# 2011 ANNUAL REPORT

A CALL

# PHILIPPINE NUCLEAR RESEARCH INSTITUTE

**DEPARTMENT OF SCIENCE AND TECHNOLOGY** 

## 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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# message from the secretary



The year 2011 was another defining year for the Department of Science and Technology (DOST), particularly for the Philippine Nuclear Research Institute (PNRI). At the first quarter, we had to act swiftly and decisively to respond appropriately to the Fukushima nuclear accident in Japan. Though the incident was thousands of miles away, the global community was shaken, including our own front yard. The DOST, through the PNRI, was the sole authority that could assuage our people's fears. Our nuclear experts, in close coordination with international bodies and the member-agencies of the National Radiological Emergency Preparedness and Response Plan, studied every aspect of the accident and its possible impact on the Philippines. Our findings were immediately relayed to the media and the public through daily bulletins, news releases, and press conferences. We fielded our researchers to check radioactivity in the air around Metro Manila, in addition to generating data from our monitoring station in Tanay, Rizal.

The PNRI's timely, objective, and accurate response to the Fukushima accident ultimately resulted to a public more informed and more confident in the current administration.

Though events in the first half of 2011 significantly affected the public's perception of nuclear energy, the Institute's relevance and importance to the Philippine society in the realm of nuclear technology could not be overemphasized. PNRI's services and R & D projects, as detailed in this report, contribute significantly to health and nutrition, environmental resource management, agriculture and industrial productivity, human resource development, and peaceful applications of nuclear energy.

for Filipinos.

Mabuhay tayong lahat!



As our commitment to developing local technologies that work and contribute to the over-all development of the Philippine society, DOST-PNRI, anchoring on its 2011 performance, is set to embark on more high impact projects in the future. Through DOST-PNRI, we will continue to develop and expand nuclear technologies by Filipinos

MARIO G. MONTEIO Secretary



# message from the director



The year 2011 was both a challenging and exciting year for the Philippine Nuclear Research Institute - Department of Science and Technology (PNRI-DOST). Several events, planned and otherwise, confronted the PNRI's capability and resources in rendering the highest quality of service to our clientele and the public in general. In this Annual Report, we look back on the success of our response to challenges as we pursue our dual mandate of promoting the peaceful uses of nuclear energy and regulating their safe and secure utilization.

On 11 March 2011, the Great East Japan Earthquake of magnitude 9 occurred off the eastern coast of Japan followed by a 15-meter tsunami which disabled the power supply and cooling systems of the Fukushima Daiichi Nuclear Power Plant resulting in the reactor core meltdowns and subsequent release of radioactivity. As the national competent authority on nuclear matters, the PNRI was thrust to the center of the public's eye in the midst of the public's clamor to have a clearer understanding of the event and how it could possibly affect the country.

We convened the PNRI Executive Coordinating Council with the Experts Support Team, deployed radiation monitoring teams, and recommended the activation of the National Radiological Emergency Preparedness and Response Plan (RADPLAN) by the National Disaster Risk Reduction Management Council (NDRRMC) to enable the government to provide timely, accurate and objective information to the public. Through daily information bulletins on its website, press conferences and interviews by the tri-media, the PNRI kept the public and government officials connected with the unfolding events in the crippled nuclear power plant. Dose assessments undertaken by the PNRI scientists showed insignificant effects of the Fukushima nuclear accident to public health and safety and to the environment. With the support of the DOST and the NDRRMC, the PNRI allayed the fears of the public.

To counteract a possible backlash from the accident on its nuclear program, the PNRI pursued a more aggressive information campaign to promote nuclear applications, culminating at the year-end Atomic Energy Week Celebration.

Developments in the applications of nuclear technology and in the establishment of research infrastructures were achieved. Based on their completed research, the PNRI scientists recommended a guarantine dose for mango pulp weevil, making the fruits pest-free and appropriate for export. The guarantine protocol is now being evaluated by the United States Department of Agriculture-Animal Plant Protocol with the IAEA. The PNRI and the US Department of Health Inspection Service-Center for Plant Health Science and Energy continue their active cooperation in the Megaports Technology. The PNRI continues its work on radiation-modified Initiative Project which monitors illicit shipment of nuclear and natural polymers such as carrageenan, chitosan, and alginate. radioactive materials. This year, the US Government turned over PNRI collaborated with Philippine Rice Research Institute and the radiation portal monitors installed at the North and South National Institute of Molecular Biology and Biotechnology on Harbors to the Philippine Government. pot experiments which showed the plant growth promoting properties of oligo-carrageenan and oligo-chitosan on rice, The PNRI also strengthened its linkages and networks mungbean and tomato. The radiation-processed alginate-honey particularly with the IAEA, with the participation of DOST wound dressing is promising for the management of wounds Secretary Mario G. Montejo in the 55th IAEA General Conference. with exudates. In the absence of a working research reactor, the In their bilateral meeting held at the sidelines of the General PNRI scientists set up a small neutron source for nuclear reaction Conference, Secretary Montejo and IAEA Director General studies for research and training. The International Atomic Yukiya Amano have renewed their commitments for the peaceful Energy Agency (IAEA) designated the Philippines as one of three applications of nuclear energy for the Filipino people. pilot countries for the IAEA Water Availability Enhancement (I-WAVE) Project that aims to strengthen the national capacity to The PNRI is proud of the Dangal ng Bayan Award conferred to conduct a comprehensive water resources assessment. Dr. Lucille V. Abad by the Civil Service Commission. Ms. Glenda The PNRI is the Project Coordinator supporting the National Obra and Mr. Sotero Resilva garnered the Silver Award for Best Water Resources Board as Lead Agency. The Project has identified R&D Paper and Gold Award for Best R&D Poster, Agriculture

the hydrological gaps in water resources assessment. and Fisheries Modernization Act (AFMA) Award for Applied Research/Technology Generation and Information Generation, This year, the PNRI received technical assistance from the IAEA conferred by the Department of Agriculture. Five technical and the DOST Grants-in-Aid Program for the establishment of staff are pursuing their PhD programs and 14 are taking their two important facilities namely, the Technetium-99m (99mTc) M.Sc. degrees in physics, chemistry, biology, engineering and Generator Production Facility which will make <sup>99m</sup>Tc more environmental sciences. affordable to patients, and the Electron Beam Facility which will expand R&D on radiation chemistry and radiation processing.

On nuclear and related services, the PNRI's gamma irradiation services continue to expand as the Institute provided services to 61 clients from the industry and irradiated a total of 42,350 samples, marking a 77 percent increase over last year's figures. Equally notable was the increase of 270 percent in the number of samples forwarded to PNRI for radioactivity analysis at the heels of the Fukushima Daiichi nuclear accident.

As the Nuclear Regulatory Body, the PNRI formulated rules and regulations on the safety and security of atomic energy facilities and radioactive materials, regulated, and inspected about 300 licensees. Through PNRI, the government has complied with its commitments under her Safeguards Agreement and Additional

Indeed, we had an exciting 2011. We will strive to achieve more and sustain what we have achieved in the coming years. We owe this commitment to our dedicated staff, stakeholders, partners, and the people whom we serve.

ALUMANDA M. DELA ROSA, Ph.D.

Director

# **Generation** of **Knowledge** and Technologies



#### **BASIC RESEARCH**

#### **Applications of Radiation-Processed** Materials from Natural Polymers and their Derivatives

Studies on the use of radiation technology on natural polymers such as kappacarrageenan, chitosan and carboxymethylcellulose are being undertaken by PNRI to explore various applications of these materials, not only because they are abundant in the Philippines, but primarily due to their inherent bioactive properties. Among these properties are their plant growth promoting effect, hemostatic efficacy, and antioxidant property. The properties are enhanced when these natural polymers are converted to oligomers (polymers with shorter fragments) upon treatment with gamma radiation.

#### **Agricultural Applications**

Radiation-modified kappa-carrageenan and chitosan are being studied for their plant growth promoting effect. The Chemistry Research Section and the Agricultural Research Section of PNRI, in collaboration with the Philippine Rice Research Institute (PHILRICE) conducted preliminary pot experiments on rice and mungbean to determine the effect of oligo-carrageenan, in combination with chemical fertilizer on these crops. The effect of oligo-chitosan, in combination with biofertilizer, on rice and tomato were tested by National Institute of Molecular Biology and Biotechnology.

The results showed a notable difference in yield of mungbean treated with 75 mg/L oligo-carrageenan solution compared

to the control samples (no treatment of oligosaccharide). Results obtained by PHILRICE on the effect of oligo-carrageenan on rice indicated an increase in yield of around 17 percent at half-recommended rate of fertilizer application. An increase of 32 percent was observed for samples treated with oligo-carrageenan combined with full-recommended rate of nitrogen, phosphorus and potassium (NPK) concentrations. Initial experiments with oligo-chitosan, in combination with fullrecommended rate of fertilizer, indicated a 12.4 percent increase in the yield of tomato

#### **Health Applications**

Hemostats with different formulations and forms were prepared and tested for hemostatic efficacy. Initial tests conducted in vitro using swine blood indicated that the carboxymethyl-cellulose hemostat was comparable in performance to a commercial hemostat product (Quikclot).

#### **Other Applications**

The antioxidant property of kappacarrageenan irradiated at different doses was also assessed. The results showed that this property increases as the radiation dose increases.

#### Development of High Technology Materials

The Applied Physics Research Section (APRS) focused on the following activities as part of PNRI's research and development studies on the applications of neutron spectroscopic and other related techniques in the characterization of advance materials:

Research and development projects continue to brew from the Institute's

and agriculture, health and medicine, and industrial applications.

laboratories as the beneficial uses of nuclear technology spill onto more areas

of Filipino lives such as for: environmental protection and management, food



(1) capacity building in the use and operation of small neutron sources for nuclear reaction studies. The APRS has done efficiency calibration of the high purity germanium (HPGe) detector as well as alignment experiments of the americiumberyllium neutron source and thermalize neutron using the target-moderatorreflector (TMR) assembly; (2) development of research techniques for detection of heavy metals with ultra low concentrations using Total Reflection X-ray Fluoresence Spectrometry (TXRF); and (3) investigation of the performance of newly-acquired 50-millimeter (mm)<sup>2</sup> Silicon Drift Detector used for the TXRF module.



Heavy metal sample deposition onto silica substrate for TXRF analysis



#### NUCLEAR APPLICATIONS IN FOOD AND AGRICULTURE

Crop Improvement Through Radiation Technology

#### Rice

Agricultural Research Section continued its studies on the irradiated IR 72 rice variety to obtain mutants with increased protein content and with low to intermediate amylose content. Cooked rice with low to intermediate amylose content is soft and sticky, which is preffered by most Filipino consumers.

Gamma Irradiation. Irradiation at 200 gray (Gy) appears to be the optimum dose for improving the quality of rice. Screening results showed that the amylose content of the seeds obtained from the sixth generation  $(M_c)$  plantings of IR 72 irradiated at 200 Gy were in the low to intermediate range in 12 out of 153 plants. Only one out of 127 plants irradiated at 300 Gy produced seeds with low to intermediate amylose content. Seeds from the control (unirradiated) IR 72 and the check or recommended variety (IR 64) contained high amylose content. The results will be verified using quantitative methods.

Plants irradiated at 200 Gy exhibited improved agronomic traits. They showed higher tillering and higher number of grains per panicle than the plants from the parent variety or control (IR 72), the check or recommended variety (IR 64), and even from the plants irradiated at 300 Gy.

plants of IR 72 seeds previously irradiated at 10, 20, 30 and 40 Gy by heavy ion beam at Takasaki Ion Accelerator for Advanced Radiation Application in Japan were planted in the PNRI experimental field. Of these, the seeds exposed to 25 Gy produced plants that are 25 percent shorter than those obtained from the unirradiated IR 72 seeds. Furthermore, the seeds exposed to 20 Gy produced plants that flowered about a week earlier. Subsequent studies will focus on the plants that exhibited improved traits.

**Ion Beam Irradiation.** Third generation (M<sub>2</sub>)

#### Mungbean

The Agricultural Research Section (ARS) planted five high-yielding varieties of mungbean previously irradiated with doses of 200, 400, 600 and 800 gray (Gy) gamma radiation at the PNRI experimental field in 2010. These varieties consisted of the following: Psj-B-11-176 and Psj-31 (Indonesia); VC 2917 (China); KPS2 (Thailand); and NM51xVC1973A (Pakistan). The local variety, NSIC Mg 11, served as check variety.

In 2011, results of the evaluation of the protein content of the seeds obtained from the fourth generation (M<sub>2</sub>) planting of the five varieties showed that one plant of Psj-B 11-176 irradiated at 400 Gy had the highest protein content of 28.22 percent. One plant of the same variety irradiated at 600 Gy yielded 26.62 percent; and that from VC-2917 irradiated at 800 Gy had 17.40 to 23.20 percent. Protein content of the control (unirradiated Psj-B 11-176) ranged from 22.53 to 23.63 percent while

that of the unirradiated VC-2917 ranged from 20.43 to 20.95 percent.

#### Cashew and Mangosteen

Ongoing mutation breeding researches in PNRI aim to obtain varieties with increased yield, improved fruit quality, more desirable agronomic traits, such as short stature to facilitate harvesting, early maturity and all year round fruiting.

Cashew. Seeds of Makiling cashew cultivar obtained from the University of the Philippines in Los Baños were irradiated with 100 to 400 gray (Gy) gamma rays and then planted in the PNRI experimental greenhouse together with the control. It was observed that seeds exposed to 100 and 200 Gy dose survived vigorously six months after planting.

Forty-one cashew trees from the first generation (M<sub>1</sub>) of irradiated and unirradiated seeds planted at the PNRI experimental field were maintained. Fruits from the trees irradiated at 100 to 400 Gy were harvested and evaluated based on the parameters standardized by the National Seed Industry Council for fruit crops. Three putative mutants and one Makiling strain were selected for evaluation of nut characteristics (such as length, width and weight) of both nut and kernel. The percentage of nut shell recovery was also evaluated to determine the nut:kernel ratio.

Cashew seedlings from the second generation (M<sub>2</sub>) of 165 irradiated seeds and 30 unirradiated seeds were maintained at the PNRI screenhouse. Seedlings which

control

Putative mutants of Makiling cashew





were treated with 100 to 400 Gy gamma radiation are being evaluated.

Mangosteen. Seeds of mangosteen irradiated with 10 to 50 gray (Gy) dose of gamma rays and planted in vivo as whole seeds and half cotyledons were germinated in seed boxes (perlite medium) prior to their transfer to individual plastic bags after one month. It was observed that 50 days from transplanting, the seedlings (both from the whole and half cotyledons) that were treated with 10 Gy had the highest survival percentage (89 %).

Series of *in vitro* planting of seeds from Davao mangosteen fruits were conducted to produce a steady supply of explants for vegetative micropropagation. Regenerated shoots and plantlets from these in vitro germinated seeds will likewise be used for nutrient medium selection studies and generation advancement using vegetative parts.

#### Ornamentals

Newly Registered Varieties. Six PNRIdeveloped mutant varieties of ornamental plants that are registered with the National Seed Industry Council (NSIC) have been officially registered with the joint Food and Agriculture Organization/International Atomic Energy Agency Database of Mutant Variety and Genetic Stocks (http://mvgs. iaea.org). These are: Murraya 'Ibarra Santos', Dracaena 'Marea', Cordyline 'Medina', Sansevieria 'Sword of Ibe', Freycinetia 'Golden Stairs', and Cordyline 'Afable'.

To maintain a steady supply of mutant ornamentals for promotional purposes, Murraya 'Ibarra Santos', Dracaena 'Marea' and *Cordyline* 'Medina' are continuously being propagated at the PNRI screenhouse through seeds and cuttings.

application for registration of Callisia repens 'Bart's Trail' with NSIC was submitted in July. This mutant variety has longer, purplish internodes and larger leaves. Samples of the mutant clone, the original parent material and a commercial variety of Callisia repens were sent to the Bureau of Plant Industry - Los Baños National Crop Research and Development Center for characterization.

The application for registration of *Dracaena* 'Sun Beam' was reactivated in 2011 when 155 plants of the chlorophyll mutant Dracaena sanderiana var. virescens had been propagated. However, the Technical Work Group on Ornamental Crops of the NSIC was not able to evaluate the application forms.

The application for registration of the mutant "Bagauak na Puti/Itim" (Clerodendrum calamitosum) will be filed when at least 50 plants are produced. The mutant will be registered as Clerodendrum 'Alum's Bloom' in honor of the first woman director of the PNRI, Dr. Alumanda M. Dela Rosa. This mutant variety is a semi-dwarf and early-maturing shrub. It is suitable for the garden of plants with fragrant flowers because of its scented blooms.

The mutant of Acalypha 'Brownie' will be registered in 2012 as Acalypha 'Excitement'.





#### Mutant Varieties for Registration. The

This variety has large, greenish brown leaves of different shapes that turn bright red depending on the light intensity and temperature instead of small, coppery leaves. It can be used as a landscaping material for bright and cool areas. Plants may be containerized but should be grown and exposed to sunlight.

#### Putative Mutants of Other Ornamental

Plants. The following experimental plants are under observation and vegetative generation (V) advancement: (1) chlorophyll mutant Indian necklace (Clerodendrum wallichii) at V<sub>2</sub> and another one at V, that bore flowers in compact inflorescences; (2) dwarf and/or compact Golden duranta (Duranta repens) at M,V.; (3) variegated Powderpuff lily or African Blood lily (Scadoxus multiflorus) with loose flower umbel at  $V_{a}$ ; (4) Ti plant (Cordyline fruticosa) with leaves that differed in color and shape from the control at V<sub>2</sub>; (5) Orange amaryllis (Hippeastrum puniceum) with thicker and darker-colored flowers on shorter peduncles at  $V_{2}$ ; (6) Pink amaryllis (Hippeastrum reticulatum) with thicker flowers at  $V_{a}$ ; (7) variegated native "Galamay-amo" or Five fingers (*Schefflera* sp.) from M<sub>1</sub>V<sub>1</sub> to M<sub>1</sub>V<sub>2</sub>; and a yellow-spotted Zz plant (Zamioculcas zamiifolia) at V, to V,

Putative mutant Duranta erecta

#### **Other Ornamental Crops**

Spathoglottis Orchids . The application for patent of "Embryo Culture Medium Composition for Spathoglottis and Other Orchids" (Application No. 1-2011-000185) had been filed with the Intellectual Property Office (IPO) through the Technology Application and Promotion Institute (TAPI). The application of the utility model registration of the technology "Process for Karyotyping Mitotic Chromosomes of Spathoglottis spp. and Other Orchids " (Application No. 2-2011-000282) had also been filed with the IPO through TAPI.

A white-flowered form of a possible new species of Spathoglottis has been discovered among the collection at PNRI.

Hoya. The application for patent of "Production of Mutant Philippine Endemic Hoya by Gamma Irradiation of Stem Cuttings" (Application No. 1-2011-000184) has been filed with the IPO.

As of December 31, 2011, there are 184 living accessions of Hoya with 66 identified native species, 18 unknown native species, and 25 imported species at the PNRI germplasm collection. Eight of the 18 unknown native species are probably unidentified or new to science.

Selected putative mutants of Hoya are being propagated at PNRI to advance their vegetative generation. These are now observed for stability of altered characteristics. Likewise, seeds of Hoya obscura stored in a glass container and kept in the refrigerator for two months had a

The 2011 First Quarter Issue of Topical Stamps featuring Philippine Ho

germination of 70 percent versus 98 percent in Hoya buotii under similar storage conditions and time.

This year, PNRI provided the Philippine Postal Corporation (PPC) with photos and information on names and descriptions of selected Philippine Hoya species. The PPC used these information for the 2011 First Quarter Issue of Topical stamps featuring Philippine Hoyas which was officially released on March 8, 2011 and will be available until March 7, 2012 or as stocks allow. It is classified as a "special" kind of issue with a denomination of Php7.00.

#### Pest Control

#### Quarantine of Mango Pulp Weevil in Philippine Carabao (Philippine Super) Mangoes

Research studies at PNRI have shown that a minimum absorbed radiation dose of 165 gray (Gy) is sufficient to cause sterility (no egg laying or oviposition) in adult mango pulp weevil (MPW), Sternochetus frigidus (F.) and that this dose would provide quarantine security for S. frigidus in exported Philippine "Carabao" or "Manila Super" mangoes. Mango pulp weevil is a quarantine pest that prevents the export of mangoes from the Philippines to countries with strict quarantine regulations. On the other hand, those obtained from Guimaras Island which are certified as seed weevil and pulp weevil- free can be exported.

The data obtained from the studies will be submitted to the United States Department of Agriculture (USDA) - Animal and Plant

Health Inspection Service -Center for Plant Health Science and Technology (APHIS-CPHST) through the Department of Agriculture – Bureau of Plant Industry (DA-BPI) for approval as guarantine treatment to enable export of our Philippine Super Mango to the United States.

The approval of the recommended dose would result in the expansion of the export market for our Philippine mango. It would also mean an increase in income for our mango growers and exporters. Actual export can be done after the recommended dose has been approved and the upgrading of the PNRI Multipurpose Irradiation facility has been accredited by the USDA-APHIS-CPHST. In collaboration with the DA-BPI, the PNRI is undertaking preparations for the accreditation in consultation with the USDA.

#### **Effect of Gamma Irradiation on** Coconut Leaf Beetle, Brontispa longissima (Gestro)

The study is a component of the project entitled "Development of Integrated Pest Management Strategies Against Brontispa longissima (Gestro), an Invasive Pest of Coconut and Other Palm Species". This is being done in collaboration with the Philippine Coconut Authority, Department Brontispa longissima (Gestro), an invasive of Agriculture (DA-PCA) to coconut pest. determine the effect of gamma (actual size: 9.5 mm x 2.0 mm) irradiation on the sterility of B. longissima, one of the most destructive

> ulp weevil-infested mangoes inside the tote boxes are being readied for irradiation inside the PNRI Multipurpose Irradiation Facility.



Skin-Ap

insect pests of coconut. No study has ever been done on the irradiation of B. longissima. If this insect can be rendered sterile by gamma radiation without adversely affecting its competitiveness, then releases of sterile insects can be considered as an alternative method of control for this pest. Thus, the sterile insect technique using gamma radiation can be integrated with other methods of control in an integrated pest management program.

skin-Up

As initial activities for this study, adults (males or females) were irradiated with varying doses of gamma radiation to determine the dose that will cause sterility. Based on the preliminary results of the irradiation on adult males, egg hatch decreased with increasing dose. In adult females, the eggs laid also decreased as the dose was increased from 20 to 25 gray (Gy). No egg hatch was observed beyond 25 Gy.

