECT DURATION		PROJECT COST (in Pesos)
			Start	End	
PNRI	Alumanda M. dela Rosa,PhD amdelarosa@pnri.dost.gov.ph	Human Resource Development and Nuclear Technology Support	2003	2006	2,793,637.00
PNRI	Avelina G. Lapade aglapade@pnri.dost.gov.ph	Enhancing Agricultural Productivity Through Radiation Technology in Mindanao	2003	2006	1,814,911.00
PNRI	Ma. Visitacion B. Palatao mvbpalatao@pnri.dost.gov.ph	Site Selection and Conceptual Design of a Near-Surface Disposal Facility for Low and Intermediate Level Radioactive Waste	2003	2006	3,063,186.00
PNRI	Adelina dM Bulos admbulos@pnri.dost.gov.ph	Assessment of Erosion and Sedimentation Processes for Effective Formulation of Soil Conservation and Water Quality Protection Measures	2005	2006	3,004,239.00
PNRI	Flora L. Santos flsantos@pnri.dost.gov.ph	Nuclear Analytical Techniques for Evaluation of Airborne Pollution from Fossil Fuel-Fired Power Plants	2005	2006	3,558,380.00
PNRI	Soledad S. Castañeda sscastaneda@pnri.dost.gov.ph	Isotope Applications in Improving Water Resource Management and Protection	2005	2008	240,786.00
PNRI	Percedita T. Cansino ptcansino@pnri.dost.gov.ph	Enhanced Nondestructive Testing Training	2005	2006	5,147,744.00
PNRI	Estelita G. Cabalfin egcabalfin@pnri.dost.gov.ph	Upgrading the Gamma Irradiation Facility	2005	2008	382,984.00

TOTAL: Php 20,005,867.00

* Technical Cooperation Projects are under the IAEA Technical Cooperation Programme and are funded by the Technical Cooperation Fund (TCF) 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. (Project grants provided by the IAEA in US $; Conversion: US$1=Php 49.00)

TABLE 3. INTERNATIONAL SCIENTIFIC LINKAGES AND NETWORKS

SCIENTIFIC INSTITUTION		NATURE/DESCRIPTION OF SCIENTIFIC LINKAGES	DATES OF ENGAGEMENT	
Name of Institution/Country	Name/E-mail/Position of Contact Person		Start	End
International Atomic Energy Agency(IAEA)/ Vienna, Austria	Thru PNRI as the national competent authority on nuclear-related matters ***Contact Person:*** Alumanda M. dela Rosa, PhD. Director, PNRI	Technical cooperation program (including national technical cooperation projects, research contracts, regional RCA and non-RCA projects, and interregional projects)	1958	Present
Regional Cooperative Agreement and Training Related to Nuclear Science and Technology (RCA) for Asia and the Pacific/Vienna, Austria	Thru PNRI	Regional projects; provision of training and experts, and minimal equipment/supplies	1972	Present
Ministry of Science, Technology, Education, Culture and Sports/Japan	Thru PNRI	Nuclear researchers exchange program	1985	Present
Comprehensive Nuclear Test Ban Treaty Organization (CTBTO)	Thru PNRI	Establishment/maintenance of international monitoring stations and data center; provision of training	1999	Present
Forum for Nuclear Cooperation in Asia (FNCA)/ Japan	Thru PNRI	Regional projects	2000	Present
RCA Regional Office/ Korea	Thru PNRI	Regional projects and provision of training and education	2002	Present
Nuclear Safety Research Association (NSRA)/ Japan	Thru PNRI	Expert dispatch and training provision	2004	Present
United States Department of Energy	Thru PNRI	Project; experts; equipment; and training provision	2005	Present
Australian Nuclear Science and Technology Organization (ANSTO)	Thru PNRI	Regional project, expert and training provision	2006	Present
Other Organizations from Australia, Japan. Canada, United States, Korea and other countries	Thru PNRI	Bilateral agreements/institute agreements		

TABLE 4. EXPERTS / MISSIONS

FIELD / PURPOSE	NAME OF EXPERT / MISSION	DATE OF VISIT
Air Quality Modelling	Philip Hopke	9 – 15 Jan '06
Seminar on Present Status of Nuclear Power in the World (INVAP, Argentina)	Jose Lolich	13 – 14 March '06
Technical Officer for the Technical Cooperation Project "Enhancing Agricultural Productivity Through Radiation Technology in Mindanao"	Madeleine Spencer	13 – 17 March '06
X-ray Fluorescence (XRF) Analysis	Darek Wegrzynek	22 – 24 March '06
Technical Officer for the Technical Cooperation Project "Enhanced and Nondestructive Testing Training"	Isaac Einav	27 – 31 March '06
Hydrogeological Data Assimilation and Modelling	Matej Gedeon	15 – 19 May '06
United States Department of Agriculture Project Meeting	Gary Greene and Dennis Voboril	17 May '06
Technical Officer for the Project on Human Resource Development and Nuclear Technology Support	Kisher Solanki	22 – 26 May '06
Review of Ongoing Technical Cooperation Projects	Reyad Kamel and Kesrat Sukasam	12 – 16 June '06
Technical Officer for the Project on Site Selection and Conceptual Design of a Near-Surface Disposal Facility	Bernard Neerdael	2 – 7 July '06
RONPAKU Scholarship	Hisaaki Kudo	20 – 21 July '06
Integrated Management System	Abou Yehia and Adrian Verkooijen	24 – 28 July '06
National Training Course on Nondestructive Testing (NDT)	Ibrahim Nassir	31 July – 11 Aug '06
Nuclear Safety	Yutaka Kawakami	28 Aug – 29 Sept '06
Draft Nuclear Law	George Philip and Carl Stoiber	4 – 7 Sept '06

Nuclear Power Generation	Atsushi Takeda and Akira Tanabe	25 – 28 Sept '06
Expenditure of Energy in the Elderly	Elaine Rush	6 – 10 Nov '06
Joint Convention on the Safety of Fuel Management and on the Safety of Radioactive Waste Management	Didier Louvat and Hioki Kazumasa	14 – 16 Nov '06
Safeguards Inspection	M. Pellechi and P. Andreev	20 – 21 Nov '06
Design and Safety Evaluation	Dirk Mallants	4 – 8 Dec '06

