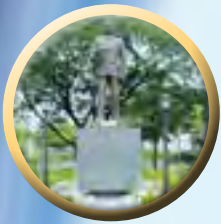




Department of Science and Technology
**PHILIPPINE NUCLEAR
RESEARCH INSTITUTE**

2012
ANNUAL REPORT

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.

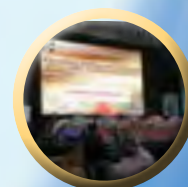
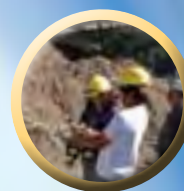


Our Mission

"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."

Table of Contents

4	<i>Message from the Secretary</i>
5	<i>Message from the Director</i>
6	<i>Generation of New Knowledge and Technologies</i>
22	<i>Provision of Quality S & T Services</i>
26	<i>Ensuring the Safety and Security of Radioactive Sources</i>
32	<i>Diffusion of Knowledge and Technologies</i>
36	<i>S & T Linking and Networking</i>
39	<i>40th Atomic Energy Week Celebration</i>
40	<i>Philippine Nuclear Science Quiz</i>
41	<i>Other PNRI-Activities</i>
42	<i>Human Resources Development</i>
44	<i>Financial Resources</i>
45	<i>Appendices</i>
61	<i>Organizational Chart</i>
62	<i>PNRI Officials</i>





Message from the Secretary

*T*he contribution of nuclear science and technology in the Philippines, particularly in the areas of agriculture, food security, health, environment and industry sectors have steadily developed in recent years, due to the unwavering efforts of the Philippine Nuclear Research Institute - Department of Science and Technology (PNRI-DOST). In fact, most of PNRI's research and development projects can be harnessed to serve a broader clientele, leading to the creation of more jobs and business opportunities that will stimulate industry and improve the economy.



As detailed in this report, PNRI has likewise gone the extra mile to expand its linkages to enhance its nuclear services and to help address the country's concerns such as agricultural productivity in the midst of climate change, vaccine development for mosquito-transmitted diseases, provision of more affordable nuclear facilities for medical purposes, conduct of water resource assessment, and strengthening nuclear security, among others.

PNRI's role in regulating nuclear-related activities deserves special mention, even in an environment where nuclear energy has yet to thrive. Its tight and high-profile linkages with international organizations likewise assure the country of PNRI's leading role in terms of nuclear safety.

PNRI's accomplishments for year 2012 clearly show that its efforts over the years continue to progress.

Congratulations to the PNRI management and staff!


Mario G. Montejo
Secretary



Message from the Director

2012 has proven to be an eventful year for PNRI.

On one hand, we have been reaping the fruits of our efforts, not only in the progress of our research and development (R & D) activities, but also in the networks of local and international partners that we have established and maintained with great consistency.

On the other hand, we have steadily sustained the progress of our R & D activities and expanded the delivery of our nuclear and allied services while remaining vigilant in regulating the safe, secure and peaceful applications of nuclear science and technology in the country.

In terms of R& D, the PNRI focused its direction to initiatives that respond to social and industrial needs, making nuclear energy more relevant to the community. Applying nuclear technology on our production systems for mutant rice and other crops will further increase their yield and improve their quality, thus helping to sustain agricultural productivity despite the ravages of climate change. Continuing research on isotope techniques and assays have also proven effective in the analysis of red tide, and our experience in the field served as an example to our fellow nations. The Technetium-99m Generator Facility, which is nearing operational status, will make this radiopharmaceutical more affordable to Filipinos. In cooperation with the International Atomic Energy Agency (IAEA) and our fellow government agencies, the PNRI continues to support the role of the Philippines as a pilot country for the IAEA Water Availability Enhancement (IWAVE) Project, which involves the application of isotopes in water resource management.