#### HEALTH AND MEDICINE

#### Stability Testing and Technology Transfer of PVP Carrageenan Hydrogel Dressing for Burns, Wounds and Bedsores

The final phase of this project was undertaken. It involved the conduct of stability testing, finalization of the market acceptability study and eventual transfer of technology to Biotecos Company, Inc., a private cooperating agency which signified interest in the commercialization of the polyvinyl pyrollidone (PVP)-carrageenan

hydrogel dressing for burns, wounds and aerigunosa and Staphylococcus aureus. bedsores. As part of the mentioned activities, the process flow for the semi-commercial The selection of appropriate packaging production of hydrogels by radiation material compatible for radiation processing was optimized. Benzalakonium sterilization of the honey wound dressing chloride was determined to be an was also done. Initial results of migration appropriate antibactericide for the hydrogels. tests for irradiated samples in plastic It was found to substantially decrease film packaging showed that irradiated bioburden without altering the physicoand non-irradiated films conform to mechanical properties of hydrogels. approved specification limits for articles (ethanol, acetic acid, n-heptane, potassium The Licensing Agreement between PNRI and permanganate consumption) intended for Biotecos has been drafted for approval of packaging.

both parties.

#### Development of Radiation-Processed Honey Wound Dressing

The Institute has initially developed a biomedical dressing in pad form for the treatment of deep wounds which consists of an alginate fiber sheet with organic honey as the main ingredient. Honey is a good material for wound management because it was found to have an antimicrobial property and some bioactive compounds.

The Biomedical Research Section conducted tests to prove the antimicrobial property of honey infused in the alginate dressing. Results of the tests indicate that honey has antimicrobial property against two microorganisms, namely, Pseudomonas



Philippine Nuclear Research Institute | Annual Report 2011 Photo: http://www. http://pinoytrees.blogspot.com/2011/05/hoya-mail-anyone.html





#### Application of Nuclear Techniques in Harmful Algal Bloom Studies

#### **Gamma-based Detection System** for Monitoring Paralytic Shellfish Poisoning

A radioisotope-based device or a novel gamma-based field detection system is being developed for simple, rapid and on-site measurement and analysis of levels of paralytic shellfish toxins (PSP) or "red tide poisons", in samples like mussels, oysters and clams. The device will serve as a useful tool in the effective management of harmful algal blooms or red tide.

Work is also being done on optimizing iodination of the conotoxin compound to replace the currently used imported and unstable tritium-radiolabelled reagent for use in the receptor binding assay (RBA) for PSP. The RBA is a laboratory-based technique for PSP monitoring.



Sensory evaluation of non-irradiated and irradiated pork adobo for immuno- compromised patients

#### The newly upgraded PNRI Radioisotope Laboratory building that will house the Technetium-99m (99mTc) hot cell facility (right photo)







### Shelf-Stable Filipino Ethnic Foods for Immuno-Compromised Patients and **Calamity Victims**

PNRI is developing safe, shelf-stable and good quality, ready-to-eat food for immuno-compromised patients through radiation technology.

Three experimental trials on the efficacy of irradiation on the quality and shelf-life of pork adobo were completed this year. The evaluation was based on the microbiological, physico-chemical and sensory qualities of irradiated and non-irradiated cooked meat. Initial results indicated that at a dose of 6 kilogray (kGy), the microbiological load of pork adobo was reduced to an acceptable level for immuno-compromised patients. Sensory ratings of the irradiated samples were comparable to non-irradiated lots. The organoleptic quality of both irradiated and non-irradiated samples showed acceptable ratings up to a period of 10 days at chilled conditions.

PNRI also completed three experimental trials on the efficacy of irradiation on the quality of pork adobo packaged in polyethylene pouches. Migration tests were conducted on the irradiated and nonirradiated packaging materials to prove that irradiating plastic and aluminium materials will not cause undesirable effects on the cooked meat. Results of packaging materials indicated that irradiation at a dose of 10 kGy

did not cause migration of additives to food products and that the materials conform to approved specification limits for articles intended for food packaging.

#### Establishment of the Technetium-99m **Generator Plant Facility**

With assistance from the International Atomic Energy Agency (IAEA), the PNRI completed the rehabilitation and upgrading of the Radioisotope Laboratory building that will house the Technetium-99m (99mTc) Generator Plant. IAEA's assistance was extended to ensure that the laboratory complies with good manufacturing practice and radiological safety requirements for the production of <sup>99</sup>molybdenum-<sup>99m</sup>Tc generator as source of <sup>99m</sup>Tc. Technetium-99m is a medical radioisotope which makes up about 80 percent of nuclear medicine diagnostic procedures in the country.

Preparations for the installation of the <sup>99m</sup>Tc hot cell facility for production of <sup>99m</sup>Tc generators as well as studies on the quality control procedures for the preparation of <sup>99m</sup>Tc and <sup>99m</sup>Tc radiopharmaceuticals have been undertaken.

With the establishment of the <sup>99m</sup> Tc generator production facility, the PNRI hopes to provide 99m Tc to hospitals at a lower cost as compared to the cost of imported ones. It would also make this radiopharmaceutical available for research.

#### Development of Personnel Dose Monitoring System in PNRI

In support of this project, the Health Physics Research Section conducts studies on the characteristics of different types of solid state dosimeters such as the thermoluminescent dosimeter (TLD), glass dosimeter and optically stimulated luminescence dosimeter. As part of the studies, the Institute participated in the inter-comparison study on personnel dosimeters at Oarai Research Center in Japan, A total of 35 TLDs from PNRI were sent to Oarai Research Center for exposure to radiation sources. The irradiated dosimeters were then sent back to PNRI for dose measurements.

Result of this inter-comparison experiment showed that the TLDs sent by PNRI were well-calibrated and within acceptable dose values vis-à-vis the known exposure and blind exposure to the radionuclides cesium-137, nitrogen-40 and cesium-137 plus nitrogen-40.

#### Local Production of Medical Cyclotron-Produced Radioisotopes

To have access to modern diagnostic treatment through local production of medical cyclotron- produced radioisotopes, a Task Force (TF) was formed to spearhead the development of the concept for the establishment of a centralized

medical cyclotron and Positron Emission Tomography-Computed Tomography (PET-CT) facility in the Philippines. The TF consisted of representatives from PNRI, Technology Resource Center; nuclear medicine practitioners; potential hospital partners; Office of the Government Corporate Counsel; and Public-Private Partnership Center of the Philippines of the National Economic and Development Authority.

The International Atomic Energy Agency is extending technical assistance to the Philippines with the approval of a Technical Cooperation project in the establishment of a medical cyclotron facility.

# AND MANAGEMENT

# Tide Areas



An initial concept of a centralized medical cyclotron and PET-CT facility



Time-integrated suspended sediment



Lead-210 analysis in sediment core using alpha spectrometry

# ENVIRONMENTAL PROTECTION

#### Historical Sedimentation Rate and Radiometric Fingerprinting of Suspected Sediments in Selected Red

Isotopic tracers are used as tools to establish the historical profile of nutrients and other contaminants in marine ecosystems which can contribute to increased occurrence of sediments. The sediments can contribute to increased occurrence of harmful algal bloom (HAB), commonly known as "red tide" in Sorsogon Bay which is an area that experiences regular HABs. In the past years, a harvest and consumption ban had been declared in the area as the level of toxin in shellfish exceeded the regulatory limit.

#### **Sedimentation Rates** in Sorsogon Bay

Sediments are associated with toxic elements and pollutants that could lead to negative effects, including HAB. Lead-210 (Pb-210), a naturally occurring radionuclide, was used to estimate the sedimentation rates in Sorsogon Bay. Results show that the central part of the Bay experiences slow build up of sediments at a rate of 0.5 centimeter per year (cm/year). The influence of anthropogenic activities on the sedimentation rate is seen in the more rapid accumulation of sediments near human settlements (1.3 cm/year) and an open dumpsite (1.8 cm/year). In an area where volcanic materials are suspected to have contributed to the sediment load, a sedimentation rate of 1.8 cm/year was observed.

#### **Sediment Fingerprinting** in Sampaloc River

Statistical analysis of the stable isotopic composition of carbon and nitrogen and the elemental composition of suspended sediments from the Sampaloc River, a tributary to the Sorsogon Bay, provided a fingerprint of the sediments which facilitated the identification of sources of sediments in the river. This could be related further to the source of contaminants/ nutrients that load the river system. The



(Left photo) Distillation of water samples from various towns in Bulacan prior to electrolytic enrichment for

The High Purity Germanium (HPGe) detector is being used for the analysis of NORM/ TENORM in the Philippine

mathematical mixing model showed that channel banks are the largest sediment load contributors in Sampaloc River. The cultivated areas and woodland areas are the next significant contributors. This information would be useful in prioritizing areas to focus for conservation and remediation. Sediment control and management should focus more on the channel bank area.

#### Isotope Applications in Verifying **Recharge Processes in Bulacan**

The project involves the use of isotopebased techniques and chemical analyses to assess the vulnerability of groundwater to contamination and salinization and to verify groundwater recharge processes. The data obtained from this project would be very useful in formulating policies for the management and protection of groundwater resource and freshwater quality in the study areas.

#### **Groundwater Recharge Process**

Integrating the hydrogeological, water chemistry, and isotopic data obtained, the replenishment of the groundwater system in Bulacan province is perceived to take place through the following processes: (1) direct rainfall infiltration into the top soil and exposed permeable rocks; (2) infiltration of surface water (river and irrigation water); and (3) recharge from the hilly areas.

#### Source of Groundwater Salinity

In the coastal area, there is mixing with sea water. The intrusion of sea water from

Manila Bay produces well waters with chloride content that exceeds 1,000 mg/L such as in Balagtas and in Obando, Bulacan province. The water level in these wells normally approximates the sea level elevation, indicating hydraulic connection between the fresh groundwater and the sea. In the areas of Angat, Baliuag, Sta. Maria, San Miguel, San Rafael, Plaridel, and Calumpit, the leaching of dissolved halite increases the salinity of the groundwater. This is different from connate water which is of marine origin. This differentiation is shown by the profile of the isotopic composition and chloride concentration of groundwater. The infiltration of irrigation water, characterized by young evaporated water and relatively higher salinity, is also shown to be a cause of salinity in Plaridel and Baliwag. The detection of recent recharge to the groundwater indicated vulnerability of the groundwater to contamination sources from agricultural

#### Isotope Hydrology in National Water Assessment in the Philippines

and industrial sources in the area.

#### The I-WAVE Project

The Philippines, through PNRI, was chosen as one of the pilot sites for the implementation of the Water Availability Enhancement (I-WAVE) Project of the International Atomic Energy Agency (IAEA). This project aims to strengthen the national capacity to conduct a comprehensive water resources assessment.

In coordination with the National Water Resources Board (NWRB) and with assistance from the IAEA and the Department of Science and Technology, the PNRI successfully hosted the National Workshop for the Development of the Philippine Hydrological Gap Plan in March 2011. The first draft of the report resulting from this workshop entitled "Gaps in Hydrological Data and Information in the Philippines" has been completed for review by concerned agencies.

#### Fourth Interlaboratory **Comparison Exercise for Analysis** of Water Samples

The PNRI participated in the fourth interlaboratory comparison exercise for  $\delta$  hydrogen-2 ( $\delta^{2}$ H) and  $\delta$  oxygen-18 ( $\delta^{18}$ O) analysis of water samples (WICO2011) organized by the IAEA Isotope Hydrology Laboratory for laboratories engaged in routine analysis of hydrogen and oxygen stable isotope composition of water samples. The exercise was participated in by 137 laboratories from 53 countries. One hundred percent acceptable results within  $\pm 2\%$  for  $\delta^2$ H and  $\pm 0.2\%$  for  $\delta^{18}$ O were obtained by PNRI. However,  $\delta^2$ H exhibited large variability and the precision needs to be improved. The primary cause of deviation from the reference value appeared to be improper or compromised storage of laboratory standard and primary reference waters, so the importance of proper storage and handling of laboratory standards can not be understated.

#### Assessment of TENORM in Philippine Marine Biota

Under a DOST Grants-in-Aid project, the Health Physics Research Section conducted marine sampling activities in three study areas to assess the presence of technologically-enhanced naturallyoccurring radioactive materials (TENORM) in the Philippine marine biota. The study areas were chosen on the basis of their proximity to industrial plants producing TENORM in their operations. These areas were: (1) Dupong Bay in Isabel, Leyte where the Philippine Phosphate Fertilizer Plant is located; (2) Lingayen Gulf in Pangasinan, site of the Sual coal-fired power plant; and (3) Balayan Bay in Batangas, site of the Calaca coal-fired power plant.

A total of 30 marine biota samples that are commonly eaten by the populace (milkfish, shrimp and squid) were collected from the three sampling sites. The gamma emissions from the samples were analyzed for the radioactive elements thorium-232 (Th-232), radium-226 (Ra-226) and potassium-40 (K-40) using a High Purity Germanium detector.

The analyses of the biota samples showed the following results: (1) Milkfish from Lingayen Gulf and Indian mackerel from Balayan Bay showed low concentrations of Ra-226 while the rest of the samples were below the lower limit of detection; (2) Th-232 concentrations were observed in 10 fish, one crustacean (shrimp) and one mollusc (squid) samples. Th-232 concentrations in these samples ranged from 1 to 7 becquerel per kilogram (Bq/kg) with

an average concentration of  $3 \pm 1$  Bg/kg; (3) the concentration of K-40 in all marine biota samples analyzed ranged from 105-607 Bg/kg with an average concentration of 333 + 140 Bg/kg. The observed values for the concentration of K-40 in fish are within the range of values reported in the Asia-Pacific Marine Radioactivity Database (ASPAMARD) which is 4 to 720 Bq/kg. The Th-232 concentration of fish samples reported in ASPAMARD ranged from 0.1 to 2.3 Bg/kg.

#### Management of CTBTO Stations in the Philippines: RN52 and NDC-137

The Philippines, through PNRI, has continued its active involvement in the management of the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) Radionuclide Station (PHP52) and National Data Center (NDC-137). The general objectives of this project are to operate and maintain the PHP52 and the NDC-137 stations, and transmit data to the International Data Center in Vienna, Austria. Data from the CTBTO radionuclide monitoring station (RN52) were used to assess the impact of the Fukushima Nuclear Power Plant accident that occurred in Japan on 11 March 2011.

The radionuclides detected and quantified at the PHP52 station include cesium-137 (Cs-137), cesium-134 (Cs-134), cesium-136 (Cs-136), iodine-131 (I-131), iodine-132 (I-132), tellurium-129 (Te-129), and tellurium-132 (Te-132). These are attributed to be emissions from the Fukushima nuclear power plant. The most significant artificial radionuclides were Cs-134 (activation

product), Cs-137 (fission product), and I-131 (fission product). Maximum activity concentrations of these radionuclides are the following: 92 microbecquerels per cubic meter ( $\mu$ Bq/m<sup>3</sup>) of Cs-137 and 480  $\mu$ Bq/m<sup>3</sup> of I-131. A person exposed to these maximum concentrations of radionuclides for a whole year will receive an estimated dose of about 130 nanoSievert (nSv) through inhalation and immersion, a dose that is about 7,000 times lower than the limit of 1 milliSievert (mSv) per year for public exposure due to radiation practices. These radioactivity levels pose no hazards to human health.

#### Radon Monitoring at the Valley Fault System and its Implication as an Earthquake Precursor

The concentration of radon in soil is being used by PNRI as indicator of seismic activity or as a possible tool to predict an earthquake. Radon is a naturally-occurring radioactive inert gas and faults are one of the escape routes or pathways of radon. This year, measurements of radon in soil using RAD 7 Electronic Radon Detector was conducted on a five-day monthly basis at 23 established monitoring stations along the East and West Valley fault system. Evaluation of the results obtained from the 204 radon measurements showed no significant changes in the radon pattern.

Another technique for monitoring radon in soil was applied in the United Nations Development Program-assisted project on the monitoring of the valley fault system (VFS). The technique uses LR-115 (type 2





(Left photo) Heavy duty air sampler at the CTBTO PHP52 air particulate monitoring station in Tanay, Rizal

#### 2

Radon monitoring using a RAD 7 electronic radon detector within the West Valley fault system along the boundaries of Rodriguez, Rizal and Quezon Citv



(Left photo) Air sample collection from PNRIestablished monitoring station at the Ateneo de Manila University in Quezon City

> Analysis of marine sediments using X-ray fluorescence spectrometry

Kodak film) plastic detector, placed at the top of a 30 centimeter long PVC pipe which is then placed inside the bottom of a one meter long PVC pipe that is dug into the ground. The detector is left on the ground for 30 days after which it is retrieved and replaced. The film or plastic, when exposed to alpha radiation from radon, will exhibit alpha tracks which are counted and processed with the aid of a trinocular microscope. An appropriate technique for the chemical processing and optical density measurement of LR-115 films have also been developed to improve the analysis of radon measurement.

The track technique was used on a total of 18 stations along the VFS, 14 along the West Valley Fault, one along the East Valley Fault, and three inside the PNRI compound. A total of 154 films have been deployed and retrieved. These have been processed and developed. Evaluation and analysis of radon is ongoing.

#### **Pollution Source Apportionment**

Nuclear analytical techniques are being used to obtain data on the major sources of pollution and to estimate the relative contribution of these sources to air pollution in Metro Manila. This year, additional data were obtained from the analyses of 510 air filter samples obtained from PNRI-established monitoring stations in Valenzuela City; Poveda Learning Center in Pasig City; and in Ateneo de Manila University (ADMU) campus in Quezon City. The latter is being maintained by PNRI in collaboration with the Australian Nuclear

Science and Technology Organization. The collected air filter samples, fractionated into the coarse and fine fractions, were analyzed for their particulate mass by gravimetry, black carbon by reflectometry, and multi-elements present by energy dispersive x-ray fluorescence. Results of the analyses showed that prevailing air quality in Metro Manila is still very bad since PM 2.5 levels still exceed the World Health Organization guideline value of 10 µgm-3. The bulk of the fine air particulate pollutants were determined to come from traffic-related activities as shown by source apportionment studies.

This year, the PNRI started a DOST Grantsin-Aid project on "Assessment of Air Particulate Lead Sources in Valenzuela, Metro Manila by Nuclear Analytical Techniques and Receptor Modeling". This is primarily aimed at validating and determining the possible sources of lead in Valenzuela, Metro Manila. PNRI also started sampling for organic carbon/ elemental carbon at Encanto, Bulacan (in collaboration with the community of the Notre Dame de Vie) and at Valenzuela.

#### Elemental Characterization of Marine Sediments and Rice Samples Using Nuclear - Related Techniques

In collaboration with the Forum for Nuclear Cooperation in Asia (FNCA), the PNRI started projects on determining the toxic and trace element inputs in two bays and a river as well as in rice samples through the use of nuclear and related analytical techniques.

#### In Manila Bay

An analysis of the marine sediments in Manila Bay was done by employing X-ray fluorescence spectrometry. Results showed the presence of the following elements: (1) naturally-occurring (lithogenic such as silicon, titanium, aluminium, magnesium, rubidium, zinc and iron), biogenic (calcium, magnesium) and conservative (sodium and chlorine); (2) non-naturally occurring, mostly anthropogenic, brought to the bodies of water by aeolian or fluvial input (heavy metals lead-copper-zinc and nickelchromium). The heavy metal enrichment was attributed to the burning of fossil fuels, iron and steel manufacturing (present in Valenzuela-Bulacan area), ferry and fishing services and other industrial activities present in Manila Bay. Marine organisms are affected by the presence of these heavy metals by means of bioaccumulation, and may later on affect humans because of trophic transfer and biomagnification.

#### In Sorsogon Bay

Toxic and trace element inputs in Sorsogon Bay sediments were determined using X-ray fluorescence spectrometry. Analyses of the marine sediment samples collected indicated that most of the trace elements which cause heavy metal enrichment are of anthropogenic origin, which in turn may have been caused by industrial activities surrounding the area.

#### In Aklan River

Application of a nuclear analytical technique for the reliable determination of major elements (such as chlorine, magnesium, iron) and trace elements (like copper, barium, cadmium) in sediment samples was successfully carried out by a PNRI researcher during her threemonth fellowship under the Nuclear Scientist Exchange Program at the Tokyo Metropolitan University in Japan. The evaluation was carried out by using neutron activation analysis to analyze stream sediments obtained from four sites in the tributaries of Aklan River and five marine coastal sediments from Batan, Aklan in the Philippines.

#### **In Rice Samples**

As part of the FNCA project, three Japanese rice samples and four Philippine polished rice samples, mostly bought from the supermarkets, were analyzed for toxic and trace elements by a PNRI researcher during her three-month fellowship training under the Nuclear Scientist Exchange Program at the Tokyo Metropolitan University in Japan. Instrumental neutron activation analysis (a very sensitive non-destructive multielement analytical technique) and isotoperatio mass spectrometry were used for the analyses. The samples were also analyzed at PNRI using energy diffraction x-ray fluorescence spectrometry and isotope ratio-mass spectrometry.

Results indicated that compared with the unpolished rice standard NIES CRM10b, the polished Japanese and Philippine rice samples had reduced concentrations of elements by as much as 1/10 for magnesium; <sup>1</sup>/<sub>4</sub> for manganese; 1/5 for potassium and 1/3 for sodium. However, levels of calcium and zinc were not greatly affected. Arsenic was found in all the Japanese rice tested at an average concentration of 0.103 microgram per gram  $(\mu g/g)$  and three out of four of the Philippine rice at an average concentration of  $0.070 \,\mu g/g$ . Arsenic contamination may have been introduced from the fertilizer used in rice fields. Higher levels of bromine were seen in two of the Philippine

rice at 14 and 34  $\mu$ g/g with the most probable source being the pesticide methyl bromide. Japanese and Philippine rice were distinguishable from isotopic ratio data of carbon-13. A Philippine rice sample with high bromide and isotopic data different from the other Philippine rice samples indicates that this particular sample may have been imported and may have been exposed to the pesticide methyl bromide on quarantine.

### INDUSTRIAL APPLICATIONS

### Survey of Nuclear and Other Industrial Minerals

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

#### **Thorium-Uranium-Rare Earth** Sand Deposits in San Vicente, Northern Palawan

The beach/coastal areas in Erawan and Ombo were re-evaluated for their thoriumuranium-rare earth elements potential using two newly acquired portable gamma ray spectrometers. The total length of the coast surveyed in Ombo was 660 meters while that in Erawan was 1,220 meters.