TABLE 5. PNRI HOSTINGS

FIELD	PHILIPPINE PARTICIPANT	AGENCY / INSTITUTE	ORGANIZER	VENUE	DATE
FNCA 2005 Workshop on Biofertilizer	Richard M. Balog (Project Leader) and Faye G. Rivera Dr. Mercedes Umali-Garcia and Juliet Anarna	PNRI University of the Philippines – Los Baños	MEXT/JAIF and PNRI	PNRI	9–13 Jan '06
Regional Training Course on Current Standards and Future Directions in Radiation Oncology	Numbers of Philippine Radiation Oncology Society		PNRI; Philippine Radiation Oncology Society; and the American Society of Therapeutic Radiology and Oncology	Manila Hotel	15–19 Jan '06
Project Coordinators Meeting to Assess the Results of the Pilot Study of the ASO Distance Learning Course	Gaudencio Vega	St Luke's Medical Center	PNRI and St. Luke's Medical Center	Traders Hotel	23–25 Jan '06
First Technical Meeting on the Research Reactor Decommissioning Demonstration Project (R^2D^2P)	Leonardo S. Leopando Teofilo V. Leonin, Jr.	PNRI	IAEA and PNRI	The Linden Suites	26–30 June '06
FNCA 2006 Workshop on Mutation Breeding of Banana Subproject for Disease Resistance and Fusarium Infestation	Avelina Lapade Alfonso O.Grafia Victoria Fe O. Medina Ana Marie S. Veluz and Mary Jane Manrique Olivia Damaso	PNRI Inst. of Plant Breeding	MEXT/JAIF and PNRI	PNRI	26 – 28 July '06
FNCA 2006 Workshop on the Utilization of Research Reactors	Flora L. Santos Elvira Z. Sombrito Ma. Teresa L. Borras Rizalina G. Osorio	PNRI	MEXT/JAIF and PNRI	The Linden Suites	28 Aug–1 Sept '06
Regional Meeting on Integrated Safety Evaluation	Alumanda M. dela Rosa and Corazon C. Bernido	PNRI	IAEA and PNRI	The Richmonde Hotel	11–13 Sept '06
ANSN (Asian Nuclear Safety Network) Promotional Meeting "Caravan"	70 participants from various sectors	PNRI	IAEA and PNRI	PNRI	13–14 Sept '06
Regional Meeting to Finalize ISED (Indicators for Sustainable Energy Development) Analysis and Review Interim Report on National Studies	Christina A. Petrache Salvador D. Sarmiento Jr.	PNRI National Power Corporation	IAEA and PNRI	The Richmonde Hotel	2 – 6 Oct '06
Workshop on the Basics of Decommissioning of Research Reactors	Leonardo S. Leopando and Corazon M. Garcia (Observers: Maria Visitacion B. Palattao, John Marquez, Lopito Caluag, Arturo Salih)	PNRI	IAEA and PNRI	The Linden Suites	16–20 Oct '06

TABLE 6. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN)

FIELD	NAME	AGENCY/	TRAINING VENUE	DATE	SPONSOR
ON-THE-JOB TRAINING					
Radiation Medicine and Health	Francis Gerard Estrada	St. Luke's Medical Center	London	6 Feb–5 May '06	IAEA
Health Contaminants	Leni Quirit	University of the Philippines	USA	29 May–28 July '06	IAEA
Soil Organic Carbon Dynamics	Belina Pajarito	Bureau of Soil and Water Management	Canada	4 Sept – 3 Oct '06	IAEA
Groundwater Hydrology	Ma. Victoria Olivar, Gabriel Ignatius M. Aragon, Danilo Dacillo	Philippine National Oil Company – Energy Development Center	Indonesia	15 Nov–15 Dec '06	IAEA
TRAINING COURSE					
Advanced NDT Technology (Digital RT/UT)	Gerald S. Gallardo	Cifra Industrial Services	India	20 – 24 Feb '06	IAEA
Nuclear Techniques to Measure Calcium Bioavailability and Bone Density	Aida Mallillin	Food and Nutrition Research Institute	Hongkong and China	20 – 24 Feb '06	IAEA
Regulatory Aspects of Radiation Practices	Bayani San Juan	Bureau of Health Devices and Technology	Dubai, UAE	18 – 22 March '06	IAEA
Sentinel Lymph Node Detection with Nuclear Medicine Technique	Jonas Santiago Roel Tolentino	St. Luke's Medical Center	China	4 – 28 April '06	IAEA
Exchange of Experiences in Using IAEA's Energy Models and Assessment of Further Training Needs (Training/Meeting and Workshop)	Lana Rose Manaligod	Department of Energy	Korea	4 – 28 April '06	IAEA
10th Introductory Course on On-site Inspection	Robert O. Ferrer Jr.	Ambaphil, Vienna	Austria	2 – 5 May '06	CTBTO
Radiation Biology for Radiation Oncology	Teresita Sy Ortin Vicente Francisco Hizon	University of Sto. Tomas Hospital University of the Philippines	Japan	15 – 19 May '06	IAEA
Competitiveness of Nuclear Power and Other Energy Technologies in Restructured Electricity Markets (Training/Meeting and Workshop)	Norman Vincent T. Martirez	Department of Energy	USA	5 – 16 June '06	IAEA
Combating Illicit Trafficking in Nuclear and Other Radioactive Materials	Necomedes Enad Roly T. Rola	Bureau of Customs Philippine Ports Authority	Malaysia	19 – 22 June '06	IAEA
Radiological Risk Assessment	Sharon Juliet Arruejo	PAGASA	Australia	19 – 23 June '06	IAEA
Practical Response to Radiological Emergencies-First Responders	Antonio Guimiran Jr. & Joseph Bacareza	Philippine National Police Bureau of Fire Protection	Indonesia	24 July – 4 Aug '06	IAEA
Nuclear Power Policy, Planning and Project Management	Elvira Gelindon	Department of Energy	Korea	8 – 28 Oct '06	KOICA & IAEA
Implementation of TRS 430 in Quality Assurance for Radiotherapy Treatment Planning Systems	Maureen R. Bojador Lilian V. Rodriguez Merle Sintos	University of Sto. Tomas Hosp. Jose Reyes Memorial Med.Ctr. Rizal Medical Center	China	9 – 14 Oct '06	IAEA
Nuclear Oncology Applications	Michele Duldulao Ma. Lourdes Taylan	Philippine Heart Center University of Sto. Tomas Hosp.	Korea	21 – 25 Oct '06	IAEA
Brachytherapy for Gastro-Intestinal Malignancies-Beyond Palliation	Efren T. Madrid Conchita O. Mendoza	Rizal Medical Center St. Luke's Medical Center	Japan	23 – 27 Oct '06	IAEA
PET Applications for Oncologists, Radiation Oncologists and Hematologists	Fatima Fuerte Regina Edusma	Rizal Medical Center Makati Medical Center	Japan	13 – 17 Nov '06	IAEA
Safety and Security in Transport of Radioactive Materials	Dante M. Lantin	Department of Transportation and Communication	Malaysia	13 – 24 Nov '06	IAEA
IAEA Nobel Peace Prize Fund Schools for Nutrition Regional Event in Asia and the Pacific: Focus on Interventions to Combat Undernutrition During Early Life	Jovita B. Raval and Milagros Eliza V. Federizo	National Nutrition Council	Bangladesh	19 – 23 Nov '06	IAEA

Rapid Diagnosis of Avian Influenza (Bird Flu)	Cristina F. Legaspi	Bureau of Animal Industry	Austria	20 Nov – 1 Dec '06	IAEA
Radiation Protection and Safety of Radiation Sources	Francis D. Rupinta	Department of Health - Ilocos	Malaysia	27 Nov '06–7 July '07	IAEA
SEMINAR					
Nuclear Safety 2005: Dissemination of Nuclear Knowledge Course	Higina F. Villarosa	Department of Education	Japan	15 – 25 Jan '06	RADA
Strengthening Nuclear Security in Asian Countries	Francisco Mier	National Intelligence Coordination Agency	Japan	8 – 10 Nov '06	IAEA
MEETING					
Progress Review on Mutant Multilocation Trials and Mutation Enhancement of Genetic Diversity	Consorcia Reaño	University of the Philippines – Los Baños, Laguna	Indonesia	13– 17 March '06	IAEA
Technical Meeting to Review the Handbook on Combating Illicit Trafficking in Nuclear and Other Radioactive Materials	Necomedes Enad	Bureau of Customs	Austria	27 – 31 March '06	IAEA
Regional Screening Network for Neonatal Hypothyropidism Phase II	Juanita Basilio Carmencita Padilla	Department of Health UP-National Institute of Health	Korea	27 – 31 March '06	IAEA
Technical Meeting on Training in and Demonstration of Waste Disposal Technologies in Underground Research Facilities – An IAEA Network of Centres of Excellence	Carlo Arcilla	UP-National Institute of Geosciences	Sweden	26 – 28 April '06	IAEA
Executive Meeting on Application of Isotope Techniques in Geogenic Contamination	Noel C. Montaña Edilberto Arreza	Davao City Water District Mines and Geosciences Bureau Region XI	Vietnam	23 – 26 May '06	IAEA
Regional Meeting on Implementation of a Quality System Based in ISO 15189	Concepcion F. Ang	UP-Philippine General Hospital	Thailand	30 Oct – 3 Nov '06	IAEA
IAEA Nobel Prize Special Event for Asia and the Pacific	Gaudencio Vega Miriam Joy Calaguas	St. Luke's Medical Center	Thailand	4 – 8 Dec ' 06	IAEA
SYMPOSIUM					
Radiation Emergency Medical Preparedness in Asia	Roberto Dalmacion Marilyn Go	Quezon City Memorial Medical Center	Japan	13 – 17 Nov '06	IAEA

TABLE 7. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN)

FIELD	NAME	TRAINING VENUE	DATE	SPONSOR
ON-THE-JOB TRAINING				
Non-Destructive Testing (NDT) & Non-Destructive Examination (NDE)	Percedita T. Cansino	Canada	1 March – 9 June '06	IAEA
Nondestructive Testing and Nondestructive Examination	Renato T. Bañaga	Malaysia	3 April – 26 May '06	IAEA
Radioanalytical Techniques	Joseph Michael D. Racho	Austria	1 July – 30 Sept '06	IAEA
Soil and Water Management and Crop Nutrition	Richard M. Balog	Canada	10 July – 9 Sept '06	IAEA
Radiation Processing Facilities and Applications	Arnold R. Valenzuela	Malaysia	7 Aug– 3 Nov '06	IAEA
Nondestructive Testing and Evaluation	Archimedes J. Andres	Canada	2 Dec '06 – 24 Feb '07	IAEA
TRAINING COURSE				
Training and Acceptance Testing of 225 KV Manual Radiation Dosimetry System (Comet MXR-225)	Estrella S. Caseria	USA	16 – 17 Jan '06	WILLICK Eng'g Co. Inc.
Management Systems for Occupational Radiation Exposure	Estrella S. Caseria	Yemen	29 Jan – 2 Feb '06	IAEA
Advance Non-Destructive Testing (NDT) Technology (Digital RT/UT)	Renato T. Bañaga	India	20 – 24 Feb '06	IAEA
Applications of Radiation in Nanotechnology	Neil Raymund D. Guillermo Lucille V. Abad	Malaysia	27 Feb – 10 March '06	IAEA

Field Trials of Emergency Response Capacity	Estrella S. Caseria Jose N. Calaycay	Korea	13 – 17 March '06	IAEA/RCA
Security of Nuclear Research Facilities	Edgar G. Racho Ma. Teresa A. Salabit	Australia	20 – 31 March '06	IAEA
PMF Apportionment Applied to Regional Data and Key Trans-boundary Events and Methods to Quantify Transboundary Pollution Including Residence Time Weighted Concentration Analysis	Ryan P. Morco Preciosa Corazon Pabroa	Pakistan	3 – 7 April '06	IAEA
Selective Breeding Gene Technologies	Ma. Lucia C. Cobar	Korea	3 – 7 April '06	IAEA
Methane Emission Methodologies	Faye G. Rivera and Celia O. Asaad	Thailand	17 – 28 April '06	IAEA
Introductory Training Programme for Station Operators and National Data Center Managers	Fe M. Dela Cruz	Austria	8 – 12 May '06	CTBTO
Sealed Sources and Radiotracer Applications in FCCU and Industrial Processes Gamma Tomography	Denis DL. Aquino	India	8 – 19 May '06	IAEA
Interdiction of Weapons of Mass Destruction	Julietta I. Seguis	USA	15 – 19 May '06	US DOE
DOE/NNSA Megaports Initiative Training Course	Neil Raymund D. Guillermo, Alfonso Singayan, Archimedes J. Andres, Nelson P. Badinas, Kristine Marie D. Romallosa, Giuseppe Dean, Reynaldo S. Jimenez, Jade D. Trono, Theresa B. Deyto, Ramoncito F. Sulit, Roberto N. Fontanilla, Eduardo E. Cabildo, Ana Elena L. Conjares, Estrellita U. Tabora, Mikhael Jethro L. Montes, Lynette B. Cayabo, Christopher G. Halnin, Sofronio O. Enriquez	USA	15 – 19 May '06	DOE/NNSA
Technical Training Programme for Radionuclide Station Operators	Fe M. Dela Cruz	Austria	15 – 19 May '06	CTBTO
Control of Radioactive Discharges to the Enviroment	Corazon M. Garcia	Pakistan	5 – 19 June '06	IAEA
Combating Illicit Trafficking in Nuclear & Other Radioactive Materials	Nelson P. Badinas	Malaysia	19 – 22 June '06	IAEA
Radiological Risk Assessment	Alfonso A. Singayan	Australia	19 – 23 June '06	IAEA/RCA
Organization and Implementation of a National Regulatory Programme for Control of Radioactive Sources Including Code of Conduct	Thelma A. Artificio Teresita G. De Jesus Luzviminda L. Venida	Singapore	3 – 7 July '06	IAEA
Sampling Methods in Environmental Monitoring	Efren J. Sta. Maria Rosalina V. Almoneda	Japan	10 – 14 July '06	IAEA/RCA
Hysplit Back Trajectory Techniques Applied to Regional Data and Key Transboundary Events	Preciosa Corazon B. Pabroa Ryan P. Morco	Vietnam	14 – 18 Aug '06	IAEA
Economical and Social Benefit of Radiation Processing, Standardization and Legislation Issues Regarding Radiation Processing Implementation	Luvimina G. Lanuza	Hungary	27 Aug – 1 Sept '06	IAEA
Nuclear Knowledge Management	Mylene M. Espinal	Italy	18 – 22 Sept '06	ICTP
Extended Response to a Radiological Incident by Radiological Assessors	Teofilo Y. Garcia, Carl M. Nohay, Demetrio S. Salom	China	16 – 27 Oct '06	IAEA
Radiation Deactivation and Sterilization of Biohazards	Luvimina G. Lanuza Ma. Teresa A. Salabit	India Japan	30 Oct – 06 Nov '06 13 – 24 Nov '06	IAEA IAEA
Training/Studies on "Frontiers of Molecular Science: Electronic and Structural Properties of Molecules and Nano Materials	Valerie Ann A. Innis	Japan	20 – 22 Nov '06	Sokendai Asian Winter School
Plant Production Under Controlled Environment System and Cell Culture Using Bioreactor Technology and Extraction and Compound Profiling of Herbal Plants	Ana Marie S. Veluz Mary Jayne C. Manrique	Malaysia	20 Nov – 1 Dec '06	Malaysian Nuclear Agency
Combining Contaminant Transport and Ecological Risk Assessment Models for Response to Environmental Emergencies	Socrates Cañete Rhett Simon DC. Tabbada	China	5 – 13 Dec '06	IAEA