The following elements were measured in Ombo: potassium (0.7 – 2.8 ppm); uranium (1.2 - 31.2 ppm); and thorium (2.2-688.7 ppm). In Erawan, the following were measured: potassium (1.3 - 2.6 ppm); uranium (1.2 - 14.6 ppm); thorium (8.6 -388.5 ppm). Background radioactivity in the area registered the following dose rates: in Ombo, 415 nSv/h- 2.5 uSv/h; in Erawan, 63.6 nSv/h- 1.1 uSv/h.

#### Natural Radioelement Signatures of Porphyry Copper-Gold Deposits

Analyses of soil samples for eight elements (copper, lead, zinc, silver, nickel, cobalt, manganese and iron) by atomic absorption



Heavy mineral sampling and dose rate measurement for K, U, Th over an exposed Kapoas granitic rock at Ombo creek within the Ombo area in northern Palawan

spectrophotometer were continued. This year, a total of 274 soil samples previously taken from the Didipio, Kasibu in Nueva Vizcaya mineralized area that hosts the known Dinkidi porphyry copper- silver deposit were analyzed. The results showed that copper values ranged from 26.0 to 842.9 mg/kg; lead values ranged from 2.3 to 140.9 mg/kg; zinc (20.3 to 229.5 mg/kg); silver (0.86 to 4.06 mg/kg; nickel (11.4 to 76.3; manganese (109 - 3,200 mg/kg; iron (2.57 to 15.97 percent; and cobalt (11.4 to 86.7 mg/kg).

#### **Recovery of Rare Earth Elements** and Nuclear Materials

Further experiments on the heavy beach sand concentrate containing major allanite and monazite minerals were conducted to determine the optimum recovery of rare earth elements (REE) and thorium (Th). The experiments showed that around 25.5 percent REE and 25.4 percent Th were obtained. Considering that the average concentration of the heavy beach sand are 39.42 percent REE and 1.28 percent for Th, then it could be estimated that the percentage recovery for REE is 64 percent while that of Th is 88.28 percent. Other treatments will be explored to obtain a higher percentage of recovery for REE. If these treatments are successful, PNRI will conduct experiments on separation of REE with thorium.

# Provision of Quality S & T Services

Nuclear and related services continued to be provided by the Institute in response to specialized needs of the public and other institutional sectors of society such as for radiation protection and monitoring, products and materials irradiation, and nuclear analytical and measurement services.

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#### GAMMA IRRADIATION SERVICES

Using the Multipurpose Irradiation Facility (MIF) and the Gammacell-220 irradiator, the PNRI provided gamma irradiation services to 61 clients from industry, the academe and research institutions.

More clients were served by PNRI with the upgrading of the MIF in 2011 and with the addition of 150,000 curies of cobalt-60 source from MDS Nordion of Canada in 2009.

This year, the number of samples irradiated at the MIF reached 42,350 which represents a 77 percent increase compared to the number of products/samples irradiated in 2010. The samples irradiated for decontamination were spices/food seasonings; dehydrated vegetables; herbal products; dye; cosmetics and cosmetic raw materials such as talc powder and mica; cosmetic brushes and applicators. The samples irradiated for sterilization consisted of frozen bone grafts and hydrogel wound dressings while those for research and development purposes included polymers, nanoparticles and food products.

A total of 976 samples were irradiated at the Gammacell-220 for research applications. These samples consisted of plant cultures, seeds, ornamental plants, fruits, mice/rats and coconut beetles.

### NUCLEAR -BASED AND **RELATED ANALYTICAL** SERVICES

A significant increase (270 percent) in the number of samples analyzed by the Nuclear Analytical Techniques Applications (NATA) Section was noted for this year. The increase from 219 samples in FY 2010 to 810 from 104 clients in FY 2011 has been attributed to requests from a number of agencies and private individuals for radioactivity analysis by gamma etry of various imported Japanese items/products. The requests were made due to concerns of radioactive contamination from the Fukushima Daiichi-Nuclear Power Plant accident in Japan in March 2011. Other requests for analyses were provided by the Section for nonradioactivity certification of products prior to trading and export and also for research and development activities.

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#### 1

(Left photo) The control room of the Multipurpose Irradiation Facility

#### 2 & 3

Preparation and analysis of food samples for radioactivity by gamma spectrometry

The samples analyzed for radioactivity included imported food/foodstuff such as chocolates; condiments; frozen fish; feeds and other items. Results showed that none of the samples analyzed exceeded the appropriate standards for radioactivity.

The following analyses were also provided to a number of clients: (1) determination of mass of samples using a microbalance; (2) rapid characterization of elements present in some samples using X-ray fluorescence spectrometry, a nuclear-related analytical technique; (3) detection of acetic acid adulteration in vinegar samples by carbon-14 assay; and (4) determination of gross alpha and beta in drinking and source water by liquid sentillation counting.

#### Total Number of Samples Irradiated at the Multipurpose Irradiation Facility 2009-2011



#### Total Number of Samples Analyzed for Radioactivity • 2009-2011





**RADIATION PROTECTION** 

The PNRI continued to render these

to radiation and to authorized users

of radioactive materials and nuclear

that the workers as well as the public

services to workers occupationally exposed

instruments. This is being done to ensure

are not unnecessarily exposed to ionizing

radiation. In 2011, the following were

• Personnel monitoring and assessment of

personnel monitoring services;

ensure reliable measurements;

• Radiation control services such as area/ air monitoring; leak-testing of sealed

radioactive sources; radioactivity content analysis in swipe samples to make sure that the work areas and the operation/condition of radiation-emitting devices in authorized facilities in the country are in accordance with national radiation safety standards;

the external radiation exposures of workers

from various institutions through the PNRI's

national film badge and thermoluminiscent

• Calibration and standardization of nuclear instruments from various institutions, dose output calibration of brachytherapy and

dose calibration equipment in hospitals to

SERVICES

undertaken:



Calibration of a survey meter

Radioactive waste management which

Rental by authorized users/facilities

of radiation detection instruments

such as survey meters for use in the

density gauge for road construction.

workplace for area monitoring around

radiation emitting devices, and moisture

radioactive materials;

includes the collection and proper/safe

management of spent sealed sources and

solid wastes generated by licensed users of





#### MICROBIOLOGICAL SERVICES

The Biomedical Research Section provided the following microbiological services to 16 clients: (1) bioburden tests to determine microbial load of 217 samples; (2) sterility tests of 78 samples; and (3) moisture and acidity level analyses of 28 samples.

RADIATI	<b>RADIATION PROTECTION SERVICES * 2011</b>				
Personnel radiation monitoring	<ul> <li>~12,000 clients issued film badges</li> <li>~1,800 clients issued thermoluminiscent dosimeters</li> </ul>	<ul> <li>~3,000 institutions served</li> <li>127 institutions served</li> </ul>			
Calibration of radiation detection instruments	<ul><li>65 units of contamination meters</li><li>417 units of pen dosimeters</li><li>466 units of dose calibrators</li></ul>	<ul> <li>55 institutions served</li> <li>115 institutions served</li> <li>369 institutions served</li> </ul>			
Leak testing of sealed radioactive sources	<ul><li> 24 on-site leak testing</li><li> 586 off-site leak testing</li></ul>	• 177 institutions served			
Management of spent sealed sources Management of solid wastes	<ul><li> 49 spent sealed sources</li><li> 2 cubic meters of solid wastes</li></ul>	<ul><li> 2 institutions served</li><li> 2 institutions served</li></ul>			
Output calibration of brachytherapy sources	<ul><li>high dose rate units calibrated</li><li>22 low dose rates units calibrated</li></ul>	• 5 institutions served			
Area/Air monitoring	• 29 services rendered	• 29 institutions served			
Rental of survey meter and moisture density gauge	<ul><li> 162 survey meters</li><li> 3 moisture density gauges</li></ul>	• 162 institutions served			

### CYTOGENETIC ANALYSIS

A total of 34 clients availed of PNRI's expertise in cytogenetic analysis for the following purposes: (1) to confirm the presence or absence of genetic disorder like Downs Syndrome in newborn babies; and (2) to determine the levels of radiation exposures of workers in radiation facilities.

#### ENGINEERING SERVICES

**Electron beam** 

The fabrication and repair of radiation instruments and equipment used for research are ongoing activities of the PNRI's Engineering Services Section. This year, the Section repaired a number of radiation detection instruments (such as survey meters

H.V. Terminal

**Components of an Electron Accelerator** 

and Geiger counters) for PNRI and non-PNRI clients. Fabrication of components/parts for radiation-related equipment/devices used for research were also completed.

### ESTABLISHMENT OF AN **ELECTRON BEAM FACILITY**

The International Atomic Energy Agency (IAEA), through its Technical Cooperation (TC) Program, approved a TC Project on the establishment of an electron beam (EB) facility in the Philippines. Under this project, IAEA committed to support the electron beam project and allotted approximately USD 700,000 for the purchase of an electron beam accelerator and for staff development.



Accelerating tube

Irradiated material



#### 1

(Left photo) Microscopic analysis of human blood samples to determine genetic disorder or level of radiation exposure



The fabrication and repair of radiation instruments are ongoing activities of PNRI.

The total cost of a 2.5 MeV EB accelerator is around USD1,000,000. The Philippines was able to secure USD 300,000 from the USA and Japan as a Footnote A component of the IAEA TC Project and this will complete the funds required for the purchase of the equipment. The IAEA conducted the bidding for the equipment and awarded the supply of the EB accelerator to a Korean Company, EBTech Co. Ltd.

A DOST-GIA Project was also approved by the Department of Science and Technology aimed to develop PNRI capability in utilizing EB technology for the development of functional materials for industrial, health and environmental applications. The project will be implemented in 2012.

#### **ELECTRON BEAM FACILITY**

**Typical Electron Beam Facility** 

# Ensuring the Safety and Security of Radioactive Sources

Safety, security and safeguards-related activities epitomize the premium placed by the Institute to its regulatory mandate, which continues to be reinforced through both local and international collaboration.

#### **REGULATIONS AND** STANDARDS DEVELOPMENT

To further enhance safety in the use of radioactive materials in the country and to assist the licensees in complying with regulatory requirements, the Regulations and Standards Development Section (RSDS) develops and revises/updates nuclear regulations, regulatory bulletins, regulatory guides and model procedures.

**Hicial Gazett** 

CPR Part 16 was

undergoing review.

This year, PNRI developed/ updated five Codes of PNRI Regulations (CPRs). CPR Part 16 "Licenses for the Use of Sealed Sources Contained in Industrial Devices" was published in the Official Gazette on

October 3, 2011. The published in the Official Gazette in October 2011 following four CPRs while CPRs 4 and 13 are are undergoing PNRI review: (1) CPR Part 4,

"Regulations for the Safe Transport of Radioactive Materials in the Philippines"; (2) CPR Part 7, "Licensing of Atomic Energy Facilities"; (3) CPR Part 13, "Licenses for Medical Use of Radiopharmaceuticals"; and (4) CPR Part 25, "Licenses for Commercial Providers of Nuclear Technical Services".

Four regulatory guides and two regulatory bulletins were also developed to improve understanding of regulatory requirements and the effectiveness of regulatory enforcement. Guides for the following two CPRs were approved for dissemination to

licensees, namely : CPR Part 14, "Licenses for-Medical Use of Sealed Radioactive Sources in Brachytherapy"; and CPR Part 11, "Licenses for Industrial Radiography and Radiation Safety Requirements for Radiographic Operations". The other two guides for CPR Part 17, "Licenses for Commercial Sale and Distribution of Radioactive Materials"; and CPR Part 16 are still undergoing revisions.

The information bulletin on "Revisions to Regulations on the Medical Use of Radioactive Sources in Teletherapy and Brachytherapy" was approved for dissemination to licensees. The bulletin on "Regulatory Criteria in Determining Severity of Violations" is undergoing PNRI review.

## LICENSING REVIEW AND **EVALUATION**

In line with the PNRI's mandate to license and regulate the safe and peaceful uses of radioactive materials in the country, the Licensing Review and Evaluation Section (LRES) reviewed and evaluated 324 license applications of medical institutions, commercial and industrial companies for authorization to use, possess, store, sell or import radioactive materials.





Out of the 324 license applications, PNRI issued 315 licenses (29 new, 56 amended and 230 renewed) for the following purposes: (1) industrial applications such as density gauging, level gauging, thickness gauging, among others; (2) medical applications in the diagnosis and treatment of diseases; (3) selling and distribution of radioactive materials; (4) industrial radiography; (5) research and education; and (6) medical cyclotron. Prior to issuance of the abovementioned licenses, the LRES conducted pre-licensing or verification inspections to confirm the commitments of the applicants and the licensees in their license applications.

This year, PNRI also processed the license termination of 20 institutions and license exemption certificates of three institutions. A total of 567 "Certificates of Release" were likewise issued to licensed users and suppliers for release of shipments of imported radioactive materials from the Bureau of Customs.

#### Distribution of Radioactive Material Licenses Issued by PNRI



A nuclear regulatory staff reviews the activity of a licensee that uses radioimmunoassay kits

### Inspection of an installed nuclear gauge in a bottling company

#### INSPECTION AND **ENFORCEMENT**

The Inspection and Enforcement Section (IES) conducted annual regulatory inspection and audit of 172 PNRI licensees who are using radioactive materials in medical, industrial, research and training applications to verify compliance with PNRI regulations and standards on radiation safety and security. Unannounced inspections were also completed on six facilities to verify whether the facilities, equipment and work performance meet all necessary radiation safety and security requirements during actual normal operations. Results showed that most of these facilities were identified to have violated PNRI regulatory requirements and criteria. Follow up inspections carried out on five licensed facilities showed that the committed corrections on the inspection findings were implemented appropriately and effectively.

The IES completed evaluations on the submitted responses required from licensees to correct identified inspection findings and concerns. Relative to this, the IES issued a total of 114 reports of evaluations in 2011.

As part of the enforcement actions, the IES undertook the following: (1) issuance of Notice of Violation to nine licensees who were found to have significant violations of PNRI regulations. The concerned licensees provided acceptable corrective actions to

prevent similar violations from recurring; (2) Took custody of a nuclear gauge with disused radioactive Krypton-85 sealed source from a foreclosed paper mill. The gauge was properly endorsed to the PNRI Radioactive Waste Management facility for management; (3) Oversight monitoring of the completed operations by two licensees regarding the successful transfer to secured area of the radioactive sources used in radiography that were stored in a facility involved in an insurgent attack incident; and (4) Continuous monitoring, including assistance of local police operatives, on the safety and security of two highly radioactive sources stored in a foreclosed medical facility.

PNRI issued a total of 4,264 "Authority to Transport" certificates requested by licensed stakeholders for the transport of radioactive materials to authorized destinations.in the country.

#### RADIOLOGICAL IMPACT ASSESSMENT

In support of PNRI nuclear regulatory function, the Radiological Impact Assessment Section (RIAS) conducted preassessment study of exposure to natural thorium in thoriated tungsten electrode used as a raw material in producing halogen lamps. The result showed that worker exposure from possible inhalation of natural thorium from loose dust material or settled

dust from cutting, machining or polishing of electrode surfaces will not exceed the annual occupational dose limit specified in the Code of PNRI Regulation (CPR) Part 3- Standards for Protection against Radiation.

A study on iodine-125 (I-125) radioimmunoassay (RIA) kits was started in relation to its relevance in the preparation of regulatory requirement for in vitro applications of small sources of radioactive materials based on best practices and international developments. The study involves collection, assessment, and reporting of updated safety and radiological information of I-125 RIA kits (from product acquisition to handling), transport and applications up to management of waste materials. RIAS prepared a survey guestionnaire to gather information and review the activities of licensees that use RIA kits. This year, three nuclear medicine laboratories and one radiopharmaceutical distributor in Metro Manila were visited to gather factual information on RIA kits.

### NUCLEAR SAFEGUARDS AND SECURITY

#### Safeguards Inspections

To ensure that nuclear materials are not diverted for non-peaceful applications, safeguards inspectors from the International Atomic Energy Agency (IAEA) conduct inspections of nuclear facilities in IAEA

member-countries. This year, the Nuclear Safeguards and Security Section (NSSS) assisted the IAEA inspectors in their annual physical inventory verification inspection of nuclear fuels in the Philippine Research Reactor -1 (PRR-1) at PNRI and in the design verification at the PRR-1 and the Bataan Nuclear Power Plant (BNPP). Complementary access was also conducted by IAEA at PNRI and the BNPP sites to verify the site boundaries and buildings and other Additional Protocol (AP) -relevant structures on site as declared by PNRI in 2010 for the PRR-1 and for the BNPP.

A safeguards ection at the itaan Nuclear Power Plant

The NSSS provided inputs/comments on matters pertaining to nuclear safeguards and security as requested by the United Nations International Organization/ Department of Foreign Affairs. The NSS also provided data/information as input to the Nuclear Security Report 2011 of the IAEA Director General and to the Office of the Vice President for the Nuclear Security Summit.

In addition, reports on the Additional Protocol for the application of safeguards were submitted to the IAEA through the PNRI-IAEA secure communication system.

#### **Global Threat Reduction Initiative**

The Global Threat Reduction Initiative of the United States Department of Energy (US DOE) is a comprehensive global initiative

aimed to address nuclear security around the world, particularly to reduce the threat of nuclear terrorism. As lead agency in the Philippines involved in this initiative, the PNRI through the NSSS, undertook the following: a Evaluation of the quarterly preventive

maintenance activities of the security contractor for the upgraded facilities at nine hospitals/medical centers in the National Capital Region, Baguio City, Visayas, Mindanao and in three PNRI facilities, namely, the Radioactive Waste Management Facility, Multipurpose Irradiation Facility, and Secondary Standards Dosimetry Laboratory. Four



Five-day Train-the-Trainers Course on Security of Radioactive Material During Transport held in January 2011 at Puerto Princesa, Palawan.



quarterly reports of the results of the evaluations were submitted to the US DOE.

Facilitation of the conduct of five training courses/workshops on radiological incident response, awareness seminar for decision makers and managers, transport security and physical protection and security management of radioactive sources.

#### **International Safeguards Engagement** Program (INSEP)

The Nuclear Safeguards and Security Section, in coordination with the United States Department of Energy (US DOE), formulated an action roadmap for cooperation of PNRI and US DOE in relation to the implementation of the Additional Protocol for application of safeguards. Several potential areas were identified including industry/university outreach and train-thetrainers.

#### **Regional Security of Radioactive** Sources (RSRS)

An action plan for future activities under a RSRS-US DOE joint project was formulated in coordination with the Australian Nuclear Science and Technology Organization and the US DOE. Among the activities/ issues discussed were training of security inspectors, PNRI security plan, training management plan and module/content development.

#### **Megaports Initiative Project**

In coordination with the Bureau of Customs (BoC) and the Philippine Ports Authority (PPA), the PNRI continued to actively take

part in the Megaports Initiative Project which was initiated by the US Department of Energy-National Nuclear Security Administration. The Megaports Initiative involves the detection of illicit shipment of nuclear and other radioactive materials through the radiation portal monitors installed at the South Harbor (SH) and at the Manila International Container Terminal (MICT) at the Port of Manila

As part of its commitment to the Megaports Initiative, the Nuclear Safeguards and Security Section (NSSS) continued to manage the operation of the PNRI Mirror Central Alarm Station and provide technical assistance to the Primary Central Alarm Station at the SH and MICT during radiation detection alarms. The NSSS also facilitated the monthly preventive maintenance of the local service contractor at the two radiation portal monitor sites.

Furthermore, the NSSS facilitated and coordinated the official commissioning of the radiation portal monitor systems at the Port of Manila. The Governments of the Philippines and the United States formally inaugurated the radiation portal monitor systems at MICT site on September 13, 2011.

In 2011, the PNRI and the US Megaports Training Team conducted/facilitated ten training courses and one awareness seminar for operators of the BoC CAS, Asian Terminals, Incorporated-South Harbor and International Container Terminal Services, Incorporated-MICT. The training courses/seminars included the following: (1) Megaports Awareness Seminar for Managers; (2) Megaports Operational Readiness Training Courses; (3) Megaports Training for Service Provider (GuardAll); and (4) Megaports Refresher Training.

### RADIOLOGICAL EMERGENCY **PLANNING & PREPAREDNESS**

#### **Response to Radiological Incidents**

The Radiological Impact Assessment Section (RIAS), as member of the PNRI Radiological **Emergency Monitoring and Control** (REMCON) team, responded to requests of two national government agencies to verify unknown materials in Nueva Ecija and in Metro Manila for possible radioactive content.

The RIAS also participated in several activities in response to the Fukushima Daiichi Nuclear Power Plant accident in Japan.



DOST Secretary Mario G. Montejo and U.S. Ambassador Harry K. Thomas along with U.S. Department of Energy Project Manager Kim Prono, cut the ribbon at the MICT to commission the radiation portal monitor systems. The U.S. Department of Energy contributed USD 26 million to set up the systems that aim to prevent illicit trafficking of nuclear and other radioactive materials through the seaport. (Photo: U.S. Embassy, Manila, 13 September 2011)



#### Drills, Exercises and Training on **Radiological Emergencies**

To enhance the capability to respond to radiological or nuclear incident, the RIAS successfully facilitated and conducted a sixday workshop on emergency preparedness and response for members of the PNRI Radiological Emergency Monitoring and Control (REMCON) team in January in Bagac, Bataan. The workshop, participated in by 23 members of the team, was conducted in cooperation with the Australian Nuclear Science and Technology Organization under the Regional Security of Radioactive Sources project. In this workshop, the procedures contained in a manual specifically developed by the team for implementation during response operations in the event of an emergency were demonstrated and applied.

The following in-house seminars/workshops for the REMCON team were also facilitated and conducted at PNRI:

(1) Seminar on Familiarization of Monitoring Equipment in January with 16 team members as participants; (2) Seminar/ Workshop on the Use and Application of Radiation Instruments for Field Monitoring held in May with 26 participants; and (3) Workshop on the Techniques in Search and Secure of Lost Radioactive Material held in July and participated in by 22 members. Lectures on emergency preparedness were

also conducted by the RIAS in three PNRI nuclear training courses.