SEMINAR / WORKSHOP /SYMPOSIUM				
Nuclear Safety 2005: Administrative Management Course	Virginia S. Calix	Japan	15 – 24 Feb '06	IAEA
Regional Security of Radioactive Sources Project – Radiation Detection, Equipment Provision and Training	Teofilo V. Leonin Jr, Demetrio S. Salom, Abelardo A. Inovero, Louie R. Del Castillo, Giuseppe Dean, Alfonso A. Singayan, Jesus R. Perez, Kristine Marie D. Romallosa, Nelson P. Badinas, Jose N. Calaycay	Australia	27 Feb – 3 March '06	ANSTO
International Cooperation for the National Implementation of the CTBTO for States from South East Asia	Virginia S. Calix	Malaysia	31 May – 2 June '06	CTBTO
Incident and Emergency Preparedness: Lessons Learned from Past Accidents at Nuclear Installations	Eulinia M. Valdezco	China	27 – 30 June '06	IAEA
Regional Seminar - Facts of Nuclear Power for Electricity Generation	Christina A. Petrache	Thailand	19 – 22 Jul '06	IAEA
Human Resources Development	Corazon C. Bernido	China	31 July – 4 Aug '06	FNCA
Mutation Breeding	Adelaida C. Barrida	Japan	11 – 15 Sept '06	IAEA
Nuclear Safety Culture	Vangeline K. Parami	Japan	19 – 21 Sept '06	FNCA
Nuclear Safety 2006: Administrative Management Course	Eulinia M. Valdezco	Japan	10 – 20 Oct '06	RADA
Regional Seminar on Strengthening Nuclear Security in Asian Countries	Julietta E. Seguis	Japan	8 – 10 Nov '06	IAEA
Emergency Medical Preparedness in Asia	Eulinia M. Valdezco	Japan	13 – 17 Nov '06	NIRS
Biofertilizers	Richard M. Balog	Thailand	20 – 24 Nov '06	FNCA
CTBTO Network Operations	Adelina dM. Bulos	Austria	20 – 24 Nov '06	CTBTO
Radioactive Waste Management	Edith A. Marcelo, Ma. Visitacion B. Palattao	China	20 – 24 Nov '06	MEXT/FNCA
CTBTO Network and Data Operations	Adelina dM. Bulos	Finland	27 – 29 Nov '06	CTBTO
1st Asian/Australian Region National Competent Authority Workshop	Eulinia M. Valdezco	Australia	27 – 29 Nov '06	ARPANSA
Project on Application of Electron Accelerator	Lorna S.A. Relleve	Malaysia	11 – 17 Dec '06	FNCA
MEETING / CONFERENCE / SYMPOSIUM				
International Safeguards – Addressing Verification Challenges	Julietta E. Seguis	Austria	16 – 20 Oct '06	IAEA
Progress Assessment Meeting on Nuclear Techniques for Improved Management of Transboundary Air Pollution	Flora L. Santos	Indonesia	6 – 10 Feb '06	IAEA
Meeting for Standing Advisory Group on Technical Assistance and Cooperation (SAGTAC)	Alumanda M. Dela Rosa	Austria	6 – 10 Feb '06	IAEA
Regional Coordinators Meeting for Developing Technical Capabilities for the Protection of Health and Safety of Workers Exposed to Ionizing Radiation	Estrella S. Caseria	Thailand	13 – 17 Feb '06	IAEA
Meeting on Assessment of Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques	Soledad S. Castañeda	Malaysia	20 – 24 Feb '06	IAEA/RCA
Meeting and Workshop on Developing Future Environment Strategy; Pre-project Review Meeting on RCA-UNDP Post Tsunami Environment Impact Assessment Project	Elvira Z. Sombrito	Korea	20 – 24 Feb '06	IAEA
International Conference on Safety and Security of Effective Regulatory Systems, Facing Safety and Security Challenges	Alumanda M. Dela Rosa Eulinia M. Valdezco	Russia	27 Feb – 3 March '06	IAEA
CIMRP 2006 International Meeting on Radiation Processing	Neil D. Guillermo	Malaysia	27 Feb– 3 March '06	MOSTI
7th Forum for Nuclear Cooperation in Asia Coordination Meeting	Corazon C. Bernido Victoria Fe O. Medina	Japan	1 – 3 March '06	FNCA
Management Meeting on Radiation Protection	Eulinia M. Valdezco	Singapore	6 – 10 March '06	IAEA

Progress Review Meeting on Mutants Multilocation Trials and Enhancement of Genetic Diversity	Alfonso O. Grafia	Indonesia	13 – 17 March '06	IAEA
Final Project Review Meeting to Discuss National Experiences in Applying Knowledge Management Techniques	Corazon C. Bernido Angel B. Anden	China	20 – 24 March '06	IAEA
28th Meeting of the Regional Cooperative Agreement National Representatives	Alumanda M. Dela Rosa	Thailand	27 – 31 March '06	Philippine Government
Support Group Meeting on Information Technology	Angel B. Anden Christopher G. Halnin	Malaysia	24 – 26 April '06	IAEA
Expert Advisory Group Meeting on Strategic Planning for Sustainable National Nuclear Institutions	Alumanda M. Dela Rosa	Australia	8 – 11 May '06	IAEA
National Coordinators Meeting to Review ISEDs Developed by National Project Teams	Christina A. Petrache	Indonesia	8 – 12 May '06	IAEA
Technical Meeting on Draft Guideline on the Security of Radioactive Sources	Eulinia M. Valdezco	Austria	8 – 12 May '06	IAEA
ANSN (Asian Nuclear Safety Network) Topical Group Meeting on Safety Analysis	Carl M. Nohay	Korea	9 – 12 May '06	IAEA
Regional Technical Meeting on Illicit Trafficking Database Points of Contact	Julietta E. Seguis	Austria	10 – 12 May '06	IAEA
Meeting to Design RCA Projects Being Considered for 2007-2008	Lucille V. Abad	Austria	15 – 19 May '06	IAEA
Women in Nuclear (WIN) Global 2006 Meeting	Alumanda M. Dela Rosa	Canada	29 May – 2 Jue '06	Women in Nuclear
Technical Meeting on Implementing the Code of Conduct on the Safety and Security of Radioactive Sources	Eulinia M. Valdezco	Austria	31 May – 2 June '06	IAEA
4th Meeting of the Steering Committee on the Asian Nuclear Safety Network	Corazon C. Bernido	Japan	6 – 7 June '06	IAEA
8th Meeting of the Standing Advisory Group on Nuclear Applications (SAGNA)	Alumanda M. Dela Rosa	Austria	19 – 23 June '06	IAEA
Regional Security of Radioactive Sources Project – Regulations Working Group Meeting	Ma. Visitacion B. Palattao, Sylvia S. Busine, Eulinia M. Valdezco, Edgar G. Racho	Australia	19 – 23 June '06	ANSTO
1st Meeting for Asia Nuclear Safety Network (ANSN) on Preparedness and Response	Eulinia M. Valdezco	China	26 – 27 June '06	IAEA
Meeting on Health Care Stimuli Responsive Radiation Processed Materials	Charito T. Aranilla and Lucille V. Abad	Bangladesh	26 – 30 June '06	IAEA
Technical Meeting for National Liaison Officers Consultation on Technical Cooperation Regional Project Proposals for 2007 – 2008	Nydia C. Medina	China	26 – 28 June '06	IAEA
XIII International Conference for Small Angle Scattering	Valerie Ann A. Innis	Japan	9 – 13 July '06	SAS2006 Secretariat
Meeting on Managing Projects, Teams and Organizations in Sustainable National Nuclear Institutions	Virginia S. Calix	Vietnam	31 Jul – 4 Aug '06	IAEA
Meeting of RCA-UNDP Post Tsunami Environment Impact Assessment Project	Efren J. Sta. Maria Elvira Z. Sombrito	Indonesia	22 – 25 Aug '06	IAEA
Technical Meeting - National Experience on Return of Research Reactor Spent Fuel to the Country of Origin	Leonardo S. Leopando	Austria	28 – 31 Aug '06	IAEA
Technical Meeting - Asian Network for Education in Nuclear Technology	Corazon C. Bernido	Korea	4 – 8 Sept '06	IAEA
2nd Research Coordination Meeting on Improving Sterile Male Performance in Fruit Fly SIT Programme	Glenda B. Obra and Sotero S. Resilva	Brazil	5 – 9 Sept '06	IAEA
Technical Meeting on Development of the Web Version of the RAIS	Carl M. Nohay	Austria	11 – 15 Sept '06	IAEA
35th RCA General Conference; Seniors Regulators Meeting; 50th Session of the IAEA General Conference	Alumanda M. Dela Rosa	Austria	15 – 22 Sept '06	Philippine Government
Safety of Radioactive Waste Meeting and Workshop on Nat'l Strategies for the Safety of Radioactive Waste Management and the Safety Case Concept for Demonstrating the Safety and Licensing of Management Facilities and Activities	Ma. Visitacion B. Palattao Edith A. Marcelo	Japan	25 – 29 Sept '06	IAEA

Consultancy Meeting for Coordinated Research Project on Seafood Safety	Elvira Z. Sombrito	Monaco	25 – 27 Sept '06	IAEA
Technical Meeting to Develop Guidance Document for Nuclear Knowledge Management in Government Industry and Academia	Ana Elena L. Conjares	Austria	9 – 13 Oct '06	IAEA
ANSN Topical Group Meeting on Training and Education	Corazon C. Bernido	Austria	9 – 11 Oct '06	IAEA
Technical Meeting on Lessons Learned by Member States in Operating Low-Level Radioactive Waste Processing and Storage Facilities	Editha A. Marcelo	Austria	30 Oct – 1 Nov '06	IAEA
3rd Meeting of the FNCA Panel on Role of Nuclear Energy for Sustainable Development in Asia	Christina A. Petrache	Japan	1 – 2 Nov '06	FNCA
National Nondestructive Testing (NDT) Coordination Meeting and 12th Asia-Pacific Conference on NDT	Renato T. Bañaga	New Zealand	2 – 10 Nov '06	IAEA
12th Asean – India Technology Summit and Technology Platform	Valerie Ann A. Innis	India	6 – 7 Nov '06	ASEAN-INDIA COOP. FUND
FNCA 2006 Project Leaders Meeting on Public Acceptance	Rhodora R. Leonin	Indonesia	6 – 10 Nov '06	FNCA
Regional Meeting for Senior Government Officials International Legal Framework Governing Nuclear Safety, Security & Safeguards	Eulinia M. Valdezco	Malaysia	7 – 9 Nov '06	IAEA
1st Research Coordinators Meeting on Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation	Ana Elena L. Conjares	Austria	13 – 17 Nov '06	IAEA
7th Forum for Nuclear Cooperation in Asia Meeting	Aumanda M. Dela Rosa	Malaysia	25 – 27 Nov '06	FNCA
5th Meeting of the ANSN Steering Committee & Technical Meeting to Review Progress & Future Activities of the EBP on the Safety of Nuclear Installations in the South East Asia, The Pacific & The Far East Countries	Corazon C. Berrnido	Austria	30 Nov – 07 Dec '06	IAEA
Technical Meeting on Guidance for the Development and Maintenance of a Design Basis Threat	Julietta E. Seguis	Austria	4 – 8 Dec '06	IAEA
2006 Asian Seas Congress	Elvira Z. Sombrito	China	12 – 16 Dec '06	PEMSEA
Advisory Committee Meeting on Training, Competence and Outreach in Radiological Risk Assessment	Ma. Visitacion B. Palattao Teofilo V. Leonin Jr.	China	18 – 21 Dec '06	IAEA
SCIENTIFIC VISIT / EXPERT MISSION				
Scientific Visit- Safe Predisposal & Disposal of Radioactive Waste	Raquel E. Grijaldo	Czech Republic	3 – 14 Apr '06	IAEA
Scientific Visit- Radioactive Waste	Jose N. Calaycay Demetrio S. Salom	South Africa	8 – 19 May '06	IAEA
Scientific Visit- Non-Destructive Testing (NDT)	Alumanda M. Dela Rosa	New Zealand	4 – 14 Nov '06	IAEA
Expert Mission Assignment- Determination of Pupal Eye Color of Vienna 8 tsl Medfly Strain in relation to its Physiological Development	Sotero S. Resilva	Reduil, Mauritius	6 March- 7 April '06	IAEA
Expert Mission Assignment- Determination of Pupal Eye Color of *Bactrocera zonata* and *Bactrocera cucurbitae* in Relation to their Respective Physiological Development	Sotero S. Resilva	SIT Africa Mass rearing Facility, South Africa	13 Nov – 19 Dec -06	IAEA
OTHERS				
Nuclear Research Exchange Program - Radiation Processing of Natural Polymers	Charito T. Aranilla	Japan	21 Aug '06 – 29 June '07	MEXT
Nuclear Research Exchange Program - Dose Assessment Due to Exposure to Naturally-Occurring Radioactive Material (NORM)	Eliza B. Enriquez	Japan	21 Aug '06 – 23 March '07	MEXT
Research Fellowship - Radiation Chemistry Studies of Carrageenan	Lucille V. Abad	Japan	1 Sept – 29 Nov '06	JSPS
Fellowship Attachment to the RCA Regional Office	Efren J. Sta. Maria	Korea	18 Sept '06 – 17 March '07	IAEA
Graduate Studies - Application of Nuclear Techniques in Marine Environmental Research and Coastal Management	Ryan U. Olivares	Japan	01 Oct '06– 01 Oct '07	ADB-JSP
Fellowship Visit – Nuclear and Radiological Security and Enhancement for Professional Development	Estrella S. Caseria Kristine Marie D. Romallosa Lorena A. Del Castillo	Australia	27 Nov – 12 Dec '06	ANSTO

TABLE 8. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL)