### ESTABLISHMENT OF A NATIONAL RADIOACTIVE WASTE DISPOSAL FACILITY

The PNRI, in collaboration with other government agencies, laid out the groundwork for the technical evaluation of the borehole disposal of sealed sources or the BOSS concept to be co-located with a near surface disposal facility at the preferred site. The development of a deep borehole necessitates further investigations, especially those concerning the hydrogeologic and hydrogeochemical characteristics of the rocks. This deep borehole must be developed within hydrogeological layers that have a sufficiently low hydraulic conductivity and hydrogeochemical properties that are not aggressive to the disposal containers.

Results of geophysical measurement indicated no evidence of fault or displacement detected along the resistivity lines. Geological fractures were identified and locations with higher resistivity profile with no suspected geological fractures were determined. For these reasons, the location of the proposed investigation borehole has been identified and discussed with the contracted drilling company. This deep borehole will be drilled within the

Field Monitoring for REMCON Team (May 17-18)

existing footprint down to approximately 100 meters. Care for selecting the proposed location was ensured in order that both disposal concepts (near surface and borehole disposal) would maximally benefit from the new investigations. The proposed location was recommended to be outside the estimated potential contamination window of the near surface disposal vaults.

Drilling of the 100 meter deep borehole required the participation of private drilling companies. The PNRI prepared the terms of reference of the drilling campaign and selected the most qualified and competent drilling company in accordance with the approved terms of reference. In mid-2011, a mission was conducted by the IAEA Technical Officer to discuss the implementation of the drilling campaign.

> Groundwater monitoring in one of the observation wells

The proposed methodology and the expected outputs were discussed and agreed upon during the meetings held at PNRI. In support of the development of a hydrogeological model of the preferred site, the groundwater level has been continuously monitored with weekly measurements at the previously installed four groundwater observation wells. Two creeks (Repo-1 and Repo-2) were noted to drain the area and the groundwater system is fed by atmospheric recharge previously estimated as five percent of the annual precipitation rate. Due to the complexity of procedures and legal requirements involving the planning and establishment of a final repository, the PNRI exerted more efforts in resolving the issue of land ownership and public acceptance of the project. The Institute is closely coordinating with the regional officers of the Department of Science and Technology and Department of Environment and Natural Resources. Representation (or interface) with the local government units were continuously undertaken to ensure the smooth implementation of the site investigation and evaluation process.



Electrical Resistivity Profile of Lines 1 and 2

# Diffusion of Knowledge and Technologies



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relations served as boon to these efforts, particularly in the light of the tsunami-spurred impact on the nuclear facilities at Fukushima-Daiichi Nuclear Power Plant in Japan.

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PNRI lecturer (right) supervises a practical exercise or

f Congressman Angelo Palmones (left) together with (L-R) PNRI Director Alumanda Dela Rosa; PNRI Technology Diffusion Division Chief Victoria Fe O. Medina and Arturo Carballo, Nido Fortified Science Discov Center (NFSDC) Manager, at the ceremonia cutting of the ribbon to formally open the clear Awareness Exhibit at NFSDC, SM Mall of Asia in Pasay City.

#### NUCLEAR TRAINING

monitoring of a thickness gauge.

In line with PNRI's commitment to develop human resources in the field of nuclear science and technology, the Nuclear Training Center (NTC) pursues the conduct of training courses on the following areas: radioisotope techniques; radiation and nuclear safety; and nondestructive testing.

In 2011, the NTC organized 46 training courses participated in by 624 professionals and technicians from different government and private institutions. A total of 41 courses were conducted at PNRI while five on-site training courses were held in Palawan, Laguna, Bulacan, Masbate, and Pampanga.

Under its on-the-job training program for undergraduates, PNRI accommodated 83 students from 21 schools. Twenty five (25) students from six schools were also placed for thesis/research advisorship.

#### NUCLEAR INFORMATION AND DOCUMENTATION

The PNRI, through the Nuclear Information and Documentation Section (NIDS), implements various public information dissemination and communication strategies to increase the awareness and enhance knowledge and understanding of different stakeholders regarding various aspects of nuclear science and technology. In 2011,

around 10,000 clients were served by the Institute through the following strategies and services:

#### **Development of Information Materials**

The Institute produced the 2010 PNRI Annual Report and a new flyer on "Environmental Radioactivity Monitoring". These publications, together with existing ones, were distributed to various clients. Three banners were also produced for display in science and technology fair exhibitions. These were on environmental radioactivity monitoring, nuclear technology applications in agriculture, and on electron beam technology.

#### Educational Tour

Around 2,000 visitors from 61 schools/ agencies came to PNRI for educational tour of its laboratories and facilities. PNRI also provided information assistance to 1,000 walk-in visitors from 544 schools/institutes.

#### Nuclear Awareness Seminar

In coordination with PNRI technical staff and the Nuclear Training Center, NIDS coordinated/arranged the conduct of 15 nuclear awareness seminars/lectures at PNRI for 800 students from 15 schools. The NIDS Information Officers coordinated and served as lecturers at the awareness seminars held at Colegio de San Agustin in Makati and in La Trinidad, Benquet.

#### Participation in Special Events

PNRI disseminated information on nuclear science and technology in the following six science and technology fairs and events: (1) Founding Anniversary of Research and **Development Center- Philippine Army** in Quezon City; (2) Foundation Week of Adamson University- Environmental Innovation in Ermita, Manila; (3) Technology Resource Center's 34th Anniversary Innovations for Business Expo at SM Megamall; (4) DOST Annual Science and Technology Fair- Expo Science Exhibit at SMX Convention Center; (5) Regional Science and Technology Fair- Invention Contest cum Exhibition at Benquet State University, La Trinidad Benguet; and (6) 39th Atomic Energy Week celebration at PNRI.

The PNRI, in partnership with Nido Fortified Science Discovery Center (NFSDC), held a three-month Nuclear Awareness exhibit from June to September 2011 at NFSDC, SM Mall of Asia, Pasay City. The exhibit was aimed at enhancing public awareness on the beneficial applications of nuclear technology.

#### Media Publicity

The dissemination of information on nuclear science and technology through the media has always been accorded importance by the Institute. This year, the Nuclear Information and Documentation Section

(NIDS) arranged/coordinated the following in cooperation with the Science and Technology Information Institute:

(1) around 45 radio/television interviews and coverage of PNRI officials and technical staff; (2) a press conference attended by 35 media representatives; and (3) preparation and monitoring of news releases and radio/ television coverages.

In cooperation with the Public Information and Consultation Team of the Inter-agency Core Group on Nuclear Energy, the Section coordinated/organized a Media Orientation Seminar on Nuclear Energy and visit to the Bataan Nuclear Power Plant, Bataan in March 5-6, 2011 for 25 officers and members of Liga ng mga Brodkaster ng Pilipinas.

As lead in the Media Coordination Team under the PNRI Radiological Emergency and Response Plan, the Section coordinated/ arranged media briefings, radio and television interviews of PNRI officials and technical staff to provide factual, timely and accurate information and updates on the Fukushima Daiichi- Nuclear Power Plant accident in Japan.

#### Library Services

Around 1,500 PNRI and non-PNRI researchers, composed mostly of students, availed themselves of the library services of the Institute. To augment its collections, the PNRI library continued to acquire books,

journals and other publications through exchange and donations from local and foreign institutions. Active participation in on-line library networkings was also strengthened and pursued, specifically, with the International Nuclear Information System; and the DOST Science and Technology Information System or SciNet (http://www.scinet.dost.gov.ph).

## SYSTEMS

The PNRI's Management Information Section (MIS) carried out the following activities in support of the promotional and nuclear regulatory operations of PNRI: (1) developed a network restructuring plan for a more efficient and secured PNRI internet network; (2) improved the speed of PNRI's internet connectivity and the PNRI's Local Area Network in coordination with the Advanced Science and Technology Institute; (3) developed and pilot-tested the Computerized Attendance Tracking System using barcode scanning technology; (4) tested the Integrated PNRI Information System Personnel Management; and (5) installed and configured the IAEA's Regulatory Authority Information System=

As part of the PNRI's knowledge management/preservation project, the MIS completed the digitization of the following documents on the nuclear regulatory and pre-operational activities of the First Philippine Nuclear Power Plant (PNPP-1):





#### MANAGEMENT INFORMATION

(1) PNPP-1 Preliminary Safety Analysis Report; (2) Final Safety Analysis Report; (3) Preliminary Site Investigation Report; (4) Report Investigations of the Postulated Faulting Adjacent to Napot Point; and (5) PAEC Priority Questions on Geology and Seismology.

#### **BUSINESS DEVELOPMENT**

The Institute develops and implements strategies to bring the Institute's products and services to end-users/adoptors/ collaborators for commercialization to achieve self-reliance and a higher degree of the Institute's sustainability. This year, the PNRI worked on the development of technology transfer plans for PNRI's commerciable technologies. These plans include a business plan for the Technetium-99m Project and an initial industry study for the establishment of a medical cyclotron and Positron Emission Tomography- Computerized Tomography (PET-CT) facility in the country. Expert assistance in crafting legal documentations was likewise extended for project leaders of PNRI projects on mutation breeding in ornamentals.

Establishment/development of linkages were also pursued with probable partners/ collaborators/stakeholders for a continuous commercialization of present and future technologies.

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Members and officers of Liga ng mga Brodkaster ng Pilipinas who participated in the Media Orientation on Nuclear Energy in a group photo with PNRI Director Dr. Alumanda M. Dela Rosa (seated, second from right) and members of the Public Information and Consultation Team on Nuclear Energy.



# S & T Linking and Networking

Department of Science and Technolo Secretary Mario G. Montejo delivers the Philippine statement at the 55th General Conference of the IAEA in Vienna Austria, on 17 September 2011 Photo: Dean Calma/IAEA;

Bilateral meeting between Department of Science and Technology Secretary Mario G. Montejo and International Atomic Energy Agency (IAEA) Director General Yukiya Amano at the IAEA 55th General Conference, IAEA, Vienna, Austria on 20 September 2011.

Photo: Dean Calma/IAEA

The Institute successfully maintained collaborative linkages here and abroad in pursuit of the safe, secure and peaceful applications of nuclear technology, as exemplified by its continuing partnership and interface with local and international agencies/institutions.

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### LOCAL S & T NETWORKING

The PNRI was able to implement several research and development projects in the areas of agriculture, industry and environment through the grants-in-aid of the following institutions:

- Department of Science and Technology •
- Philippine Council for Agriculture, Aquatic, Forestry and Natural Resources Research and Development
- Philippine Council for Health Research • and Development
- Philippine Council for Industry, Energy and Emerging Technology Research and Development
- Municipality of Bulacan

Collaborative projects with the following agencies/institutions were also continued:

- Bureau of Soils and Water Management
- Department of Agriculture Bureau of ٠ Plant Industry
- Department of Environment and • Natural Resources
- **Environmental Management Bureau**
- Department of Energy
- National Power Corporation
- Philippine Coconut Authority .

#### FOREIGN S&T NETWORKING

PNRI's partnerships with these institutions have likewise enhanced the institute's mandate of promoting and regulating the peaceful uses of nuclear science and technology:

- (IAEA), Vienna, Austria
- Vienna, Austria
- RCA Regional office in Korea
- . (FNCA), Japan
- Comprehensive Nuclear Test Ban Treaty Organization (CTBTO), Vienna, Austria Australian Nuclear Science and Technology Organization (ANSTO) United States Department of Energy
- (US DOE)
- United States Department of Agriculture (USDA) Ministry of Education, Culture, Sports, Science and Technology of Japan
- (MEXT)
- Nuclear Safety Research Association of Japan (NSRA) • Japan Atomic Energy Agency (JAEA) National Institute of Radiological Sciences (NIRS), Japan
- - Japan Atomics Energy Research Institute
  - Korea Atomic Energy Research Institute • Korea Advanced Institute of Science and
  - Technology Institut de Radioprotection et de Sûreté • Nucléaire (IRNSN) European Union



PNRI Director Alumanda M. Dela Rosa reports the recommendations of the working session II at the International Conference on Nuclear Safety Organization of the IAEA in Vienna, Austria 20-24 June 2011.

Photo: Dean Calma/IAEA

International Atomic Energy Agency

- Regional Cooperative Agreement
  - (RCA) for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific,
  - Forum for Nuclear Cooperation in Asia



U.S Department of Energy Project Manager Kim Prono awards a plaque of appreciation to Philippine Department of Science and Technology Secretary Mario Montejo for his government's role in the partnership with the U.S. Government to provide equipment upgrades to secure Philippine ports. (Photo: US Embassy, Manila, 13 September 2011)

6 IAEA Research Contracts other fellowship grants on nuclear science & technology participated in by PNRI and non-PNRI staff



## DOST-PNRI RESPONSE TO THE IMPACT IN THE PHILIPPINES OF THE FUKUSHIMA DAIICHI NUCLEAR POWER PLANT ACCIDENT

The threat to the Philippine environment and the possibilities of radionuclide contamination reaching the country through different pathways was a major public concern during the Fukushima Daiichi Nuclear Power Plant accident which occurred after the Great Japan Earthquake and tsunami on March 11, 2011 in Japan. In response to public concerns and to assess the possible radiological impact of the releases of radioactivity into the environment, the DOST-PNRI, in coordination with the member-agencies of the National Disaster Risk Reduction Management Council, (NDRRMC) implemented various activities.





2 Meeting of DOST-PNRI with NDRRMC



On 13 March 2011, the PNRI Director convened the Executive Coordinating Council per PNRI Radiological Emergency Preparedness and Response Plan (RADPLAN), and activated the following response teams under the Radiological Emergency Manager: Technical Support team (pool of experts), Radiation Monitoring team, and Media Coordination team.

2 DOST-PNRI briefed the member-agencies of the NDRRMC on the nuclear power plant accident. A press conference was also held at Malacañan Palace with DOST-PNRI

3

DOST-PNRI organized 16 press conferences/media briefings to provide timely, factually correct and objective information: arranged more than 48 television coverages and 50 radio interviews with officials and technical support staff. PNRI also provided information to more than 2,000 inquiries by telephone and email

4

DOST-PNRI officials and technical support staff held meetings for the issuance of Information Bulletins. A total of 31 Bulletins were prepared, distributed and posted in the PNRI website (www.pnri.dost.gov.ph). A total of 50,000 hits registered on the PNRI website.

5 All ambient dose rate measurements taken at PNRI; in different parts of Metro Manila; in Batanes, Cagayan; Aurora; Nueva Ecija; Camarines Norte; Eastern Samar; Surigao del Norte and Davao Oriental were comparable to the 2010 PNRI baseline levels of  $102 \pm 13$  nanoSieverts per hour (nSv/hr), which are within normal radiation levels, and to the nationwide natural radioactivity levels of 21 to 124 nSv/hr.





2 Press Conference at Malacañan Palace



4 Information bulletins on updates on the nuclear power plant accident



SAM 935 portable gamma 5 Monitoring of ambient gamma spectrometer with 2x2 dose rate in Metro Manila and in Na(TL) detector (Berkeley various provinces in the country Nucleonic)



**7** Monitoring of air particulates through the CTBTO Radionuclide Monitoring Station - PHP52 in Tanay, Rizal

8 Radionuclide analysis of food products imported from Japan





9 Screening for radioactivity of container vans and cargo from abroad using the radiation monitoring system (RMS) at the Port of Manila



contamination



**3** Press conferences/media briefings at PNRI and media coverages/interviews with DOST and PNRI officials and technical support team



- **6** Environmental radioactivity monitoring through collection of environmental samples in selected areas and analyses of samples using a High Purity Germanium Detector





Soil, grass, seawater, marine sediments and biota (fish, crustaceans, molluscs, algae) were collected in Quezon City, Batanes, Cagayan, Aurora, Camarines Norte, Eastern Samar, Leyte, Surigao del Norte and Davao Oriental. These samples were analyzed for cesium -134 (Cs-134), cesium-137 (Cs-137), and iodine-131 (I-131).

Only Cs-137 activity concentrations were detected in some environmental and seawater samples. The maximum Cs-137 activity concentration detected in seawater was 3.44 millibecquerel per liter (mBq/l). This level is very low and within normal levels and is within the baseline level of the Asia-Pacific Marine Radioactivity Database (ASPAMARD) of 0.25 to 11.47 mBg/L Cs-137.



Radionuclide concentrations of Cs-137, Cs-134, and I-131 detected by the station from March 23 to May 4, 2011 and posed no significant health effects. Since May 4, 2011, the radionuclides were no longer detected by the station.

Cs-137, Cs-134, and I-131 were analyzed in samples provided by the following regulatory agencies: Food and Drug Administration, Bureau of Animal Industry, Bureau of Fisheries and Aquatic Resources, and Bureau of Plant Industry, and also by voluntary submission of private companies.

Analyses showed activity concentrations of less than 1 to 3 becquerel per kilogram (Bg/kg) for Cs-134 and Cs-137, and less than 0.2 to 1 Bq/kg for I-131. These concentrations were below the limits set by Codex Alimentarius Commission which is 1000 Bq/kg for Cs-134 and Cs-137 and 100 Bg/kg for I-131.

Part of the initiatives of the government was the scanning of incoming cargoes from Japan for radioactive contamination using the radiation monitoring systems (RMS) at the Port of Manila. In support of this activity, large volume of cesium-137 reference sources were prepared to test the sensitivity of the RMS in screening for radioactive contamination in foodstuffs.

A total of 34 members of the media, the public as well as overseas Filipino workers who arrived from Japan were pre-screened for external contamination and possible radioiodine uptake. Results showed no contamination and radioiodine uptake.

10









## THEME: "NUCLEAR ENERGY: CHALLENGES AND OPPORTUNITIES"

The annual Atomic Energy Week (AEW) celebration, as mandated under Presidential Proclamation No. 1211 in 1973, aims to generate awareness of the Filipino people on the beneficial uses of nuclear science and technology in food and agriculture, health and medicine, industry, energy, and the environment.

# 39<sup>th</sup> Atomic Energy Week Celebration DECEMBER 5-9, 2011 · PNRI



Thanksgiving Mass Officiated by Rev. Fr Jerry Manlangit, O.P. of Atomic Energy in the Philippines". Sto. Domingo Parish



Wreath Laying at the Monument of General Florencio A. Medina, considered as the "Father of



PNRI Director Dr. Alumanda M. dela Rosa represented DOST Secretary Mario G. Montejo in delivering the keynote address.



Opening of AEW exhibits Dr. Filemon A. Uriarte, Jr., assisted by PNRI Director Alumanda M. Dela Rosa, cuts the ceremonial ribbon to formally open the 2011 AEW Exhibit. Dr Uriarte is a former DOST Secretary and currently executive director of the ASEAN Foundation.







Dec 5 to 9 \* AEW Open House Visitors viewed the exhibits, had guided tours, film showing and participated in the exhibit quiz.



#### Press Conference, December 5

Around 35 media representatives attended the press conference . PNRI topics presented by Dr. Alumanda M. dela Rosa included updates on the Fukushima nuclear power plant accident, highlights of PNRI activities in 2011, and new projects in 2012.



December 6 -7, Technical Sessions Two-day technical sessions on the Fukushima Daiichi Nuclear Accident and its Impact in the Philippines; Gamma Irradiation and Radiation Protection Services: Gamma Column Scanning: Technetium-99 Generator Production Facility; Nuclear Analytical Techniques and Applications; and on Nondestructive Testing





December 8 \* Technical Demonstration PNRI conducted lecture-demonstrations on x-ray and gammaray radiography, radiation shielding materials, nondestructive testing in concrete, among others



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Label Me: Technetium-99m Logo Making Contest The judges were (L-R) Dr. Filemon Uriarte, Jr, Ms. Julienne P. Dayaon, Manager of Pharmahex Inc., and Dr. Junie Billiones (Professor-University of the Philippines-Manila).



ne 99mTC logo chosen as first prize winner by the judges from among 44 entries was designed by Juanario U. Olivares, Contractual Science Research Analyst, PNRI



**Closing Ceremonies** Quezon City Mayor Herbert Bautista, who was the guest speaker, was represented by Mr. Carlos Nejeres, Executive Officer, Office of the Mayor.





Nuclear Science Quiz \* December 9

(Sponsored by PNRI in cooperation with the Department of Education and the Office of the City Mayor, Quezon City) First prize Winners: Erick John Carlo Solibet and Jan Lothan Discher (3rd & 4th from left) of Manila Science High School pose with (L-R) PNRI Deputy Director Dr. Corazon C. Bernido, PNRI Director Alumanda M. Dela Rosa and their coach Mr. Ferdinand S. Bautista. A total of 67 high school students from 34 private and public schools in the National Capital Region participated in the quiz.



Media Publicity for AEW PNRI Information Officer gives an overview of PNRI activities at PTV 4's "The Morning Show" program in which the PNRI Chorale was invited for a rendition of Christmas songs.

# Human Resource Development

In PNRI, manpower development enjoys priority attention to the extent necessary to develop a workforce capable of efficiently responding to challenges in the implementation of its nuclear research and development, promotion of nuclear technology applications and in the enforcement of its nuclear regulatory functions, among others.



MS Graduate - Mr. Chitho P. Feliciano, Senior Science Research Specialist of the Biomedical Research Section - Atomic Research Division, obtained his MS degree in Microbiology and Biotechnology from the University of the Philippines in Diliman.

PNRI staff pursued their doctorate and masteral degrees on local/foreign scholarships (2 PhDs; 1 MS degree) and on their own (5 PhDs; 13 MS degrees)

Nuclear training courses conducted by PNRI with 624 participants

Students from 24 schools were accommodated for on-the-job training

Students from six schools were accepted for thesis advisorships at PNRI

Locally-sponsored trainings/seminars/ workshops in various fields participated in by PNRI employees

Seminars organized by PNRI on Values Orientation (Levels 1 and 2), and on **Orientation of New Employees** 

Training/Fellowship grants availed of by PNRI and non-PNRI personnel through linkages with foreign institutions/agencies

Dr. Lucille V. Abad, receives a trophy for being one of the 2011 Dangal ng Bayan awardees from the Honorable Executive Secretary Paquito N. Ochoa, Jr who represented His Excellency President Benigno S. Aquino III, at Malacañang Palace on November 9, 2011. Looking on are (L-R) Franscisco Duque III, CSC Chairman; Mary Ann Z. Fernandez-Mendoza, CSC Commissioner; and Conchita Carpio-Morales, Ombudsman.

Photos: Civil Service Comission



#### LUCILLE V. ABAD, Ph.D.

Scientist I under the Civil Service Scientific Career System Supervising Science Research Specialist Chemistry Research Section, Atomic Research Division

- "Dangal ng Bayan " Award or Outstanding Public Officials and **Employees** Award Civil Service Commission Honor Awards Program
- Given on the occasion of the 111th Philippine Civil Service Anniversary in September 2011.