FIELD	NAME	VENUE	DATE
TRAINING COURSE SEMINAR			
Test Analysis and Calibration Information System	Anden B. Angel	DOST	12 Jan '06
Orientation Seminar on Security Operation	Rizalino B. Rejas, Laura R. Pineda, Federico L. Pineda Jr., Benjamin F. Mandinguiado, Ryan A. Miot, Ernesto I. Ventura Jr., Pablito S. Maat	DOST	26 Jan '06
Participation in the Kick-off Activity of the Women's Month Celebration	Emma L. Cancino and Alicia F. Lagunzad	Amoranto Sport Plaza	3 March '06
Seminar-Workshop on ISO/IEC 17025	Zenaida M. De Guzman and Soledad S. Castañeda	MIRDC, Taguig Metro Manila	24 March '06
Gender and Development Program	Emma L. Cancino	DOST	24 April '06
Courtesy Campaign National Competition in Housing Forum	Dr. Graceta DL. Cuevas, Dr. Emma I. Cancino, Christopher G. Halnin, Joseph R. Tugo, Michael J. Montes	Philamlife Bldg. UN, Manila	29 Sept '06
Seminar Workshop on Establishing Collaborative Leadership for Good Governance	Bernardo De Lara	Marikina Polytechnic College	27 Oct '06
Seminar on the Mechanisms for Applying for ISO Certification	Luvimina G. Lanuza and Preciosa Corazon B. Pabroa	DOST	27 Oct '06
Seminar-Workshop on Laboratory Safety and Chemical Analysis in Soil, Water and Air	Soledad S. Castañeda	U.P.-Diliman	6 Dec '06
TRAINING			
Training on Internal Control Structure	Alma S. Piñera	DOST	17 Jan '06
Training Course on Materials Management and Inventory Control	Conrado M. De Guzman	Philtrade, Roxas Blvd.	26 – 27 Jan '06
Chemical, Biological, Radiological and Nuclear (CBRN) International First Responder Training Program	Eulinia M. Valdezco	Camp Aquinaldo Quezon City	23 Jan '06
First GSIS Liaison Officer's Training Course	Michael P. Hernandez	GSIS, Pasay	3 March '06
Lecture and Hands- On Demo to Develop Skills on Reflexology	Alicia F. Lagunzad and Ana N. Villanueva	TAPI	15 – 19 May '06
Government Expenditure System Course(National)	Celestino M. Santos	Commission on Audit	6 – 9 June '06
Radiation Safety Training Course for Non-Technical Personnel	Joan B. Lenon	PNRI	5 – 9 June '06
First Responders Training Program	Eulinia M. Valdezco	Discovery Suites, Pasig City	10 – 11 Aug '06
Certificate Course on ISO9001:2000	Eulinia M. Valdezco, Alan M. Borras	DAP, Pasig City	18 – 22 Sept '06
Coaching on Presentation Skills	Luvimina G. Lanuza, Ma. Teresa L. Borras, Adelina DM. Bulos	DOST	8 Sept '06
Chemical, Biological, Radiological and Nuclear International First Responder Training Program	Graceta DL. Cuevas and Teofilo V. Leonin Jr	Camp Aguinaldo, Quezon City	9 – 13 Oct '06
MEETING			
Quality Assurance (QA) Representative Meeting for DOST SciNET-Phil	Isabel M. Amiscaray	DOST	19 Jan '06
2nd Plenary Meeting	Eulinia M. Valdezco	PCARRD-Los Banos, Laguna	2 May '06
3rd GSIS Membership Meeting	Emma L. Cancino, Bernard M. De Lara	Philippine Plaza Hotel	30 May '06
Test Analysis and Calibration Information System at DOST (TACIS) SAD Meeting/Workshop- Once a week	Angel B. Anden	DOST	7 July thereafter until 22 Dec 06
NAST 28th Annual Scientific Meeting	Lorena A. del Castillo Aileen Beth A. Hernandez	Manila Hotel	12-13 July '06

CONFERENCE			
Floriculture Conference	Fernando B. Aurigue	Manila Hotel	24 – 25 Jan '06
CONSAL XII General Conference	ISabel M. Amiscaray	Edsa Shangrila-Hotel	27 Jan '06
3rd GSIS Members Conference	Angel B. Anden and Michael P. Hernandez	GSIS Pasay	26 May '06
19th Statistical Research and Training Center Annual Conference	Victoria Fe O. Medina	Legend Villas Mandaluyong	6 Oct '06
3rd Annual Conference on Institutionalization and Demonstration of ISO 9001:2000-Alligned Quality Mgt. System in Government	Corazon C. Bernido, Flora L. Santos, Luvimina G. Lanuza, Ma. Celerina M. Ramiro	DAP, Pasig City	10 Nov '06
WORKSHOP			
Technicom Planning Workshop	Victoria Fe O. Medina	PCARRD, Los Baños, Laguna	7 – 8 Feb '06
IDEA Team Planning Workshop	Renato T. Bañaga	PCARRD, Los Baños, Laguna	9 March '06
3rd FNRI Writeshop	Justina S. Cerbolles	Nestle Center, Makati	10 – 11 Nov '06
International Workshop on Laboratory Quality Standards Towards Global Competitiveness	Raymond J. Sucgang, and Chitho P. Feliciano	Manila	4 – 7 Dec '06
SYMPOSIUM			
Symposium "Challenges in Health Research Ethics Global Context and Philippine Reality	Zenaida M. De Guzman	PCHRD	17 March '06
FORUM			
Business Concept Forum	Luvimina G. Lanuza, Ma. Teresa L. Borras and Adelina DM. Bulos	DOST	18 Aug '06
CONGRESS			
10th Philippine Floriculture Congress	Fernando B. Aurigue	Iloilo City	13 – 16 Nov '06

TABLE 9. PNRI GRADUATE STUDIES IN 2006

NAME/ADDRESS/E-MAIL OF SCHOLAR	LEVEL (MS or PhD) FIELD OF STUDY	NAME OF HIGHER EDUCATIONAL INSTITUTION	STATUS
WITH SCHOLARSHIP			
Valerie Ann A. Innis	M.S Physics	University of the Philippines, Diliman	Graduate
Ryan U. Olivares	Master of Engineering Major in Quantum Engineering and System Science PhD in Environment System	The University of Tokyo The University of Tokyo	Graduate On-going
Vangeline K. Parami	Ph.D. in Environmental Science	University of the Philippines-Diliman	On-going
Lucille V. Abad	Ph.D. Chemistry	The University of Tokyo	On-going
Charito T. Aranilla	M.S Chemistry	University of Sto. Tomas	On-going
Michael Dennis T. Fernandez	M.S in Nuclear and Quantum Engineering	Korea Advanced Institute of Science and Technology (KAIST)	On-going
SELF-FINANCED STUDIES			
Jade R. Trono	M.S. Physics	University of the Philippines-Diliman	Graduate
Thelma P. Artificio	Ph.D.Technology Management	Technological University of the Philippines - Manila	On-going
Soledad S. Castaneda	Ph.D. Environmental Science	University of the Philippines-Diliman	On-going

Preciosa Corazon B. Pabroa	Ph.D. Environmental Science	University of the Philippines-Diliman	On-going
Denis DC. Aquino	M.S. Engineering	University of the Philippines-Diliman	On-going
Chitho P. Feliciano	M.S. Microbiology and Biotechnology	University of the Philippines-Diliman	On-going
Lorna Jean H. Hernadez	M.S. Environmental Science	University of the Philippines-Diliman	On-going
Kristine Marie D. Romallosa	M.S. Physics	University of the Philippines-Diliman	On-going
Ryan P. Morco	M.S. Chemistry	University of Sto. Tomas	On-going
Raymond J. Sucgang	M.S. Chemistry	University of Sto. Tomas	On-going
Rhett Simon DC Tabbada	M.S. Marine Science	University of the Philippines-Diliman	On-going
Christopher G. Halnin	M.S. Information Technology	Polytechnic University of the Philippines	On-going
Justina S. Cerbolles	M.A. in Teaching	Philippine Normal University	On-going

TABLE 10. LIST OF SCIENTIFIC PUBLICATIONS IN 2006

TITLE OF SCIENTIFIC PAPER	NAME/EMAIL OF AUTHORS	PUBLICATIONS	
		Name/Type of Journal	Date Published
Small-angle Neutron Scattering on Irradiated Kappa Carrageenan.	Lucille V.Abad –PNRI lvabad@pnri.dost.gov.ph S. Okabe, S. Koizume, and M. Shibayama	Physica B, 381, 103-108/ International	2006
Reactivity of H_2O Gas with the Surface of Polycrystalline Li_2O Pellet	Takuji Oda, Yasuhisa Oya, Ryan U.Olivares (PNRI) ruolivares@pnri.dost.gov.ph Satoru Tanaka	Fusion Engineering and Design, Volume 81, Issues 1-7, Pages 613-618/International	February 2006
Thickness Measurement of Nano-Size Carrageenan Thin films by X-Ray Reflectivity and Total Reflection X-Ray Fluorescence Spectroscopy	Valerie Ann A. Innis vallerie@pnri.dost.gov.ph Pablo P. Saligan ppsaligan@dost.gov.ph Virginia S. Calix vscalix@pnri.dost.gov.ph	Proceedings of the 27th Samahang Pisika ng Pilipinas Physics Conference/ Local (Philippines)	October 2006
The Origin and Characterization of Two New *Mussaenda* Hybrids.	T. L. Rosario tl_rosario@yahoo.com Fernando B. Aurigue (PNRI) fbaurigue@pnri.dost.gov.ph	Philipp. Agric. Scientist 89(1): 85-90/Local (Philippines)	March 2006
Urea-Molasses Multi-Nutrient Block (UMNB) Supplementation of Dairy Cows Raised by Smallholders Farmers in Sariaya, Quezon Evaluation of Lesser-Known and Lesser-Utilized Feed Resource in the Philippines	Celia O. Asaad coasaad@pnri.dost.gov.ph Azucensa C. de Vera acdevera@pnri.dost.gov.ph Luzviminda M. Ignacio P.B. Tigno	IAEA TECDOC 1495 – Improving Animal Productivity by Supplementary Feeding of Multi-Nutrient Block, Controlling Internal Parasites and Enhancing Utilization of Alternative Feed Source/International (Vienna, Austria)	December 2006

TABLE 11. ADDITIONAL RESOURCES GENERATED FROM EXTERNAL SOURCES IN 2006

DONOR NAME OF INSTITUTION	PROJECT TITLE	DESCRIPTION OF ASSISTANCE	VALUE OF ASSISTANCE (in Pesos)
A. LOCAL GRANTS-IN-AID			
Department of Science and Technology (DOST) – Grants-in-Aid (GIA)	Assessment of Soil Erosion Using Fall-Out Radionuclides in Selected Agriculture Watersheds in the Philippines (Erosion)	Financing	1,190,192.00
DOST-GIA	Assessment of Soil Erosion Using Fall-Out Radionuclides in Selected Agriculture Watersheds in the Philippines (TENORM)	Financing	1,190,192.00
DOST-GIA	Establishment of a Near-Surface Radioactive Waste Repository in the Philippines	Financing	1,235,000.00
Philippine Council for Aquatic and Marine Research and Development (PCAMRD)	Application of Nuclear Techniques to Address Specific Harmful Algal Bloom Concerns- Phase II Project 1a Transfer of Receptor Binding Assay Technology to Local End Users: Assay on Marine Biotoxins- Production of Radio-labeled Compounds for Receptor Binding Assay of Marine Biotoxins	Financing	584,921.00
PCAMRD	Application of Nuclear Techniques to Address Specific Harmful Algal Bloom Concerns- Phase II Project 1b Transfer of Receptor Binding Assay Technology to Local End Users: Assay on Marine Biotoxins- Technology Transfer of Receptor Binding Assay to Regulatory Setting	Financing	582,715.00
PCAMRD	Application of Nuclear Techniques to Address Specific Harmful Algal Bloom Concerns- Phase II Project 4b Dinoflagelalte Cysts in Selected Mariculture Sites: Implication of the Management of Historical Profile of Harmful Algal Cysts and Antropogenic - Inputs in Sediment Using Isotopic Techniques	Financing	471,069.00
Philippine Council for Industrial and Energy Research and Development (PCIERD)	Establishment, Implementation and maintenance of Management Systems in all DOST RDIs and Regional Offices	Financing	2,735,607.00
Bacolod City Water District	Environmental Isotopes Application in Delineation of Recharge Zones for the Bacolod City Ground Water Systems	Financing	289,225.00
		TOTAL LOCAL GRANTS:	**Php 8,278,921.00**
B. FOREIGN GRANTS			
B-1. Cooperation Agreements			
United States Department of Agriculture (USDA) thru the Department of Agriculture/Bureau of Plant Industry (DA/BPI)	Establishment of Radiation Dose for Quarantine Treatment of Mango Pulp Weevil	Financing	1,409,992.00
USDA thru DA/BPI	Quality Assessment of Philippine Super Mangoes Irradiated at Maximum Tolerable Dose	Financing	173,332.00
USDA thru DA/BPI	Upgrading of Pilot Scale Gamma Irradiation Facility	Financing	11,724,750.00
USDA thru DA/BPI	Advocacy Program on Food Irradiation Technology	Financing	674,800.00
United States-Department of Energy (USDOE)	Radiological Threat Reduction Program	Financing	807,156.00
US-DOE	US-DOE Regulatory Infrastructure Support for PNRI	Financing	929,163.00
US-DOE	Megaports Initiative	Equipment grant	11,250,000.00 *(For PNRI)* *(260,000,000.00 Not included in Total – Grant for North and South Harbors)*

Australian Nuclear Science and Technology Organization	Regional Security of Radioactive Sources	Equipment, Training	4,800,000.00
Comprehensive Nuclear Test Ban Treaty Organization	Post Certification Activities at RN52, Tanay, Rizal	Financing	1,024,080.00
		TOTAL GRANTS: Php 32,793,273.00	

B-2. IAEA Technical Cooperation Projects

IAEA	Human Resource Development and Nuclear Technology Support	Equipment grant; expert dispatch; fellowship/training	2,793,637.00
IAEA	Enhancing Agricultural Productivity Through Radiation Technology in Mindanao	-do-	1,814,911.00
IAEA	Assessment of Erosion and Sedimentation Processes for Effective Formulation of Soil Conservation and Water Quality Protection Measures	-do-	3,004,239.00
IAEA	Nuclear Analytical Techniques for Evaluation of Airborne Pollution from Fossil Fuel-Fired Power Plants	-do-	3,558,380.00
IAEA	Isotope Applications in Improving Water Resource Management and Protection	-do-	240,786.00
IAEA	Site Selection and Conceptual Design of a Near-Surface Disposal Facility for Low and Intermediate Level Radioactive Waste	-do-	3,063,186.00
IAEA	Upgrading the Gamma Irradiation Facility	-do-	382,984.00
IAEA	Enhanced Nondestructive Testing Training	-do-	5,147,744.00
		TOTAL TC VALUE: Php 20,005,867.00	

Note: Project grants received from the IAEA in US $; Conversion rate in pesos is: US $1 = Php 49.00

B-3. IAEA Research Contracts

IAEA	Improvement of Sterile Male Performance of Oriental Fruitfly, *Bactrocera philippinensis*, for SIT Programs	Information exchange thru attendance to meetings; minimal financial support towards local expenses/activities	325,000.00
IAEA	Improvement of Mass Rearing Methods for *Bactrocera philippinensis*	-do-	325,000.00
IAEA	Use of Open Source Web Development Tools in Improving the Nuclear Knowledge Portal for the PNRI	-do-	325,000.00
		TOTAL RC VALUE: Php 975,000.00	

Grants received from the IAEA in Euro currency; Conversion: Euro 1= Php 65.00

TABLE 12. PAPERS/ REPORTS PRESENTED

Abad, Lucille V. "Small Angle Neutron Scattering of Kappa-Carrageenan". Paper presented during the Plenary Session- FNCA 2006 Workshop on the Utilization of Research Reactors", Philippines, 28 August – 1 September 2006.

Aurigue, Fernando B. "Varietal Development of Ornamental Plant Through Gamma Irradiation". Paper presented at the 10th Philippine Floriculture Congress", Sarabia Manor Hotel and Convention Center, Iloilo City, 14 November 2006.

Balog, Richard M. Faye G. Rivera and Juliet A. Anarna. "Yield Response and Feasibility Studies, Irradiation of Carrier and Technology Transfer of Biofertilizers in the Philippines". Paper presented at the 2005 FNCA Biofertilizer Workshop, PNRI Compound, Quezon City, Philippines, 9–13 January 2006.