#### **GLENDA B. OBRA**

Supervising Science Research Specialist Agricultural Research Section (ARS) Atomic Research Division (ARD)

#### SOTERO S. RESILVA

Senior Science Research Specialist Entomology Unit, ARS, ARD together with

#### DR. LOUELLA DI. LORENZANA

Regional Field Office, Region IV-B, Department of Agriculture)

- Silver award, Agriculture and Fisheries Modernization Act (AFMA) Best R & D Paper for Applied Research-Technology Generation/Information Generation
- Gold award, AFMA Best R & D poster Given during the 23rd National

November 2011

Dr. Abad was among the ten "Dangal ng Bayan" awardees in 2011 who were chosen from various sectors of government services The award is conferred to an individual for performance of extraordinary act or public service and consistent demonstration of ethical behavior on the basis of observance of the eight norms of behavior provided under Republic Act 6713, known as the Code

> Research Symposium organized by the Department of Agricultural Research in Quezon City, 2011

Their research paper "Irradiation as Quarantine Treatment for Mango Pulp



Dr. Louella Rowena de Jesus-Lorenzana and Ms. Glenda B. Obra (3rd and 4th from left) receive the two agriculture research awards. Department of Agriculture (DA) Secretary Proceso J. Alcala (2nd from left), together with DA Undersecretary Antonio A. Fleta, BAR Director Nicomedes P. Eleazar, and Asst. Director Teodoro S. Solsoloy presented the awards at the Manila Hotel. (Photo by DA-BAR)

## **RECOGNITION AWARDS GIVEN TO PNRI RESEARCHERS**

• Awarding ceremonies were held in Malacańang Palace in Manila,

of Conduct and Ethical Standards for Public Officials and Employees.

Dr. Abad undertook studies and researches which have been recognized by the scientific community for their immediate relevance and impact in agriculture, health and environmental protection. One of her major accomplishments to date is the development of the polyvinyl pyrollidone carageenan hydrogel dressing for skin burns, wounds and bedsores. The commercialization of this product is underway.

Weevil, Sternochetus frigidus (Fabr) in the Philippine "Super Mango" explores how irradiation of the Philippine Super Mango can be utilized as a post-harvest control of the mango pulp weevil Sternochetus frigidus (Fabr).

# PNRI RECOGNITION AWARDS

The PNRI, through the Program Awards and Incentives for Excellence (PRAISE) Committee, granted recognition awards to 17 of its staff during the Employees' Day of the 39th Atomic Energy Week celebration at the Institute on December 5. The awards given were the following: 1 The PRAISE Special Award for expertise shared to the Institute on matters relating to nuclear technology and nuclear power. 2 Director's Choice Award based on the employee's contributions to the Institute and commitment to service, and 3 Division Awardee for contributing greatly to the accomplishment of the division's functions and goals.

#### P.R.A.I.S.E. SPECIAL AWARD

LEONARDO S. LEOPANDO Supervising Science Research Specialist Nuclear Reactor Operations Section Nuclear Services Division



**DIVISION AWARDEES** 

#### NUCLEAR SERVICES DIVISION

**GLORIA R. JIMENEZ** Science Research Assistant and DANILO A. CUYCO Science Research Analyst Nuclear Analytical Techniques **Applications Section** 

#### **TECHNOLOGY DIFFUSION DIVISION**

ISABEL M. AMISCARAY Scientific Documentation Officer III Nuclear Information & Documentation Section





## **DIRECTOR'S CHOICE AWARD**

JULIETTA E. SEGUIS Supervising Science Research Specialist Nuclear Safeguards and Security Section Nuclear Regulatory Division

#### NUCLEAR REGULATORY DIVISION

SYLVIA S. BUSINE Senior Science Research Specialist Nuclear Safeguards and Security Section

#### **FINANCE & ADMINISTRATIVE** DIVISION

**GERALD DG. CONISE** Accountant III Accounting Section

### Seated (L-R)

ELIZA B. ENRIQUEZ Senior Science Research Specialist Health Physics Research Section (HPRS)

TEOFILO Y. GARCIA Supervising Science Research Specialist HPRS

> LORNA JEAN H. PALAD Science Research Specialist II HPRS

#### ATOMIC RESEARCH DIVISION (ARD) PNRI Environmental Monitoring Team



Standing (L-R) **ROSARIO R. ENCABO** Science Research Specialist II, HPRS

ESTRELITA V. TABORA Science Research Specialist I Nuclear Materials Research Section (NMRS)

FE M. DELA CRUZ Senior Science Research Specialist, HPRS

**ROLANDO Y. REYES** Supervising Science Research Specialist, NMRS

PAOLO TRISTAN F. CRUZ Science Research Specialist I Isotope Techniques Research Section (ITRS)

RYAN JOSEPH ANIAGO Science Research Specialist I, HPRS

ANTONIO A. ASADA Science Research Analyst, HPRS

2011 DOST SPORTSFEST held at the Philippine Science High School









The Quezon City cluster where PNRI belongs was adjudged as the first prize winner in the DOST Gut Talent contest during the Ignite the Mind 2.0, a year-ender talent showcase and Christmas Party of the DOST.

# PNRI IN DOST ACTIVITIES



PNRI, led by **PNRI Director** Dr. Alumanda M. dela Rosa (first row, extreme right), joins other agencies of the Quezon City cluster in the presentation during the DOST Gut Talent contest.





# **Financial** Resources

#### **TREND OF PNRI BUDGET \* 2005-2011**





21%

MFO 1: Nuclear Research and Development

MFO 2: Technology Transfer Services

MFO 4: Nuclear Regulatory Services

MFO 3: Nuclear S & T Services

**ANNUAL INCOME \* 2006-2011** 

#### 2011 ALLOTMENT BY EXPENSE CLASS

-TOTAL (in Millions)





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DONOR NAME OF INSTITUTION	PROJECT TITLE	PROJECT LEADER	VALUE OF ASSISTANCE
A. LOCAL GRANTS-IN-AID			
Municipality of Bulacan	Isotope Applications in Verifying Recharge Processes in Bulacan Province Groundwater System	Soledad S. Castañeda	176,800.00
Department of Science and Technology (DOST)/Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)	Integrated Coconut Research and Development Enhancement Program (ICREDEP) Project 4. Development of an Integral Pest Management Strategies Against <i>Brontispa longgissima</i> (Gesto), Invasive Pest of Coconut and Other Palo Species	Glenda B. Obra	327,174.00
DOST/Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD)	Semi-Commercialization of PVP Carrageenan Hydrogels for Burn/ Wounds Dressing and Bed Sores( Phase 3): Stability Testing and Technology Transfer	Lucille V. Abad, Ph.D.	892,592.00
DOST- PCIEERD	Development of Packaging Protocols for Irradiated Food Products	Zenaida M. De Guzman	1,000,000.00
DOST- PCIEERD	Protocol Setting for the lodination of Conotoxin GIIIA as Ligand for Radiometric Receptor Binding Assay of Paralytic Shellfish Toxin	Adelina DM. Bulos	1,500,000.00
DOST- PCIEERD	Assessment of Technologically-Enhanced Naturally-Occurring Radioactive Materials(Tenorm) in the Philippines Marine Biota	Eliza B. Enriquez	1,000,000.00
DOST- PCIEERD	Assessment of Air Particulate Lead Sources in Valenzuela, Metro Manila by Nuclear Analytical Techniques and Receptor Modelling	Preciosa Corazon B. Pabroa	1,000,000.00
DOST- PCIEERD	Performance and Safety Assessment of the Co-Location of the Near Surface Radioactive Waste Disposal Facilities and Borehole Disposal Concept in the Philippines	Ma. Visitacion B. Palattao	525,000.00
DOST- PCIEERD	<sup>99m</sup> Tc and <sup>99m</sup> Tc Radiopharmaceuticals: Preparation and Quality Control for Nuclear Medicine Application	Alumanda M. Dela Rosa, Ph.D. Adelina DM. Bulos	19,652,624.00
DOST- Philippine Council for Aquatic and Marine Research Development (PCAMRD)	Ecology and Oceanography of Harmful Algal Blooms (HABs) in the Philippines Project 6 - Historical Sedimentation Rate and Radiometric Fingerprinting of Suspended-Sediment in Selected HAB Areas	Efren J. Sta. Maria	3,420,144.00
DOST- Philippine Council for Health Research and Development (PCHRD)	Hosting of the Executive Management Seminar on the Establishment of a Medical Cyclotron/PET Service Facility	Victoria Fe O. Medina	60,000.00
DOST	National Science and Technology Week Documentation and Evaluation	Rhodora R. Leonin	245,800.00
		Sub-Total:	Php 29,800,134.00
<b>B. FOREIGN GRANTS</b>			
International Atomic Energy Agency (IAEA)	Coordination of the National Workshop for the IAEA Water Availability Enhancement Project	Soledad S. Castañeda	265,685.00
IAEA	Development of the Philippines Hydrological Gap Plan	Soledad S. Castañeda	718,065.40
Comprehensive Nuclear Test Ban Treaty Organization (CTBTO)	Post Certification Activities at RN52, Tanay, Rizal, Philippines	Teofilo Y. Garcia	2,490,113.00
IAEA	Application of Radiotracer and Radioassay Technologies in Paralytic Shellfish Poisoning	Adelina DM. Bulos	407,297.70
United States Department of Energy (US-DOE)	Project Management and Oversight Support to Global Threat Reduction Initiative (GTRI)	Julietta E. Seguis	2,192,899.80
		Sub-Total:	Php 6,074,060.90
		GRAND TOTAL:	Php 35,874,194.90

## Philippine Nuclear Research Institute | Annual Report 2011

## **ADDITIONAL RESOURCES GENERATED THROUGH** LOCAL AND FOREIGN-FUNDED PROJECTS • 2011

## **APPENDICES**

TABLE 1. TECHNICAL TRAINING COURSES/SEMINARS CONDUCTED IN 2011

TITLE OF TRAINING	TRAINING VENUE/ LOCATION	NO. OF PARTICIPANTS	INCLUSIVE DATES CONDUCTED	FUNDING SCHEME
NUCLEAR SCIENCE AND TECHNOLOGY				
Seminar in Nuclear Science for High School Science Teachers – 35th Session	PNRI	21	April 25 – May 29	Waived
Nuclear Technology for University/College Faculty – 44th Session	PNRI	14	April 25 – May 29	Waived
RADIOISOTOPE TECHNIQUES				
Radioisotope Techniques Training Course-General	PNRI	25	January 24 – February 18	PNRI-sponsored
Radioisotope Techniques Training Course (Medical) – 97th Session	PNRI	55	July 4 – 29	Individual fee-paying
RADIATION SAFETY				
Safety in the Use of Nuclear Equipment and Devices Training Course – 45th, 47th, 49th and 52nd Sessions	PNRI	78	January 3–7; February 21–25; June 27 – July 1; November 7 – 12	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course – 46th Session	Coral Bay Nickel Corp., Palawan	10	February 7–11	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course – 48th Session	Tong Hsing Electronics Phils. Inc., Laguna	10	April 11 – 15	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course - 50th Session	Eagle Cement Corporation, Brgy. Akle, San Ildefonso, Bulacan	11	August 15 – 19	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course – 51st Session	Phil. Gold Processing and Refining Corp., Brgy. Puro, Aroroy, Masbate	11	August 22 – 26	Individual fee-paying
Radiation Safety Officer (RSO) Refresher Course	PNRI	21	February 15 –17	Company-sponsored/ PNRI-waived
Radiation Safety Officer Training Course – 3rd Session	PNRI	9	August 1 –12	Individual fee-paying
Radiological Health and Safety Course for Industrial Radiographers	PNRI	16	August 5 – 16	Individual fee-paying
Radiation Safety Course for Medical and Radiopharmaceutical Facilities	PNRI	23	September 9, 16, 23, 30; October 7, 14, 21, 28; November 4, 11	Individual fee-paying
Radiation Safety Course	CRL Environmental Corp., Clark Field, Pampanga	11	October 20–21	Individual fee-paying
NONDESTRUCTIVE TESTING (NDT) - in cooperation	with the Philippine Society for N	ondestructive Test	ng, Inc. (PSNT)	
Radiographic Testing – Level 1	PNRI	2	January 17–21	Company-sponsored
Radiographic Testing –Level 2 (5 Sessions)	PNRI	90	January 17–28; March 28–April 8; July 11 – 22; October 3 – 14; December 5–16	Individual fee-paying
Ultrasonic Testing - Level 1 (Two Sessions)	PNRI	7	February 7–11; August 1–12	Company-sponsored
Ultrasonic Testing - Level 2 (Four Sessions)	PNRI	78	February 7–18; May 9 – 20; August 1 – 12; October 17–28	Individual fee-paying
Ultrasonic Testing – Level 3 (Three Sessions)	PNRI	5	February 7 – 18 ; May 9 – 20; August 1 – 12	Individual fee-paying
Surface Methods – Level 2 (Four Sessions)	PNRI	65	February 28– March 11; May 30 – June 10; September 5 – 16; November 8 – 12	Individual fee-paying
Surface Methods – Level 3 (Two Sessions)	PNRI	2	September 5 – 16; November 8 – 12	Individual fee-paying
Eddy Current Testing - Level 1	PNRI	5	March 14 –18	Company-sponsored

#### TABLE 1. TECHNICAL TRAINING COURSES/SEMINARS CONDUCTED IN 2011 (cont'd)

TITLE OF TRAINING	TRAINING VENUE/ NO. OF INCLUS LOCATION PARTICIPANTS CON		INCLUSIVE DATES CONDUCTED	FUNDING SCHEME	
NONDESTRUCTIVE TESTING (NDT) - in cooperation with the Philippine Society for Nondestructive Testing, Inc. (PSNT)					
Eddy Current Testing – Level 2 (Two Sessions)	PNRI	19	March 14–25; June 27 – July 8	Individual fee-paying	
Radiographic Testing – Level 3 (Two Sessions)	PNRI	3	July 11 – 22, October 3 –14	Individual fee-paying	
Welding Inspectors Course (Three Sessions)	PNRI	33	January 10–14; May 2 – 26; August 15 –22	Individual fee-paying	
TOTAL NO. OF COURSES/SEMINARS : 46	TOTAL	624			

	FIELD OF TRAINING	PNRI SECTION	SCHOOL	COURSE	NO. OF STUDENTS
	Atomic Research Division				
CONTRACTOR OF THE PARTY OF THE	Environmental radiation monitoring and radiochemical analysis of naturally - occuring radioactive materials (NORM) and technologically-enhanced naturally - occuring radioactive materials (TENORM) and marine biota samples	Health Physics	University of the Philippines (UP), Visayas	BS Chemistry	2
Sector ( Sector	Instrumentation, development and applications of neutron spectroscopic and other related techniques in the characterization of advance materials	Applied Physics	Polytechnic University of the Philippines (PUP); Eulogio Amang Rodriguez Institute of Science and Technology (EARIST); UP, Los Baños; and University of Sto. Tomas (UST)	BS Physics and BS Applied Physics	7
1	Tissue culture for mutation induction; analytical/ practical techniques in soil/plant research and grain quality assessment of cereals; orchid breeding and embryo culture; radiosensitivity study and propagation of ornamental plant, data gathering and interpretation	Agriculture Research	Philippine Normal University (PNU); Philippine Science High School (PSHS), Cagayan Valley Campus ; Fatima University	BS Biology for Teachers; High School; BS Biology	9
CONTRACTOR CONTRACTOR	Research on harmful algal bloom; determination of $\alpha$ -helix and coil transition of i- $\lambda$ -, k-carrageenan by viscometry in different salts; historical sedimentation rate and fingerprinting studies using nuclear and isotopic techniques; Biochemistry and related fields	Chemistry Research	UP, Diliman; PUP; PSHS, Main Campus; UST	BS Biochemistry; BS Chemical Engineering; BS Chemistry; BS Biochemistry; High School	13
	Nuclear Services Division				
A MARY WAY AND A	Radiation protection services such as personnel monitoring services; calibration and standardization of radiation detection instruments; radiation control services	Radiation Protection	De La Salle University; PUP; EARIST	BS Physics ; BS Psychology; BS Applied Physics; BS Pre-Med Physics	11
222 W 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Nuclear analytical techniques; nuclear and isotope techniques in consumer safety studies; analysis of groundwater surface and preparation of water by ion chromatography	Nuclear Analytical Techniques	UST; PSHS, Southern Mindanao; Central Visayas Campus	BS Biochemistry; High School	9
MA	Isotope technique applications	Isotope Techniques	UP Institute of Chemistry-Diliman	BS Chemistry	1
	Repair and maintenance of radiation detection instruments	Engineering Services	PUP	BS Electronics & Communications Engineering	3
	Technology Diffusion Division				
TIMONT.	Biological experiments in teachers' training; Physics education	Nuclear Training Center	Bulacan State University; PNU; De La Salle Araneta University;	BS Biology and BS Physics for Teachers	6
	Information, education and communication activities on nuclear energy	Nuclear Information and Documentation	Asian Institute of Computer Studies; University of Rizal System	BS Computer Science	7
TAL NUMBER	Document management and office procedures	Business Development; International Cooperation	University of Rizal System; Asian Institute of Computer Studies	Computer Secretarial; Computer Science	3

#### TABLE 2. NUCLEAR S & T TRAINING FOR UNDERGRADUATES IN 2011

#### TABLE 2. NUCLEAR S & T TRAINING FOR UNDERGRADUATES \* 2011 (cont'd)

FIELD OF TRAINING	PNRI SECTION/UNIT	SCHOOL	COURSE	NO. OF STUDENTS
Office of the Director; Finance and Administrative Division (FAD)				
Office procedures and document management; human resource development	Director's Office; FAD; Planning Section	De La Salle Araneta University; Asian Institute of Computer Studies; New Era University; PUP; Pamantasan ng Montalban	BS Computer Science; BS Psychology; BSBA-HDRM	18

#### TABLE 3. THESIS/RESEARCH ADVISORSHIP IN 2011

FIELD OF TRAINING	PNRI SECTION	SCHOOL	COURSE	NO. OF
Irradiation facility- Co-60 gamma radiation hydrophonics to growing/establishment of plant tissue analysis	Agricultural Research	Philippine Normal University (PNU)	BS Biology for Teachers	1
Cytogenetic effects of diethyl hexyl phthalate (deph) on the merismatic cells of shallot onions; Radiosensitivity of biofilms; Varying effects in lycopene content in lycopersicon esculetron	Biomedical Research	De La Salle Araneta University PNU (two students)	MS Biology; BS Biology for Teachers	3
Human blood analysis by total x-ray fluorescence (TXRF) ispecroscopy of different blood types	Applied Physics	Polytechnic University of the Philippines (PUP)	BS Physics	3
Determination of biotoxin accumulation rate and levels in <i>Pernaviridis</i> using receptor binding assay; Synergistic effect of hydrogen peroxide and – irradiation on k – carrageenan degradation; Fallout beryllium as a tracer for soil erosion rate; Sample preparation and characterization of crosslinked samples in terms of gel fraction, swelling and mechanical strength; Receptor modelling studies in lead pollution in indoor and outdoor in particulates- Valenzuela, Metro Manila; Historical sedimentation rate and radiometric fingerprinting on selected harmful algal bloom areas; Optimization of oxidative folding and evaluation of activity of a novel mucorotoxin analog	Chemistry Research	Technological University of the Philippines; University of the Philippines (UP) -Diliman	BS Biology; BS Chemistry; BS in Materials Engineering; BS Biochemistry	8
Radionuclide detection using high-purity germanium detector	Health Physics Research	PNU	BS Biology for Teachers	4
Green tea as a protective agent in vein	Nuclear Analytical Techniques Applications	Philippine Science High School- Diliman	4th year high school students	3
Fabrication of Cs-137 standard in gel form for thyroid contamination monitor	Radiation Protection	PUP	BS Physics	3

#### TABLE 4. IAEA RESEARCH CONTRACTS \* IMPLEMENTED IN 2011

TITLE/DESCRIPTION OF RESEARCH		DURATION	NAME OF	
		END	RESPONSIBLE AGENCY STAFF	
Completion and Release of the Philippine I-WAVE Pilot Study Gap Report and Implementation of Specific Remedies for Identified Gaps in Hydrological Understanding	06-01-2006	12-31-2012	Susan Abaño National Water Resources Board	
Radiation-processed Materials from Carrageenan for Agricultural Applications	01-01 -2011	12-31- 2011	Lucille V. Abad PNRI	
Mutation Breeding and Molecular Genetics of Adaptation to High Temperature in Rice	06-10 -2011	06-09-2012	Thelma Padolina PHILRICE	
Development of Safe, Quality and Shelf-Stable Filipino Ethnic Foods for Immuno-compromised Patients and Calamity Victims	06-10 -2011	06-09- 2012	Zenaida De Guzman PNRI	
Doctoral CRP on Resource Sparing Curative Radiotherapy for Locally Advanced Squamous Cell Cancer of Head and Neck	11-15- 2011	11-14-2012	Miriam Joy Calaguas St Luke's Medical Center	
Improving Capability in Detecting Early Breast Cancer Using Diagnostic Imaging Modalities	11-18 -2011	11-17-2012	Orestes Monzon University of Sto. Tomas	

\*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. The grant to a project is of the average US Dollar 5,000 per year.

#### TABLE 5. IAEA TECHNICAL COOPERATION PROJECTS\* IMPLEMENTED IN 2011

				URATION	
SOMMON SOL	NAME OF PNRI CONTACT PERSON	TITLE/DESCRIPTION OF RESEARCH	START	END	PROJECT COST (IN PESOS)
1000	Corazon C. Bernido	Support for the Completion and Implementation of the Decommissioning Plan for the Philippine Research Reactor	2009	2011	Php 2,415,489.90
100000000000000000000000000000000000000	Ma. Visitacion B. Palattao	Conducting a Study and Evaluation of the Co-Location of a Borehole Disposal Concept with a Proposed Near-Surface Radioactive Waste Repository	2009	2011	1,556,479.00
N/U	Estrella E. Caseria	Upgrading the Philippine Nuclear Research Institute Secondary Standards Dosimetry Laboratory (SSDL)	2009	2011	1,136,251.50
	Adelina DM. Bulos	Setting Up a Facility for the Production of Molybdenum-99/Technetium- 99m Generators	2009	2011	10,031,976.50
01110	Luvimina G. Lanuza	Establishing an Electron Beam Facility	2009	2011	37,800,000.00

\* Technical Cooperation (TC) Projects are under the IAEA Technical Cooperation Program and are funded by the Technical Assistance Committee Fund (TACF) and extra budgetary contributions to the IAEA. Financial support is provided in the form of three components, namely, expert assistance, equipment donation and overseas training.

#### TABLE 6. INTERNATIONAL SCIENTIFIC LINKAGES AND NETWORKS IN 2011

SCIENTIFIC INSTITUT	ION		DATES OF ENGAGEMENT		
NAME OF INSTITUTION/COUNTRY	NAME/POSITION OF CONTACT PERSON	LINKAGES	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, 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	1958	Present	
Ministry of Science, Technology, Education, Culture and Sports/ Japan	Thru PNRI	Nuclear researchers exchange program	1985	Present	
Forum for Nuclear Cooperation in Asia (FNCA)/ Japan	Thru PNRI	Regional projects	2000	Present	
RCA Regional Office/ Korea	Thru PNRI	Regional projects; provision of training and education	2002	Present	
Nuclear Safety Research Association (NSRA)	Thru PNRI	Expert dispatch and training provision	2004	Present	
Japan Atomic Energy Agency (JAEA)	Thru PNRI	Expert dispatch and training provision			
United States Department of Energy	Thru PNRI	Project; expert; 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, France and other countries through bilateral agreements/institute agreements	Thru PNRI	Bilateral agreement			

TABLE 7. IAEA EXPERTS/OTHER MISSIONS IN 2011

FIELD/PURPOSE	NAME OF EXPERT/MISSION	DATE OF VISIT
IAEA Water Availability Enhancement (I-WAVE) Project Team	Pradeep Aggarwal, Mario Sophocleous, Verne Schneider, Kevin Dennehy, Wilhelm Struckmeier, Kei Yoshimura, Micahel Lee, Bruce Stewart, Charges Dunning	1– 4 March' 11
Ongoing Technical Cooperation Projects	Xiankai Shen, Dr. Homer Macapinlac	1– 4 March '11
Radiation Oncology Medical Physics Project	Robin Hill	21–24 March '11
Comprehensive Nuclear Test Ban Treaty Organization	Guillaume Claude Luis Beziat	24 March '11
Diagnostic Radiology Medical Physics	James Sullivan, Dr. John Henley	5 May'11
Research Reactor Decommissioning Project	Piers Manson, Sven Boden	23–27 May'11
Compliance Assurance for the Safe Transport of Radioactive Materials	Christoper Pecover, A.N. Nandakumar	6–10 June '11
Project Status of the Project on Conducting a Study and Evaluation of the Co-Location of a Borehole Disposal Concept with a Proposed Near-Surface Radioactive Waste Repository	Lumir Nachmilner	27 – 30 June '11
Pre-mature chromosome Condensation Assay Biological Dosimetry Techniques	Dr. Firouz Darroudi	27 June– 1 July'11
IAEA Water Availability Enhancement Project (I-WAVE) and Program of Action for Cancer Therapy	Dr. Daud Mohamad, Dr. Rethy K. Chhem	21 – 22 July '11
Project Status on the Project "Strengthening and Standardizing Nuclear Medicine Applications in Cardiology in Asia Through Education and Training"	Dr. Sam Benlangieri	25 – 27 July '11
Status of Philippine Projects	Oscar Acuña	3– 6 Augʻ 11
Water Availability Enhancement Project	Spyros Kleitsas, Charles Dunning	30 Aug– 2 Sept '11
Resource Speaker- World Conference of Science and Technology	Ferenc L. Toth	11 Sept '11
Japan Nuclear Human Resource Development Network	Nobuyoshi Arai, Yutaka Ito, Katsuhisa Yamaguchi	12– 14 Sept '11
Review (Draft of the Research Reactor Decommissioning Plan)	Patrick O' Sullivan, Niels Strufe, Piers Manson, Melanie Wong	3 – 7 Oct '11
World Institute for Nuclear Security and Regional Radiological Security Partnerships	Allan Murray	19 – 21 Oct '11
Safeguards Inspectors	Syed N. Syed Hussin Shabuddin, Mazibur Rahman	12 – 15 Dec '11
International Seminar on Effective Border Control	Valerie Chatelus, Noor Fitriah Bakri	19 – 20 Dec '11
Japan Atomic Energy Agency (JAEA) Follow-up Training Courses	Norio Nakagawa, Noboyoshi Arai, Kazuyuki Nakamura, Yukiko Yabuuchi	20 – 21 Dec '11

#### TABLE 8. PNRI HOSTINGS IN 2011

FIELD	PHILIPPINE PARTICIPANT	AGENCY/ INSTITUTE	ORGANIZER/S	VENUE	DATE
Regional Training Courses on Use of Nuclear Cardiology in Myocardial Viability Assessment and Introduction to PET and PET/CT for Advanced Users	Eric Cruz, Emelyn De Jesus Wenceslao Llauderes, Enrique Leonardo Ote		IAEA	University of Santo Tomas (UST)	1–5 Feb '11
Regional Training Course on Assuring Safety Assessment Through the Nuclear Power Plant (NPP) Project	Carl Nohay, Alfonso Singayan, Joseph R. Tugo Antonio Mercado	PNRI National Power Corporation	IAEA	Crowne Plaza Galleria Manila	14 – 18 Feb '11
Regional Training Course on Introduction to Image Based Radiotherapy for Radiation Oncologist and Medical Physicists	Dan Joseph Manlapaz Maria Lourdes Lacanilao Joseph Michael Nepomuceno Mary Ann Gehina Reyna	St. Luke's Medical Center Davao Medical Center Baguio General Hospital	IAEA	St. Luke's Medical Center, Global City, Taguig	22– 26 Feb '11

FIELD	PHILIPPINE PART
Regional Expert Group Meeting (EGM) for Finalization and Adoption of Promotional Materials, Guidelines and Protocols on New Developments and Applications of ndustrial Radiotracer and Sealed Source Technologies	Denis DC. Aquino
Executive Management Meeting for Environmental Agencies and National Nuclear Institute	Kadil Nasser Adelina DM. Bulos Ryan U. Olivares
Regional Workshop on Waste Safety Practices and Establishing Regulations for Near-Surface Disposal	Editha A. Marcelo Luzviminda L. Venid
Regional Workshop on Roles and Responsibilities of the Regulatory Body and Nuclear Power Plant Industry n Public Communication on Nuclear Energy and Safety Related Issues	Rhodora R. Leonin, J Cerbolles, Grace M. G Thelma P. Artificio Mona Carina Monter Michael Floria and Christopher Edmund Manalo Mauro Marcelo, Den Reynaldo Punzalan, Baluyot, Jose Manalo
Regional Training Course on Orphan Source Search	John Richard Fernar Allan Flores, Johnyle Melendez
<sup>2nd</sup> Regional Coordination Meeting on Development of rradiated Foods for Immuno-Compromised Patients and Other Potential Groups	Zenaida M. De Guzm
Regional Workshop for Development of Management Skills on Innovation, Technology Transfer and Successful Technology Licensing in Research and Development	Ana Elena L. Conjare Raymond J. Sucgang Gregory Ciocson Neil Raymund Guille Ana Maria S. Veluz

#### TABLE 9. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011

Teresa Borras Haydee Solomon

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
TRAINING COURSE					
Control of Public Exposure Due to Radioactive Releases to the Environment	Jerilee Sabariaga	National Power Corporation	Amman, Jordan	10 –13 May '11	IAEA
Introduction to Image Based Radiotherapy (For Radiation Oncologist and Medical Physicist)	Thelma Sarmiento Czarina Devilleres	The Medical City St. Frances Cabrini Medical Center	Jakarta, Indonesia	24 –27 May '11	IAEA
Security in the Transport of Radioactive Materials	Winston Antero P. Barquez	Department of Transportation and Communications	Kuala Lumpur, Malaysia	4 – 8 July '11	IAEA
Use of Nuclear Cardiology in Myocardial Viability Assessment and Introduction to PET & PET/CT for Beginners	Juanito Olpindo, Jr and Francis Gerard Estrada Angelin Apostol	Hospital of the Sacred Heart Our Lady of Mt. Carmel Medical Center Philippine Heart Center	Hanoi, Vietnam	11–15 July'11	IAEA
Promoting and Accelerating Nuclear SPECT/PET Imaging Technologies	Emerita A. Barrenehechea Francis Gerard M. Estrada	Veterans Memorial Medical Center Our Lady of Mt. Carmel Medical Center	Seoul, Republic of Korea	8 – 26 Augʻ11	RCA/ UNDP
Plant Breeding and Genetics	Marilyn Abregana Alforque	Bureau of Plant Industry	Vienna, Austria	1 Sept – 28 Nov'11	IAEA

#### TABLE 8. PNRI HOSTINGS IN 2011 (cont'd)

the second se				
TICIPANT	AGENCY/ INSTITUTE	ORGANIZER/S	VENUE	DATE
	PNRI	IAEA	PNRI	4 – 8 July '11
	Mindanao State University PNRI	IAEA	Manila, Philippines and PNRI	8 – 12 Aug '11
da	PNRI	IAEA	Crowne Plaza, Manila	26-30 Sept '11
, Justina S. . Carlos &	PNRI	IAEA	Linden Suites, Pasig City	17 –21 Oct '11
evirgen	DOST-STII			
ndo	Department of Energy			
ennis Gana, n, Corazon alo	National Power Corporation			
andez, len	PNRI	IAEA	Holiday Inn Manila Galleria	7– 11 Nov '11
rman	PNRI	IAEA	Richmonde Hotel	21-25 Nov'11
res ng Iermo	PNRI	IAEA	Traders Hotel	28 Nov- 2 Dec '11

#### TABLE 9. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011

#### TABLE 9. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011 (cont'd)

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
TRAINING COURSE					
Train the Trainer Course for Trainers for Quarantine Inspectors	Bartolome Mesolania Lourdes del Mundo	Bureau of Plant Industry-Plant Quarantine Service	Kuala Lumpur, Malaysia	19 – 23 Sept'11	IAEA/RCA
Interregional Training Course for Newcomers on the Physical Protection of Nuclear Materials and Facilities	Dante Caraos	National Power Corporation	Ljubljana, Slovenia	26 Sept – 7 Oct '11	IAEA
CTBTO Advanced Capacity Building Course for National Data Center Technical Staff	Babyjane T. Punongbayan	Philippine Institute of Volcanology and Seismology	Kuala Lumpur, Malaysia	18 – 29 Oct'11	СТВТО
Interregional Training Aspects for Nuclear Power Introduction	Benigno V. Resurreccion	Environmental Management Bureau	Daejeon, Republic of Korea	5 – 6 Dec '11	IAEA
SEMINAR/WORKSHOP					
Regional Workshop on Denials of Shipment of Radioactive Material	Dante Lantin	Department of Transportation and Communication	Vienna, Austria	18–19 April'11	IAEA
Regional Workshop on Volcanic, Seismic and Tsunami Hazard Assessment Related to NPP Siting Activities and Requirements and the Annual Meeting of Siting Topical Group	Babyjane T. Punongbayan	Philippine Institute of Volcanology and Seismology	Jakarta, Indonesia	13–17 June '11	IAEA
IAEA Workshop on Construction for New Nuclear Power Plants	Dante Caraos	National Power Corporation	Shanghai, China	22 – 24 June '11	IAEA
IAEA/ANSN Regional Workshop on Establishing a Nuclear Safety Infrastructure for a National Nuclear Power Programme	Raul Sabularse Lilian Fernandez	Philippine Council for Industry, Energy & Emerging Technology Research & Development Department of Energy	Vienna, Austria	4 – 15 July'11	IAEA
International Workshop on Earthquake Preparedness and Response for Nuclear Power Plants	Cirilo Bautista	National Power Corporation	Shanghai, China	10-14 Oct'11	IAEA
Specialized Training Workshop on the Operation of Liquid Water Isotope Analyzer	Christianne F. Lagura	Energy Development Corporation	Vienna, Austria	10 – 14 Oct'11	IAEA
International Workshop on Public Information and Understanding to Introduce a New Nuclear Power Plant	Jose Manalo	National Power Corporation	Seoul, Republic of Korea	10–14 Oct '11	IAEA
FAO Workshop on Control of <i>Aedes</i> Mosquitoes Using Sterile Insect Technique and Other Suppression Techniques	Alicia G. Garbo	Industrial Technology Development Institute	Vienna, Austria	8 – 11 Nov '11	IAEA
Regional Workshop on Financing Structure	Sarmiento Salvador, Jr	National Power Corporation	Vienna, Austria	12 – 15 Dec'11	IAEA
Regional Workshop on Stakeholder Involvement and Communication for Asian Countries	Dennis Gana	National Power Corporation	Jakarta, Indonesia	14 – 16 Dec'11	IAEA
MEETING					
Technical Meeting/Workshop on Topical Issues on Infrastructures Development:	Salvador Salire, Jr.	Department of Energy	Vienna, Austria	24 – 27 Jan'11	IAEA
Managing the Development of a National Infrastructure for Nuclear Power Plants	Manuel B. Plofino	National Power Corporation			
IAEA Technical Meeting on Hands-on Experience in Developing and Managing Nuclear Power Programme	Urbano C Mendiola, Jr.,	National Power Corporation	Seoul, Republic of Korea	4 – 8 April '11	IAEA
6th International Steering Committee on Denials of Shipment of Radioactive Material	Dante Lantin	Department of Transportation and Communication	Vienna, Austria	20 – 21 April '11	IAEA
IAEA/RCA Final Progress Assessment Meeting of RAS/6049 Project on Strengthening Clinical Applications of Positron Emission Tomography (PET) in RCA Member States	Gerlad Fabian Goco	St. Luke's Medical Center	Chiang Mai, Thailand	23–27 May '11	IAEA

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
MEETING					
Technical Meeting to Develop Guidance Material on Radiation Protection for Physician	Bayani San Juan	Center for Device Regulation, Radiation Health and Research, Department of Health	Vienna, Austria	26–28 Sept '11	IAEA
IAEA Regional Meeting on the Successful Launching of Nuclear Power Programs	Victor T. Francisco, Jr.	National Power Corporation	Seoul, Republic of Korea	27 Sept – 8 Oct '11	IAEA
AEA/RCA Regional Executive Management Meeting for Policy Makers and End Users on Super Water Absorbent, Toxin Metal Absorbent and Plant Growth Promoter for Agriculture Applications	Raul Sabularse	Philippine Council for Industry, Energy & Emerging Technology Research & Development	Takashi, Japan	3– 7 Oct '11	IAEA
Technical Meeting/Workshop on Sharing Experiences Among Countries Embarking on Nuclear Power in Southeast Asia	Ma. Corazon Baluyut Sarmiento Salvador, Jr	National Power Corporation	Jakarta, Indonesia	13 – 15 Oct'11	IAEA
Regional Meeting on Successful Launching of Nuclear Power Programmes	Salvador Salire, Jr	Department of Energy	Seoul, Republic of Korea	24 – 28 Oct'11	IAEA
Training Meeting on Building Partnership in Waste Disposal Programme	Angelina Resurreccion	Business Mirror	Malaysia	31 Oct-2 Nov'11	IAEA
Final Coordination Meeting for RAS6059 on Quality Assurance Team for Radiation Oncology(QUATRO) Training in Southeast Asia	Lilian V. Rodiguez	Jose Reyes Memorial Medical Center, Department of Health	Kuala Lumpur, Malaysia	2 – 4 Nov '11	IAEA
IAEA Technical Meeting on Network of Training and Demonstration of Waste Disposal Technologies in Underground Research Facilities	Carlo Arcilla	University of the Philippines - National Institute of Geological Sciences	Vienna, Austria	16 – 18 Nov'11	IAEA
Advisory Group on Increasing Access to Radiotheraphy Technology Meeting	Lillian V. Rodriguez	Jose Reyes Memorial Medical Center, Department of Health	Vienna, Austria	17 – 18Nov'11	IAEA
IAEA/RCA Final Progress Review Meeting of RAS6038 Project on Strengthening Medical Physics Through Education and Training	Agnette Peralta	Center for Device Regulation, Radiation Health and Research, Department of Health (DOH)	Hanoi, Vietnam	6 – 9 Dec '11	IAEA
Regional Meeting to Create a Network of Medical Professionals on Radiation Protection of Children	Livy P. Magno Augusto Morales, Jr.	Philippine Heart Center Center for Device Regulation, Radiation Health and Research, DOH	Bangkok, Thailand	15 – 17 Dec '11	IAEA
Annual Review Meeting on the RCA-UNDP Project on Promoting and Accelerating Nuclear SPECT/PET Imaging Technologies in the Region	Emerita Barrenechea	Veterans Memorial Medical Center	Kota Kinabalu, Malaysia	20 – 21 Dec '11	RCA
CONFERENCE/FORUM/SUMMIT					
IAEA Scientific Forum	Guillermo Q. Tabios III	National Hydraulic Research Center, University of the Philippines	Vienna, Austria	20 – 21 Sept'11	IAEA
IAEA International Conference on the Safe & Secure Transport of Radioactive Materials: The Next Fifty Years - Creating a Safe, Secure and Sustainable Framework	Dante Lantin	Department of Transportation & Communication	Vienna, Austria	17–21 Oct '11	IAEA
International Conference on Clinical PET and Molecular International Conference on the Safe & Secure Transport of Radioactive Materials: The Next Fifty Years – Creating a Safe, Secure & Sustainable Framework Nuclear Medicine (IPET 2011)	Patricia Bautista Irene Bandong Karina Michaela dela Cruz and Vincent Peter Magboo Alvin Quinon	St. Luke's Medical Center Seamen's Hospital University of Sto Tomas Hospital Cagayan de Oro Medical Center	Vienna, Austria	8 –11 Nov '11	IAEA

#### TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011

FIELD	NAME	TRAINING VENUE	DATE	SPONSOR
ON-THE-JOB TRAINING				
Group Fellowship Training Programme on Research Reactors	Ryan U. Olivares	Vienna, Austria; Czech Technical University ; Dept. of Nuclear Reactors, Praha	28 Feb – 8 April '11	IAEA
General Atomic Energy Development	Jennylyn C. Minglana	Vienna, Austria	15 Aug – 14 Oct '11	IAEA
Radiation Processing Facilities and Applications	Aurelio Maningas	Warsaw, Poland	1 Sept – 24 Nov'11	IAEA
Electron Beam Utilization: Radiation Sterilization of Medical Products as per ISO 11137	Chitho P. Feliciano	Warsaw, Poland	1 Sept – 30 Nov'11	IAEA
Techniques in Isotope Hydrology	Norman DS. Mendoza	Vienna, Austria	17 Oct – 15 Dec'11	IAEA
TRAINING COURSE				
Regulatory Control of Nuclear Power Plant	Mary Rose Q. Mundo	Daejon, Korea	4-8 April'11	IAEA
Control of Public Exposure Due to Radioactive Releases to the Environment	Ryan Joseph Aniago	Amman, Jordan	10 – 13 May '11	IAEA
Live Agent Training	Ma. Theresa A. Salabit	Alberta, Canada	16 –21 May'11	Canadian Gov't
Gamma Transmission Computed Tomography (CT) System and Image Reconstruction for Pipe Inspection	Denis DC. Aquino Ramon F. Sulit	Dalat, Vietnam	20–24 June'11	IAEA
Advanced Applications of Radiation Processing for Recycling Polymeric Wastes	Wendy G. Lim Jordan F. Madrid	Bangi, Malaysia	4 – 8 July '11	IAEA
Security in the Transport of Radioactive Materials	Raymund P. Beredo	Kuala Lumpur, Malaysia	4 – 8 July '11	IAEA
Public Communications in Radiation Emergencies	Justina S. Cerbolles & Dan Benneth C. Mangulabnan	Kuala Lumpur, Malaysia	11 –15 July '11	IAEA
Use of Isee aRTist Software for DigitaL Industrial Radiography Image Analysis and Interpretation	Renato T. Bañaga Roel A. Loteriña	Kuala Lumpur, Malaysia	25–29 July'11	IAEA
Instructor Training Course 2011: Reactor Engineering Course III	Kristine Marie D. Romallosa	Tokai, Japan	1 Aug- 15 Oct '11	IAEA
Joint ICTP-IAEA School of Nuclear Energy Management	Paolo Tristan F. Cruz	Trieste, Italy	8 –26 Aug '11	ICTP
Radiological Crime Scene Management and Introduction to Nuclear Forensics	Teolifo V. Leonin, Jr. Ma. Teresa A. Salabit	Daejon, Republic of Korea	22–26 Aug '11	IAEA
Feasibility Studies for the Establishment of Radiation Processing Facilities	Luvimina G. Lanuza	Hungary	28 Aug–2 Sept '11	IAEA
Management of Radioactive Waste in Accordance with International Safety Standards and Best Practices	Ronald E. Piquero	Clausthal Zellrfeld, Germany	5 Sept–14 Oct '11	IAEA
Diagnosis of Multi-Phase Systems of Petrochemical Plants and Waste Water Treatment Systems Using Radiotracers Incorporation with Computer Modeling and Simulation	Denis DC. Aquino Janice P. Mallilin	Daejon, Korea	19–23 Sept '11	IAEA
Train the Trainer for Quarantine Inspectors	Haydee M. Solomon	Kajang, Malaysia	19–23 Sept '11	IAEA
Training Course for Nuclear Newcomers on the Physical Protection of Nuclear Materials and Facilities	Vangeline K. Parami Lynette B. Cayabo	Ljubljana, Slovenia	26–30 Sept '11	IAEA
Instructor Training Course on Nuclear and Radiological Emergency Preparedness	Rosario R. Encabo Mary Rose Q. Mundo	Tokai-mura, Japan	10–18 Oct '11	JAEA
Radioactive Particle Tracking Techniques for Investigating Process Hydrodynamics	Adelina DM. Bulos Denis DC. Aquino	New Delhi, India	17–21 Oct '11	IAEA
Training Course and Demonstration on Upscaling of Radiation of Polymer for Agricultural Application	Charles Darwin T. Racadio Jorge P. Sahagun	Beijing, China	17–21 Oct '11	IAEA
Transition to Integrated Management System Approach Supporting the Development of a Strong Safety Culture	Gloriamaris L. Caraos Meriam F. Rejas	Dhaka, Bangladesh	24–27 Oct '11	IAEA
Physical Protection of Nuclear Material and Facilities	Raymund P. Beredo	Ibaraki, Japan	17–28 Oct '11	US DOE
Reactor Plant Safety Course	Unico A. Bautista	Tsuruga, Japan	7 Nov-2 Dec '11	MEXT/ IHRDC
International Nuclear Information System Training Seminar	Isabel M. Amiscaray	Vienna, Austria	14-16 Nov '11	IAEA