Balog, Richard M., Faye G. Rivera and Juliet A. Anarna. "Comparative Effect of Bio-N with Carrier Sterilized Through Heat Autoclave and Gamma Irradiation on Corn". Paper presented at the 2006 FNCA Biofertilizer Workshop, Chiang Mai, Thailand, 20–24 November 2006.

Borras, Ma. Teresa L., Elvira Z. Sombrito, Alumanda M. Dela Rosa, Rizalina G. Osorio and Adelina dM. Bulos. "Strategies Toward the Commercialization of PZC-based ^{99m}Tc Generator in the Philippines". Paper presented during the 2006 FNCA Workshop on the Utilization of Research Reactors, Manila, Philippines, 28 August – 1 September 2006.

Bulos, Adelina dM. "Operation of RN-52: The Philippines' Radionuclide Data Input to the CTBTO International Monitoring System (IMS)". Presented at the CTBTO Network and Data Operations Workshop, Vienna, Austria, 20 –24 November 2006

Innis, Valerie Ann A., Pablo S. Saligan and Virginia S. Calix. "Grazing Incidence X-ray Technique for Characterization and Quality Control of Soft-Matter and Semiconductor Thin Films". Paper presented at the 12th India-Asean Technology Summit and Technology Platform, New Delhi, India, 6 – 7 November 2006.

Lanuza, Luvimina G. " Status of Radiation Processing in the Philippines". Paper presented at the IAEA RTC on Economical and Social Benefit of Radiation Processing, Standardization and Legislation Issues Regarding Radiation Processing Implementation in Europe, Eger, Hungary, 27 August 2006. Also presented at the IAEA RTC on Radiation Deactivation and Sterilization of Biohazard, Vadodara, India, 30 October – 3 November 2006.

Lapade, Avelina G., Adelaida C. Barrida and Alfonso O. Grafia. "Drought Tolerance of Soybean (Glycine max L.) in the Philippines". Paper presented at the FNCA 2006 Mutation Breeding Workshop, Takasaki City, Japan, 11 –15 September 2006. (A. C. Barrida- Presentor).

Nohay, Carl M. "Management and Control of Radiation Sources: Status of Current Initiatives". Presented at the Technical Meeting on the Development of the Web Version of the Regulatory Authority Information System (RAI, Vienna, Austria, 11–15 September 2006.

Obra, Glenda B. and Sotero S. Resilva. "Improvement of Sterile Male Performance of *Bactrocera philippinensis*". Paper presented by the senior author at the Second Research Coordinated Meeting of the Coordinated Research Program on " Improving Sterile Male Performance in Fruit Fly SIT Programmes", Salvador, Bahia, Brazil, 5 -9 September 2006.

Olivares, Ryan U. "Hydrogen Isotope Behavior in Lithium Titanate". Paper presented at the Plenary Session- FNCA 2006 Workshop on the Utilization of Research Reactors, Philippines, 28 August – 1 September 2006

Palattao, Ma. Visitacion B. "Regulatory Framework for the Safe Management of Radioactive Waste in the Philippines". Presented at the Asia Nuclear Safety Network (ANSN) Technical Group Meeting, Tokyo, Japan, 25–29 September 2006.

Palattao, Ma. Visitacion B. " Radiological Risks Assessment in Support of Licensing and Regulatory Activities of PNRI". Presented during the Advisory Committee Meeting on Training, Competencies and Outreach in Radiological Risk Assessment, Beijing, China, 18–21 December 2006.

Palattao, Ma. Visitacion B. " National Infrastructure for Radioactive Waste Management and Current Initiatives". Presented during the Seminar to Present the Joint Convention on the Safety of Fuel Management and on the Safety of Radioactive Waste Management , PNRI, Manila, Philippines, 15 November 2006.

Resilva, Sotero S. and Glenda B. Obra. "Improvement of Mass-rearing of Methods for Oriental Fruit Fly, *Bactrocera philippinensis*". Paper presented by the senior author at the Second Research Coordinated Meeting of the Coordinated Research Program on "Development of Mass Rearing for New World (*Anatrepha*) and Asian (*Bactrocera*) Fruit Fly Pests in Support of SIT"; Bahia, Brazil, 5 –9, September 2006.

Sombrito, Elvira Z., Azucena C. De Vera, Ma. Celestina V. Honrado, Rhett Simon dC. Tabbada and Alumanda M. Dela Rosa. "Isotope-Based Techniques in the Management of Toxic Algal Bloom". Paper presented during the 2006 EAS Asian Seas Congress, Haikou City, PROC, 12 – 16 December 2006

Sombrito, Elvira Z., Adelina dM.Bulos, Lorena A. Del Castillo, Efren Sta.Maria and Ryan U.Olivares. "^{137}Cs as Tracer of Agricultural Pollution in Manila Bay". Paper presented at the EAS Asian Seas Congress, Haikou City, PROC, 12 – 16 December 2006

POSTERS PRESENTED

Abad, Lucille V., S. Saiki, H. Kudo, Y. Muroya, Y. Katsumura and Alumanda M. Dela Rosa. "Pulse Radiolysis of ĸ-Carrageenan". Technical poster presented during the 7th International Symposium on Ionizing Radiation of Polymers, Antalya, Turkey, 23–28 September 2006.

Abad, Lucille V., S. Saiki, H. Kudo, Y. Muroya, Y. Katsumura and Alumanda M. dela Rosa. "Pulse Radiolysis of ĸ-Carrageenan". Technical poster presented at the 49th Annual Meeting of Japanese Society of Radiation Chemistry , Gunma, Takasaki, Japan, 12–14 October 2006.

Innis Valerie Ann A., Pablo P. Saligan and Virginia S. Calix. "Thickness Measurement of Nano-size Carrageenan Thin Films by X-Ray Reflectivity and Total Reflection X-Ray Fluorescence Spectroscopy". Paper presented as technical poster at the 27th Samahang Pisika ng Pilipinas Physics Conference, 2006.

Innis,Valerie Ann A., Pablo P. Saligan and Virginia S. Calix. "On Using a Philips X-Ray Powder Diffractometer for X-Ray Reflectivity". Technical poster presented at the International Conference for Small-Angle Scattering, Kyoto International Conference Hall, Kyoto, Japan, 9–13 July 2006 and published in the Book of Abstracts of the International Conference for Small-Angle Scattering, 2006.

Lanuza, Luvimina G., Franklin A. Pares and Estelita G. Cabalfin. "Gafchromic Dosimetry: The Philippine Experience". Technical poster presented at the 11th Tihany Symposium on Radiation Chemistry; Eger, Hungary, 27 –31 August 2006.

LIST OF ABBREVIATIONS

ANSN	–	Asia Nuclear Safety Network
ANSTO	–	Australian Nuclear Science and Technology Organization
ARPANSA	–	Australian Radiation Protection and Nuclear Safety Agency
CTBTO	–	Comprehensive Nuclear Test Ban Treaty Organization
DOE/NNSA	–	Department of Energy/National Nuclear Security Administration, USA
FNCA	–	Forum for Nuclear Cooperation in Asia
IAEA	–	International Atomic Energy Agency
ICTP	–	International Center for Theoretical Physics, Italy
JSPS	–	Japan Society for the Promotion of Science
KOICA	–	Korea International Cooperation Agency
MEXT/FNCA	–	Ministry of Education, Culture and Sports, Japan
NIRS	–	National Institute of Radiological Sciences, Japan
PEMSEA	–	Partnerships in Environmental Management for the Seas of East Asia
RAIS	–	Regulatory Authority Information System
RADA	–	Radiation Application Development Association, Japan
RCA	–	Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific
USDOE	–	United States Department of Energy

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