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	FIELD	NAME	TRAINING VENUE	DATE	SPONSOR
	TRAINING COURSE				
	Physical Protection of Nuclear Facilities Against Sabotage, Assessing Vulnerabilities and Identifying Vital Areas	Joseph R. Tugo	New Delhi, India	14-18 Nov '11	IAEA
	Training Course for the Trainers on Public Communication of Nuclear Regulatory Organization	Percedita T. Cansino Alvie J. Asuncion	Daejon, Korea	24-28 Oct'11	IAEA
	SEMINAR/WORKSHOP				
	Seminar on the Agency's Safeguards System for States in the Southeast Asia with Safeguards Significant Nuclear Activities	Julietta E. Seguis	Singapore	23–24 March'11	IAEA
	Regional Workshop on Loss of Coolant Analyses Using Visa RELAP	Joseph R. Tugo	Daejon, Republic of Korea	25–29 April '11	IAEA
	CTBTO Operation and Maintenance Workshop	Fe M. Dela Cruz	San Diego, California	9-13 May'11	CTBTO
	Nuclear Safety Workshop Tailored for Regulators	Edgar G. Racho Carl M. Nohay	Republic of Korea	30 May-10 June`11	IAEA
A PARTICULAR OF	Regional Workshop on Volcanic, Seismic, and Tsunami Hazard Assessment Related to Nuclear Power Plant Siting Activities and Requirements and Annual Meeting of Siting Topical Group	Rolanda Y. Reyes Luzviminda L. Venida	Jakarta, Indonesia	13–17 June'11	IAEA
	Regional Workshop on Basic Professional Training Course in Nuclear Safety	Myrna E. Piquero	Republic of Korea	13–24 June'11	IAEA
	Workshop on National Nuclear Regulatory Portals	Nelson P. Badinas	Bonn, Germany	4–6 July '11	IAEA
	Regional Workshop on Waste Safety Practices and Establishing Regulations for Predisposal Management-Part 1	Thelma P. Artificio Teresita G. De Jesus	Daejon, Republic of Korea	4– 8 July'11	IAEA
	R <sub>2</sub> D <sub>2</sub> Workshop on the Review of a Decommissioning Plan	Vangeline K. Parami	Romania	4–8 July '11	IAEA
	Regional Seminar on Disaster Management 2011	Estrella S. Caseria	Singapore	5 –7 July'11	DCI of the French Embassy
	Regional Workshop on Nuclear Material Accounting and Control at Facilities	Jan Aldrich A. Agustin	China	7–23 Sept '11	IAEA
	Regional Workshop on Self-Assessment in the Preparation of Integrated Regulatory Review Service (IRRS) Mission	Teofilo V. Leonin, Jr. Thelma P. Artificio Cecilia M. de Vera	Bali, Indonesia	26–30 Sept '11	IAEA
	2011 National Data Center Evaluation Workshop	Salvador P. Flores	Bucharest, Romania	3–7 Oct'11	СТВТО
	Regional Seminar on Advanced Detection Techniques	Julietta E. Seguis	Bangkok, Thailand	4–6 Oct'11	EU
	International Workshop on Public Information and Understanding to Introduce a New Nuclear Power Plant	Justina S. Cerbolles	Seoul, Republic of Korea	10-14 Oct'11	IAEA
	Training Meeting Workshop on Uranium Recovery from Phosphates and Phosphoric Acid	Wendy G. Lim	Marrakech, Morocco	31 Oct – 4 Nov '11	IAEA
	International Workshop on Nuclear Education and Training	Nydia C. Medina	Daejon, Republic of Korea	7–11 Nov '11	KONICOF
	International Workshop on Advanced Technologies for Nuclear/ Radioactive Materials Management and Transport Security	Julietta E. Seguis	Seoul, Republic of Korea	21-22 Nov'11	WINS
	FNCA Workshop - Peer Review on Safety Management System for Nuclear Facilities	Adelina DM. Bulos	Kuala Lumpur, Malaysia	21-25 Nov '11	FNCA
	Regional Workshop on National Regulatory System for Nuclear Safety, Security and Safeguards	Julietta E. Seguis	Kuala Lumpur, Malaysia	28 Nov-2 Dec.'11	IAEA
	Regional Workshop on Development of Policy and Strategy for Radioactive Waste and Spent Fuel Management for Nuclear Power Program	Carl M. Nohay	Bangkok, Thailand	28 –30 Nov'11	IAEA
	Nuclear Safety Seminar 2011 Administration Course	Soledad S. Castañeda	Tokai-mura, Japan	28 Nov - 16 Dec'11	MEXT
	7th International Workshop on Ionizing Radiation Monitoring	Teofilo Y. Garcia	Orai, Japan	3-9 Dec. '11	JAERI
	Regional Workshop on Stakeholder Involvement and Communication for Asian Countries	Victoria Fe O. Medina	Jakarta, Indonesia	14–16 Dec'11	IAEA
	MEETING				
	35th Session of Working Group B of the Preparatory Commission for the Comprehensive Nuclear Test Ban Treaty Organization	Teofilo Y. Garcia	Vienna, Austria	14 Feb –4 March'11	СТВТО

#### TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011 (cont'd)

#### TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011 (cont'd)

FIELD	NAME	TRAINING VENUE	DATE	SPONSOR
MEETING				
Implementation and Assessment Group Meeting of the Global Initiatives to Combat Nuclear Terrorism	Julietta E. Seguis	Cordoba, Spain	28 Feb – 3 March'11	US Dept. of Energy
Final Progress Review Meeting: Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology	Adelaida C. Barrida	Bangkok, Thailand	21–25 March '11	IAEA
Ad Hoc Meeting of the Asia-Pacific Safeguards Network (APSN)	Julietta E. Seguis	Singapore	25 March '11	ASNO
Project Meeting on Conducting a Study and Evaluation of the Co-location of a Borehole Disposal Concept with a Proposed Near- Surface Radioactive Waste Repository	Ma. Visitacion B. Palattao	Vienna, Austria	1– 3 March'11	IAEA
Second Meeting of the Period Coordinators of the Technical Cooperation Project RAS/9059 on Strengthening Nuclear Regulatory Activities	Alan M. Borras	Vienna, Austria	29– 31 March'11	IAEA
IAEA Task Force Meeting	Zenaida M. De Guzman	Vienna, Austria	9 – 13 May'11	IAEA
Technical Meeting to Support the Development of Guidance Documents on Management Strategy and its Implementation in Nuclear Organizations	Corazon C. Bernido	Vienna, Austria	6 – 9 June '11	IAEA
Licensing of Nuclear Installation Including Review and Assessment Aspects of the Application Process	Lynette B. Cayabo	Vienna, Austria	6 – 10 June'11	IAEA
Asia & the Pacific National Liaison Officers (NLO) Meeting	Nydia C. Medina	Vienna, Austria	14– 17 June '11	IAEA
2nd Asia Pacific Safeguards Network Plenary Meeting	Julietta E. Seguis Sylvia S. Busine	Jeju Island, Republic of Korea	5 – 7 July '11	EU
3rd Meeting of Study Panel on "The Approaches Toward Infrastructure Development for Nuclear Power"	Alumanda M. Dela Rosa	Jakarta, Indonesia	5 – 6 July'11	BATAN
Meeting for Emergency Management Decision-Makers	Teofilo V. Leonin, Jr.	Vienna, Austria	11 – 15 July'11	IAEA
Train-the-Trainer International Nuclear Safeguards Engagement Program (INSEP) Meeting	Julietta E. Seguis Ma. Teresa A. Salabit	California, USA	21– 22 July '11	US DOE
Consultancy Meeting on Public Information Documents	Rhodora R. Leonin	Vienna, Austria	26 – 29 July '11	IAEA
Initial Project Planning Meeting for the Project on Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia-Pacific Region	Eliza B. Enriquez	Sydney, Australia	29 Aug – 2 Sept '11	IAEA
Technical Meeting on Guidelines for Training/Examination and Certification of Candidates in the Digital Industrial Radiography and Computer Tomography Techniques	Renato T. Bañaga	Jakarta, Indonesia	5 – 9 Sept '11	IAEA
Final Progress Review Meeting of Sustainability of Regional Radiation Protection Infrastructure	Teofilo V. Leonin, Jr.	Da Nang, Vietnam	5 – 9 Sept '11	IAEA
Annual Meeting of the ANSN Emergency Preparedness and Response Topical Group(EPRTG); Regional Workshop on Emergency Preparedness and Response on Longer Term Protective Actions & Related Matters; and Regional Workshop on Self-Assessment in the Preparation of Integrated Regulatory Review Service (IRRS) Mission	Teofilo V. Leonin, Jr. Cecilia M. De Vera	Phuket, Thailand Bali, Indonesia	19 – 23 Sept '11 26 – 30 Sept '11	IAEA
Annual Meeting of the Education and Training Topical Group (ETTG) and Workshop on Establishment of a National Education System for Countries Embarking on a Nuclear Power Program	Corazon C. Bernido Roel A. Loteriña	Vienna, Austria	26 – 30 Sept '11	IAEA
Annual Meeting of the Safety Analysis Topical Group (SATG) and Workshop on Loss of Coolant Accident (LOCA) Analysis using Visa/ RELAP	Alfonso A. Singayan Joseph R. Tugo	Jakarta, Indonesia	10 – 14 Oct '11	IAEA
Technical Meeting on Sharing Experience, Current Status and Guidelines for Environmental Applications in Developing Member States	Lorna Jean H. Palad	Vienna, Austria	17 – 21 Oct '11	IAEA
Technical Meeting on World Thorium Resources	Rolando Y. Reyes	India	17 – 21 Oct '11	IAEA
Technical Meeting on Nuclear Security Detection Architecture	Julietta E. Seguis	Vienna, Austria	17 – 21 Oct '11	IAEA
12th Asian Nuclear Safety Network(ANSN) Steering Committee Meeting	Corazon C. Bernido	Beijing, China	20 – 22 Oct '11	IAEA

	A REAL PROPERTY AND ADDRESS			
FIELD	NAME	TRAINING VENUE	DATE	SPONSOR
MEETING	Dhadaya D. Laanin	Malauria	21 Oct. 2 Nov/11	
Programme	Rhodora R. Leonin	Malaysia	31 Oct - 2 NOV 11	IAEA
Meeting for the Review of the National Report on Gaps in Hydrological Data and Information in the Philippines	Soledad S. Castañeda	Vienna, Austria	31 Oct – 4 Nov '11	IAEA
Final Progress Assessment Meeting of the Project entitled "Harmonizing Nuclear and Isotopic Techniques of Marine Pollution Management" at the Regional Level	Adelina DM. Bulos	Monaco	1 – 4 Nov '11	IAEA
Technical Meeting on Developing Strategies for Assisting Member States in the Management of Disused Sealed Radioactive Sources	Editha A. Marcelo	Vienna, Austria	8– 11 Nov '11	IAEA
Consultancy Meeting to Assist in the Review of Thematic Safety Area 7: Transport Safety	Vangeline K. Parami	Vienna, Austria	8 – 11 Nov'11	IAEA
Final Progress Review Meeting on Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management	Soledad S. Castañeda	Sydney, Australia	14 – 17 Nov '11	IAEA
Technical Meting on the Development of Guidance Material on the Management of Radiation Protection Programmes for Itinerant Workers	Estrella S. Caseria	Vienna, Austria	21–24 Nov '11	IAEA
Meeting on Quality Management System Documentation and Utilization of Regional Global Marine Databases	Eliza B. Enriquez	Monaco	21 –25 Nov'11	IAEA
Regional Meeting on Occupational Radiation Protection in Emergency Situation	Cecilia M. De Vera	Chiba, Japan	22–25 Nov'11	IAEA
Regional Meeting on Lessons Learned in Protection of the Public and Environment from Radiation Practices	Vangeline K. Parami	Kuwait, Kuwait City	27 Nov – 1 Dec '11	IAEA
Final Technical Meeting on Applications of Radiotracer and Radioassay Technologies to Seafood Safety Risk Analysis	Eliza B. Enriquez	Monaco	28 Nov – 1 Dec '11	IAEA
IAEA Experts Meeting for Piloting Technical Cooperation Monitoring and Evaluation Tools	Adelina DM. Bulos	Vietnam	28 Nov- 2 Dec '11	IAEA
Consultant's Meeting on Current Practices and Requirements for Tritium Analyses in Isotope Hydrology.	Norman DS. Mendoza	Vienna, Austria	12–15 Dec. 11	IAEA
Final Progress Review Meeting on Diagnosing Industrial Multiphase Systems by Process Visualization using Radiotracers and Sealed Sources	Denis DC. Aquino	Chiang Mai, Thailand	12–16 Dec'11	IAEA
CONFERENCE/CONGRESS/SYMPOSIUM/FORUM				
International Symposium on Isotope Hydrology, Marine Ecosystems, and Climate Change Studies	Soledad S. Castañeda	Monaco	27 March – 1 April'11	IAEA
European Geosciences Union (EGU) General Assembly	Soledad S. Castañeda	Vienna, Austria	3– 6 April'11	EGU
KAERI International Symposium	Zenaida M. De Guzman	Seoul, Republic of Korea	16 – 19 May '11	IAEA
CTBTO Science and Technology Conference 2011	Teofilo Y. Garcia and Fe M. Dela Cruz	Vienna, Austria	8 – 10 June'11	СТВТО
Institute of Nuclear Materials Management Conference	Ma. Teresa A. Salabit	California, USA	17 –22 July '11	LLNL
14th International Congress of Radiation Research	Chitho P. Feliciano	Warsaw, Poland	1–5 Sept'11	IAEA
International Conference on Security, Safety and Safeguards in Nuclear Energy	Alumanda M. Dela Rosa Julietta E. Sequis Vangeline K. Parami	Bangkok, Thailand	1–2 Sept '11	OAP
International Conference on Safe and Secure Transport of Radioactive Material; Chair, Session D, "Regional Workshop-Asia and the Pacific"	Vangeline K. Parami	Vienna, Austria	7 – 11 Oct '11	IAEA
INPRO Dialogue Forum on Nuclear Energy Innovations: Common User Considerations for Small and Medium-Sized Nuclear Power Reactor	Christina A. Petrache	Vienna, Austria	10 – 14 Oct '11	IAEA
52nd Institute of Nuclear Materials Management (INMM) Conference	Julietta E. Seguis Ma. Teresa A. Salabit	California, USA	17 – 21 Oct'11	US DOE
4th International Symposium on Material Testing Reactors	Teofilo Y. Garcia	Orai, Japan	3 – 9 Dec '11	Chiyoda Tech. Corp.

#### TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2011 (cont'd)

FIELD	NAME	TRAI	NING VENUE		DATE	SPONSOR
SCIENTIFIC VISIT						
Technical Visit at Isotope Technologies Dresden (ITD) on Technetium-99m Generator Production Facility	Adelina DM. Bulos D Ma. Teresa L. Borras Arturo F. Salih John M. Marquez	Adelina DM. Bulos Dresden, G Ma. Teresa L. Borras Arturo F. Salih		many 25 Sept – 1 Oct '11		ITD
Scientific Visit to Haceteppe University	Lucille V. Abad A	nkara, Tu	urkey	5-9 I	Dec'11	IAEA
TABLE 11. PNRI H	UMAN RESOURCES DEVELOPMENT	(LOCAL)	IN 2011			
FIELD	NAME		DATE		VENU	JE
TRAINING						
Open Office Organization Training for Quezon City Cluster	Christine P. Singayan		2– 4 March '11		Advanced Scier Technology Ins	nce & titute (ASTI)
DOST Facilities and Equipment Information System (DFEIS) End-User Training	Salvador P. Flores, Jr. and Ricky C. Gabinete		28– 30 March '11		ASTI	
2nd DOST Clients/Partners Information System (DCPIS) User Acceptance Testing Workshop and End-User Training	Salvador P. Flores, Jr. 1		11– 13 April '11		ASTI	
Chemical, Biological, Radiological and Nuclear (CBRN) Training	Ma. Teresa A. Salabit		25– 29 April '11		Cagayan De Ore	C
9th Food Safety Health Course	Gina B. Abrera		9– 13 May '11		University of th Philippines, Ma	e nila
Re-training on the SciNET Integrated Library Management System (SILMS)	Isabel M. Amiscaray; Elizabeth C. Vid Arminda V. Espineda	lal;	6 June '11		DOST	
IPv6 Training for Beginners	Christopher G. Halnin; Salvador P. Flo	ores, Jr.	9– 10 June '11		ASTI	
Level 1 Infrared Themography Training Course	Renato T. Bañaga; Arturo F. Salih		20– 23 June '11		Orchid Garden Makati	Hotel,
E-Payment (Bancnet) Training	Celestino M. Santos; Denia A. Dato-o	on	21 July '11		Makati City	
Training Course on Expanding Accountabilities of Public Service: Basic Course on Supervisory Development	Teofilo V. Leonin, Jr.		7– 9 Sept'11		Development A the Philippines	cademy of
HRDP's In-House Training on Administrative Rules of Procedure for Disciplinary Cases in the DOST System	Emma L. Cancino and Alicia F. Lagunzad		20 Oct '11		DOST	
Training of Trainers Programme on "Planning and Implementing Technology Transfer Project"	Victoria Fe O. Medina		7– 09 Nov'11		Manila	
Network Firewall (Fortigater 80C) Set-up Training	Christopher G. Halnin; Salvador P. Flo Jr.; Christine P. Singayan	ores,	8 Nov'11		Quezon City	

**Roland V. Rallos** 

Luzviminda B. Muyco

Salvador P. Flores, Jr. and

Levelyn Mitos M. Tolentino

Ma. Celerina M. Ramiro and

Teofilo V. Leonin, Jr.; Vangeline K. Parami;

Julietta E. Seguis; Edgar G. Racho; Ma. Visitacion B. Palattao; Rosita R. Daroy; Sylvia S. Busine; Ma. Teresa A. Salabit; Victoria Fe O. Medina; Nydia C. Medina

Ricky C. Gabinete

Chitho P. Feliciano

Janice P. Mallillin

Vangeline K. Parami; Rizalina G. Osorio;

Ronald E. Piquero; John Richard A. Fernandez; Paolo Tristan F. Cruz

8-10 Nov'11

5-9 Dec'11

15 Dec'11

19– 20 March '11

23-24 March '11

3– 4 May '11

17– 18 May '11

23– 24 June '11

29 June '11

Equipment and Materials		Mylene M. Espir	nal			
Gathering of CESOs and Eligibles	Graceta DL. Cuev		vas	17 June '11	PHIVOLCS	
Gender and Development (GAD) Syn	nposium	Emma L. Cancin	0	25 July'11	University of the Philippines, Los Baños	
1st International Symposium of the F Conservation Society at the Museum	Philippine Native Plants of the Filipino People	Fernando B. Aur	igue	19– 20 November '11	Manila	
	TABL	E 12. PNRI GRADU	JATE PROGRAM IN 2011			
NAME	LEVEL FIELD	OF STUDY	NAME OF REC EDUCATIONA	EIVING HIGHER L INSTITUTION	STATUS/SPONSOR	
WITH SCHOLARSHIP						
Preciosa Corazon B. Pabroa	Ph.D. in Environmenta	al Science	University of the Philippir	nes (UP) - Diliman	Ongoing/Science Education Institute (SEI)	
Ryan U. Olivares	Ph.D. in Environmenta	Ph.D. in Environmental Science The University of Tokyo			Ongoing/Asian Development Bank and Japan Scholarship Program	
Ryan P. Morco	M.S. in Chemistry	M.S. in Chemistry University of Western Or		ario, Canada	Ongoing	
SELF-FINANCED STUDIES						
Soledad S. Castañeda	Ph.D. in Environmenta	al Science	UP – Diliman		Ongoing	
Romelda P. Azores	Ph.D. in Environmenta	Ph.D. in Environmental Science			Ongoing	
Thelma P. Artificio	Ph.D. in Technology M	Ph.D. in Technology Management		Technological University of the Philippines – Manila		
Alvie J. Asuncion	Ph.D. in Physics		UP – Diliman		Ongoing	
Wendy G. Lim	Ph.D. in Chemistry		Mapua Institute of Techno	ology	Ongoing	
Ma. Llorina O. Rañada	M.S. in Chemistry		University of Santo Tomas (UST)		Ongoing	
Ryan Joseph Aniago	M.S. in Chemistry		UP – Diliman		Ongoing	
Jordan F. Madrid	M.S. in Chemistry		UP – Diliman		Ongoing	
Anie Day DC. Asa	M.S. in Biochemistry		UP – Manila		Ongoing	
Lorna Jean H. Palad	M.S. in Environmental	Science	UP - Diliman		Ongoing	
Angel T. Bautista VII	M.S. in Environmental	M.S. in Environmental Science		UP - Diliman		
Jennyvi P. Dayaon	M.S. in Environmental Science		UP - Diliman		Ongoing	
Charles Darwin T. Racadio	M.S. in Environmental	Science	UP - Diliman		Ongoing	
Rhett Simon DC. Tabbada	M.S. in Marine Science		UP - Diliman		Ongoing	
Adrian D. Cruz	M.S. in Chemical Engi	neering	UP - Diliman		Ongoing	
Paolo Tristan F. Cruz	M.S. in Pharmacology		UP – Manila		Ongoing	
Ma. Elina Salvacion Kristina V. Ramo	M.S. in Medical Physic	s	UST		Ongoing	
Chitho P. Feliciano	M.S. in Microbiology a	and Biotechnology	UP - Diliman		Graduated	
Juan Miguel M. Recto	M.S. in Molecular Biolo Biotechnology	ogy and	UP - Diliman		Ongoing	

DOST	NAME	LEVEL FIELD OF STUDY	NAME OF RECEIVING HIGHER EDUCATIONAL INSTITUTION	STATUS/SPONSOR
ASTI	WITH SCHOLARSHIP	WITH SCHOLARSHIP		
Orchid Garden Hotel, Makati	Preciosa Corazon B. Pabroa	Ph.D. in Environmental Science	University of the Philippines (UP) - Diliman	Ongoing/Science Education Institute (SEI)
Makati City				Ongoing/Asian
Development Academy of the Philippines	Ryan U. Olivares	Ph.D. in Environmental Science	The University of Tokyo	Development Bank and Japan Scholarship
DOST				Program
Maraila	Ryan P. Morco	M.S. in Chemistry	University of Western Ontario, Canada	Ongoing
Manila	SELF-FINANCED STUDIES			
Quezon City	Soledad S. Castañeda	Ph.D. in Environmental Science	UP – Diliman	Ongoing
	Romelda P. Azores	Ph.D. in Environmental Science	UP – Diliman	Ongoing
DOST	Thelma P. Artificio	Ph.D. in Technology Management	Technological University of the Philippines – Manila	Ongoing
	Alvie J. Asuncion	Ph.D. in Physics	UP – Diliman	Ongoing
Camp Nakar, Lucena	Wendy G. Lim	Ph.D. in Chemistry	Mapua Institute of Technology	Ongoing
Mandaluyong City	Ma. Llorina O. Rañada	M.S. in Chemistry	University of Santo Tomas (UST)	Ongoing
	Ryan Joseph Aniago	M.S. in Chemistry	UP – Diliman	Ongoing
Philippine Heart Center	Jordan F. Madrid	M.S. in Chemistry	UP – Diliman	Ongoing
	Anie Day DC. Asa	M.S. in Biochemistry	UP – Manila	Ongoing
ASTI	Lorna Jean H. Palad	M.S. in Environmental Science	UP - Diliman	Ongoing
	Angel T. Bautista VII	M.S. in Environmental Science	UP - Diliman	Ongoing
Giles Hotel, Makati City	Jennyvi P. Dayaon	M.S. in Environmental Science	UP - Diliman	Ongoing
Δςτι	Charles Darwin T. Racadio	M.S. in Environmental Science	UP - Diliman	Ongoing
//3/1	Rhett Simon DC. Tabbada	M.S. in Marine Science	UP - Diliman	Ongoing
DOST	Adrian D. Cruz	M.S. in Chemical Engineering	UP - Diliman	Ongoing
	Paolo Tristan F. Cruz	M.S. in Pharmacology	UP – Manila	Ongoing
	Ma. Elina Salvacion Kristina V. Ramo	M.S. in Medical Physics	UST	Ongoing
Crowne Plaza Hotel	Chitho P. Feliciano	M.S. in Microbiology and Biotechnology	UP - Diliman	Graduated
	Juan Miguel M. Recto	M.S. in Molecular Biology and Biotechnology	UP - Diliman	Ongoing

Support to Competitiveness of Local Industries for ONE ASEAN

"Enhancement of DOST R&D and Testing Laboratories in

DOST-HRDP In-House Training on Statistical Analysis for

PhilGEPS Training on the Use of the Virtual Store (Phase 2)

Distance Assisted Training Online Seminar/Workshop

2nd DOST Facilities and Equipment Information System

(DFEIS) User Acceptance Testing Workshop

Workshop on the Development of the Program,

ISO Guide 34 Awareness Seminar

Acceptance Testing Workshop

Community"

Chemical, Biological, Radiological and Nuclear (CBRN) Training Ma. Teresa A. Salabit

3rd DOST Scholarship Online-Information System (DSOIS) User Alicia F. Lagunzad

**Research and Development** 

SEMINAR/WORKSHOP

FIELD

TAPI Seminar-Workshop on Valuation on Intellectual Property

& Techniques for Negotiation and Licensing Arrangements Verification of Common Laboratory Instruments Seminar

6th Asian-Pacific Organization for Cell Biology Congress

PCHRD Forum on Procedures for Importing Research

Strategic Planning Workshop on Chemical, Biological

SEMINARS/WORKSHOP

Radiological and Nuclear Energy

CONGRESS/FORUM/SYMPOSIUM

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#### TABLE 11. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2011 (cont'd)

NAME	DATE	VENUE
Ma. Teresa A. Salabit	29– 30 Sept'11	Cavite
Gregory R. Ciocson	29– 30 Sept'11	Bayview Park Hotel
Davison T. Baldos	28 Oct '11	Metals Industry Research and Development Center
Chitho P. Feliciano	25– 28 Feb'11	Manila
Graceta DL. Cuevas Mylene M. Espinal	8 June '11	DOST
Graceta DL. Cuevas	17 June '11	PHIVOLCS
Emma L. Cancino	25 July'11	University of the Philippines, Los Baños
Fernando B. Aurigue	19– 20 November '11	Manila

#### TABLE 13. LIST OF SCIENTIFIC PUBLICATIONS IN 2011

TITLE OF SCIENTIFIC PAPER	NAME/E-MAIL OF MAIN AUTHORS	PUBLICATION/ NAME/TYPE OF JOURNAL*	DATE PUBLISHED
NMR Analysis of Fractionated Irradiated K-Carrageenan Oligomers as Plant Growth Promoters	Lucille V. Abad (Ivabad@pnri.dost.gov.ph) S. Saiki, N. Nagasawa, H. Kudo, Y. Katsumura and Alumanda M. Dela Rosa	Radiation Physics and Chemistry 80, 977-982.	2011
Influence of Adult Diet and Exposure to Methyl Eugenol in the Mating Performance of <i>Bactrocera</i> <i>philipinensis</i>	Glenda B. Obra (gbobra@pnri.dost.gov.ph) Sotero S. Resilva	Journal of Applied Entomology. published online (http://onlinelibrary. wiley.com/doi/10.1111/j.1439- 0418.2011.01678.x/abstract)	12 October 2011
Radiation Inactivation of Paenibacillus larvae and Sterilization of American Foul Brood (AFB) Infected Hives Using Co-60 Gamma Rays	Zenaida M. De Guzman (zmdeguzman@pnri.dost.gov.ph), Cleofas R. Cervancia, Kris Genelyn B. Dimasuay, Mitos M. Tolentino, Gina B. Abrera, Ma. Lucia C. Cobar, Alejandro C. Fajardo Jr., Noel G. Sabino, Analinda C. Manila-Fajardo and Chitho P. Feliciano	Applied Radiation and Isotopes, Vol. 69 pp. 1374–1379 (ISI Indexed)	2011
Environmental Isotopes and Major Hydrochemistry for Tracing Leachate Contamination from a Municipal Landfill in Metro Manila, Philippines	Soledad S. Castańeda (sscastaneda@pnri.dost.gov.ph), Raymond Sucgang, Norman Mendoza and Rosalina Almoneda	Geophysical Research Abstracts Vol. 13, EGU2011- 2011, EGU General Assembly 2011, Vienna, Austria	2011
Receptor Modeling Studies for the Characterization of Air Particulate Lead Pollution Sources in Valenzuela Sampling Site (Philippines)	Preciosa Corazon B. Pabroa (pcbpabroa@pnri.dost.gov.ph), Flora L. Santos, Ryan.P. Morco, Joseph Michael D. Racho, Angel T. Bautista VII and Camille Grace dL. Bucal	Atmospheric Pollution Research 2:213- 218	2011
Determination of Uranium Concentration and its Activity Ratio in Coal and Fly Ashes from Philippine Coal-Fired Thermal Power Plants Using ICP-MS and TIMS	S.K. Sahoo, V.K. Parami, L.L. Quirit, H. Yonehara, T. Ishikawa, S. Tokonami	Proceedings in Radioactivity – A Supplement to Radiochimica Acta, Open Access Journal, pp.257-261	September 2011
Occupational Exposure to Radon in Non-Uranium Underground Mines in the Philippines	Teofilo Y. Garcia, (tygarcia@pnri.dost.gov.ph) Fe M. dela Cruz, Eliza B. Enriquez, Dante E. Margate and Emerenciana B. Duran	Philippine Nuclear Journal (Philipp Nucl. J.) 16, pp. 1-6	2011
<sup>137</sup> Cs And <sup>210</sup> Pb Distribution in Manila Bay Sediment	Efren J. Sta. Maria, Jordan F. Madrid, Ryan U. Olivares (ruolivares@pnri. dost.gov.ph), Adelina DM Bulos, Jennyvi P. Dayaon, Anie Day dC Asa, and Elvira Z. Sombrito	Philippine Nuclear Journal (Philipp Nucl. J.) 16, pp. 7-16	2011
Sedimentation Rate Estimates in Sorsogon Bay, Philippines Using <sup>210</sup> Pb Method	Jordan F. Madrid, (jfmadrid@pnri.dost.gov.ph), Efren J. Sta. Maria, Ryan U. Olivares,Ryan Joseph Aniago, Anie Day DC Asa, Jennyvi P. Dayaon, Adelina DM Bulos, and Elvira Z. Sombrito	Philippine Nuclear Journal (Philipp Nucl. J.) 16, pp. 17-26	2011
Synthesis and Characterization of Al <sup>+3</sup> R3Fe5-xAlxO12 (R=Dy and Y) Iron Garnets	Neil Raymund D. Guillermo (nrdguillermo@pnri.dost.gov.ph), Lorena A. del Castillo and Virgina S. Calix	Philippine Nuclear Journal (Philipp Nucl. J.) 16, pp. 27-35	2011
PNRI Mutant Variety: Sansevieria 'Sword Of Ibe'	Fernando B. Aurigue, (fbaurigue@pnri.dost.gov.ph)	Philippine Nuclear Journal Philipp Nucl. J. 16, pp. 36-40	2011
Factors Contributing to the Bioburden Level of PVP-Kappa Carrageenan Hydrogels	Charles Darwin T. Racadio (cdtracadio@pnri.dost.gov.ph) Charito T. Aranilla, Chitho P. Feliciano, Wendy G. Lim, Lorna S. Relleve, Veriza Rita C. Cruz and Lucille V. Abad	Philippine Nuclear Journal (Philipp Nucl. J.) 16, pp. 41-50	2011
Sensitivity of Radiation Monitoring Systems in Manila Ports in Detecting Contamination in Food Shipments	Kristine Marie D. Romallosa (kmdromallosa@pnri.dost.gov.ph) Estrella S. Caseria, Ronald E. Piquero and Jan Aldrich A. Agustin	Philippine Nuclear Journal (Philipp Nucl. J.) 16,pp. 51-57	2011
Effect of Trainings on Attitude Formations Towards Nuclear Science and Technology	Alvie J. Asuncion (ajasuncion@pnri.dost.gov.ph), Roel A. Loteriña and Percedita T. Cansino	Philippine Nuclear Journal (Philipp Nucl. J.) 16, pp. 58 - 65	2011

#### TABLE 14. LIST OF SCIENTIFIC PAPERS PRESENTED IN 2011

Abad, Lucille V., Lorna S. Relleve, Charito T. Aranilla, C.T. Arcadio, and Alumanda M. Dela Rosa. "Characterization of Radiation Modified K-Carageenan Oligomers for Bio-based Materials Development". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13 – 15 April 2011.

Aquino, Denis. "Radiotracer Applications in Industry". "Presented at the 39th Atomic Energy Week Celebration, PNRI, Diliman, Quezon City, Philippines, December 2011

Aurigue, Fernando B. "Gamma Irradiation can Increase Hoya Diversity". Paper presented at the First International Symposium of the Philippine Native Plant Conservation Society, Inc., Museum of the Filipino People (National Museum), Manila, Philippines, 19 November 2011.

Barrida, Adelaida C. "Evaluation of Stress Tolerance and Improvement of Protein by Gamma Irradiation in Mungbean (Vigna radiata )L.)". Presented at the Final Progress Review Meeting on Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology. Bangkok, Thailand, 21–25 March 2011.

Borras, Ma. Theresa. "The PNRI 99mTc Generator Production Facility". Presented at the 39th Atomic Energy Week Celebration, PNRI, Quezon City, Philippines, December 2011.

Bulos, Adelina DM. "Local Availability of <sup>99m</sup>Tc". Presented at the Philippine Society of Nuclear Medicine Convention, 3–4 February 2011.

#### Castańeda, Soledad S., Rosalina V. Almoneda, Raymond J. Sucgang, Norman Mendoza, Lourdes Fernandez and Angelito Ramos.

"Geochemical and Isotope Techniques in Assessing Trends in Groundwater Quality in Selected Coastal Urban Areas in the Philippines IAEA-CN-186-043". Presented at the International Symposium on Isotopes in Hydrology, Marine Ecosystems, and Climate Change, Monaco, 27 March – 1 April 2011.

De Guzman, Zenaida M. "Practical Approaches of Phytosanitary Treatment Using Radiation Technology in Asian Region". Presented during the International Symposium on Food Irradiation, Seoul, Republic of Korea, 19-22 May 2011.

De Guzman, Zenaida M. "Food Irradiation Status and Trends". Presented for the technical personnel of the Philippine Center for Post Harvest Development and Mechanization, Department of Agriculture, Muńoz, Nueva Ecija, Philippines, 14 July 2011.

De Guzman, Zenaida M. "Status of R & D on Food Irradiation in the Philippines". Presented for Quality Managers (25 participants) of SM Food Group, PNRI, Diliman, Quezon City, Philippines, 22 July 2011.

De Guzman, Zenaida M. "Radiation Technology: A Tool for Preventing Spread of AFB Infected Materials". Presented during the 18th Beenet Convention, Tagaytay City, Philippines, 16 August 2011.

Mendoza, Norman DS., Raymond J. Sucgang, Leonard P. Dela Cruz, Arlin A. Laguitan, Cristina A. Dequilla, Vergel G. Valenzuela, Rosalinda V. Almoneda and Soledad S. Castańeda. " Assessing Groundwater Quality Trends in Bulacan for Enhanced Freshwater Availability Using Hydrogeochemistry and Tritium-Dating". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13-15 April 11.

Obra, Glenda B., L.R. DJ. Lorenzana and S.S. Resilva. "Irradiation as a Quarantine Treatment for Mango Pulp Weevil, Sternochetus frigidus (Fabr.) in Philippine Super Mango". Paper presented during the 23rd National Research Symposium organized by Department of Agriculture-Bureau of Agricultural Research (DA-BAR) held at the RDMIC Building, Diliman, Quezon City, Philippines, 10 October 2011.

Pabroa, Preciosa Corazon B., Raymond J. Sucgang, Dan R. Laurente, Aida P. Conanan and Mitsuru Ebihara." Neutron Activation Analysis of Streambed and Marine Sediments for River and Coastal Resources Management". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13 -15 April 2011.

Pabroa, Preciosa Corazon B., Soledad S. Castañeda, Raymond J. Sucgang, Dan R. Laurente, Aida P. Conanan, M.M.F. Mater, K.J.I. Ruzgal, C.V.F. Suner, M.M. Level, K.R. Capina, B. Matira, and Mitsuru Ebihara. "Application of Nuclear Analytical Techniques for Benchmark Hydrogeochemical and Radiological Characterization of Aklan River Tributaries". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13-15 April 2011.

Pabroa, Preciosa Corazon B., Soledad S. Castañeda, Raymond J. Sucgang, Dan R. Laurente, Aida P. Conanan and Mitsuru Ebihara. "Hydrogeochemistry Application of Nuclear Analytical Techniques for Benchmark Hydrogeochemical and Radiological Characterization of Aklan River Tributaries". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13-15 April 2011.

Pabroa, Preciosa Corazon B., Raymond J. Sucgang, and Mitsuru Ebihara." Neutron Activation Analysis for Mineral and Nutrient Obtainability from Sediments by Riparian and Intertidal Vegetation". Presented at the 2nd Philippine National Biodiversity Meeting/1st National Conference on Science, Education and Technology, Virac, Catanduanes, Philippines, 19-21 October 2011.

Reyes, Rolando Y. "Thorium Exploration in the Philippines". Presented during the International Atomic Energy Agency's Technical Meeting on "World Thorium Resources held in Thiruvananthapuram, India, 16 - 21 October 2011.

Sta. Maria, Efren, R. J. Aniago, J. AD. Asa, P. Dayaon and J. F Madrid. "Estimation of Sedimentation Rate in Sorsogon Bay Using Pb-210 Dating". Presented at the 26th Philippine Chemistry at Waterfront Hotel, Lahug, Cebu City, Philippines 13 -15 April 2011.

Sucgang, Raymond J., Preciosa Corazon B. Pabroa, Dan R. Laurente, Aida P. Conanan and Mitsuru Ebihara. "Neutron Activation Analysis of Streambed and Marine Sediments for River and Coastal Resources Management". Presented at the 26th Philippine Chemistry Congress, Waterfront Hotel, Lahug, Cebu City, Philippines, 13 -15 April 2011.

Sucgang, Raymond J., Preciosa Corazon B. Pabroa, Soledas S. Castańeda, Dan R. Laurente, Aida P. Conanan and Mitsuru Ebihara. "Hydrogeochemistry and Gross Alpha-Beta Activities of Aklan Watercourses". Presented at the National Academy of Science and Technology 33rd Annual Scientific Meeting, Manila Hotel, Philippines, 13 – 14 July.

Sucgang, Raymond J., Cherry Ann San Diego, Patrice Armynne Francisco, Joshoa Antonio Navoa, Harshill Dave, Karl Cryer, Rajeev Panemanglor, Mariecar Rama. "Characterization of Water and Marine Sediments in Laguna de Bay". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13 -15 April 2011.

Sucgang, Raymond J., Soledad S. Castaneda, Preciosa Corazon B. Pabroa, Ryan P. Morco, Norman DS. Mendoza, Angel T. Bautista VII and Joseph Michael D. Racho. "Development for Origin Assignment of Volatile Organic Chemicals (VOCS) Using C-14 Liquid Scintillation Spectrometry Method". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines 13 -15 April 2011.

Venida, L.L. and R.Y Reyes, "Philippine Workplan on NPP Siting". Presented during the IAEA-ANSN Regional Workshop on Volcanic, Seismic, and Tsunami Hazard Assessment Related to Nuclear Power Plant Siting Activities and Requirements and Annual Meeting of Siting Topical Group", Jakarta, Indonesia, 13 – 17 June 2011.

Dela Cruz F., T.Y. Garcia and A. DM. Bulos." Experiences in the Operation and Maintenance of CTBTO Radionuclide Monitoring Station in the Philippines". Technical poster presented during the CTBTO Operation and Maintenance Workshop, San Diego, California, 9-13 May 2011.

Dela Cruz F., T.Y. Garcia, A. E. L. Conjares and A. DM. Bulos " Potential Applications of Using Radionuclide Monitoring Derived-Data for Scientific Research." Technical poster presented at the Science and Technology Conference, Vienna, Austria, 8–10 June 2011.

Madrid, Jordan F. " Chemical Equilibrium Calculation by Minimization of Gibbs Free Energy Using Villars-Cruise-Smith (VCS) Algorithm on Spreadsheets". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13 – 15 April 2011.

Obra, Glenda B., L.R. DJ. Lorenzana and S.S. Resilva "Irradiation as a Quarantine Treatment for Mango Pulp Weevil, Sternochetus frigidus (Fabr.) in Philippine Super Mango". Poster presented during the 23rd National Research Symposium organized by the Department of Agriculture -Bureau of Agricultural Research (DA-BAR) held at the RDMIC Building, Diliman, Q,C, on 10 October 2011. (Gold Award, Agriculture and Fisheries Modernization Act (AFMA) Best R&D Poster)

Pabroa, P. C. B., F. L. Santos, J. M. D. Racho. R.P. Morco, A.T. Bautista, and C.G.D. Bucal." Characterization of Air Particulate Lead Pollution Sources in Valenzuela". Poster presented during the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13–15 April 2011.

Pabroa, P.C.B., A.T. Bautista VII, F.L. Santos and J.M.D. Racho. "Revealing Transboundary and Local Air Pollutant Sources Affecting Metro Manila Through Receptor Modeling Studies". Presented at the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13-15 April 2011.

Pabroa, P. C. B., M. Ebihara, R. J. Sucgang and N. DS. Mendoza. "Elemental and Isotopic Characterization of Japanese and Philippine Polished Rice Samples Using Instrumental Neutron Activation Analysis and Isotopic Ratio Mass Spectrometry". Poster presented during the National Academy of Science and Technology 33rd Annual Scientific Meeting and Scientific Posters Session, Manila Hotel, Philippines, 13 – 14 July 2011.

Santos, F. L., C.P. B. Pabroa, R.P. Morco and J.M.D. Racho." Elemental Fingerprints of Inhalable Pollution on New Year's Day in Metro Manila". Presented during the 26th Philippine Chemistry Congress at Waterfront Hotel, Lahug, Cebu City, Philippines, 13–15 April 2011.

List of Abbreviations			
ANSN	Asian Nuclear Safety Network	I-WAVE	IAEA Water Availability Enhancement
ANSTO	Australian Nuclear Science and Technology Organization	JAEA	Japan Atomic Energy Agency
ASNO	Australian Safeguards and Non-Proliferation Office	JAERI	Japan Atomic Energy Research Institute
BATAN	National Nuclear Energy Agency, Indonesia	KAERI	Korea Atomic Energy Research Institute
СТВТО	Comprehensive Nuclear Test Ban Treaty Organization	KONIKOF	Korea Nuclear International Cooperation Foundation
DCI of the French	Defense Councel International of the French Embassy	LLNL	Lawrence Livermore National Laboratory
Embassy	Defense Course international of the French Embassy	MEXT	Ministry of Education, Culture and Sports, Japan
DOST	Department of Science and Technology	NSRA	Nuclear Safety Research Association
EU	European Union	ΟΑΡ	Office of Atoms for Peace, Thailand
EGU	European Geosciences Union		Regional Cooperative Agreement For Research
FNCA	Forum for Nuclear Cooperation in Asia	RCA	Development and Training Related to Nuclear Science and
IAEA	International Atomic Energy Agency		Technology for Asia and the Pacific
ІСТР	International Center for Theoretical Physics, Italy	UNDP	United Nations Development Programme
IHRDC	International Human Resources Development Corporation	US DOE	United States Department of Energy
ITD	Isotope Technologies Dresden, Germany	WINS	World Institute for Nuclear Security

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Biomedical Research Section	Engineering Services Section	: Nuclear Training Center	
Health Physics Research Section	Irradiation Services Section	Nuclear Information and	
Applied Physics Research Section	Radiation Protection Services	Documentation Section	
Chemistry Research Section	Nuclear Analytical Techniques	Business Development Section	
Nuclear Materials Research Section	Applications Section	Management Information	
	Isotope Techniques Section	System Section	

**Planning Section** 

NUCLEAR REGULATORY DIVISION ÷

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Regulations and Standards **Development Section** 

Licensing Review and Evaluation Section

Inspection and Enforcement Section

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. Radiological Impact Assessment

Section

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**Property and Procurement** Section

**Cash Section** 

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Officer-in-Charge, Nuclear Regulatory Division \* lanuary 17 – June 30, 2011 \*\* July 1 – September 6, 2011 \*\*\*September 7 – October 2, 2011 \*\*\*\*October 3 – Dec. 31, 2011

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Editors (Seated, L-R)

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