In terms of its regulatory mandate, the PNRI continues to develop and enforce regulations for the peaceful uses of radioactive materials for medical, industrial, commercial and research purposes. It ensures the safe applications of nuclear and radioactive materials, and secures these materials against the malevolent elements of society.

The expansion of the Megaports Initiative to the Cebu International Port in October 2012 is a big leap in monitoring the security of international trade in the Philippines. Radiation Portal Monitors were installed by the United States Megaports Team and the Cebu Ports Authority to detect possible illicit trafficking of nuclear and radioactive materials.

Providing nuclear and allied services to our diverse clientele remains foremost in the Institute's functions. This year, more samples were irradiated for sterilization and decontamination purposes, our clients coming mostly from the industry sector. The PNRI also launched a new personal radiation monitoring service that makes use of an optically stimulated luminescence (OSL) dosimeter. The Institute started the establishment of an electron beam facility for the development of functional materials for industrial, health and environmental applications. The facility will be operational in 2014.

The PNRI also continues to implement its information, education and communication activities, regularly conducting nuclear training courses for various sectors. This year, a Moodle-based Distance Learning Management System (LMS) was initially developed for PNRI which may be expanded for distance learning in the future.

We thank the IAEA and our partner nations and agencies for their cooperation and assistance in the implementation of many of our projects.

We thank the government and our people for not losing faith in the benefits of peaceful applications of nuclear technology and in keeping every project's moral and financial lifeblood alive.

As bountiful as this year's harvest was, we hope to further exceed it in the years to come.




ALUMANDA M. DELA ROSA, Ph.D.
Director



BASIC RESEARCH

High Technology Materials: Development and Applications

Utilization of Small Radioactive Neutron Sources

The Applied Physics Research Section (APRS) designed a program on the use of small neutron sources for training, education and research to sustain PNRI's expertise in nuclear science and technology through transfer of nuclear knowledge to younger researchers/scientists.

Available neutron sources that will be used to implement the program are americium-beryllium (Am-Be) neutron calibrator, californium-252 (Cf-252) of different strengths, and a neutron howitzer.

In 2012, the APRS accomplished the following: (1) construction of a neutron moderator assembly for neutron slowing-down experiments; (2) neutron flux measurements on the Am-Be neutron calibrator by neutron activation of the elements manganese, silicon, aluminum and gold; (3) estimation of the energy of neutrons leaking out on the top side of the Am-Be neutron calibrator by performing a slowing down experiment; and (4) construction and initial testing of a neutron shielding drum made of borated paraffin wax which will be used for transporting one or more Cf-252 sources.

GENERATION OF NEW KNOWLEDGE AND TECHNOLOGIES

Research and development projects on nuclear science and technology continue to come out with results that are geared towards helping solve environmental problems, improving materials for new applications and better performance, enhancing access to medically-beneficial radioisotopes, and providing research-based support to disaster monitoring and climate change response.



Samples are placed inside the Neutron Calibrator for neutron activation analysis

Characterization of Thorium and Uranium-bearing Rare Earth Minerals

Identification and quantification of rare earth elements thorium and uranium in mineral deposits (i.e. allanite, monazite and zircon) in beach sands and stream sediments from Palawan is an ongoing project of the Applied Physics Research Section, in collaboration with the Nuclear Materials Research Section. The project is being undertaken to search for possible thorium deposits which will be needed as nuclear fuel for future generation IV power reactors.

Elemental analyses were conducted using an americium-beryllium radioisotope excited X-ray fluorescence (XRF) set-up. The results showed that: (1) only thorium concentrations were detected in the samples; (2) on a per mineral basis, monazite contains more thorium than allanite; (3) bulk sand samples contain more allanite than monazite, hence, the total thorium contribution of allanite in each of the bulk samples is greater; and (4) zirconium was not detectable in the samples analyzed.

Radiation – Processed Materials From Carrageenan and Chitosan

Plant Growth Promoter from Irradiated Carrageenan

In collaboration with the National Institute of Microbiology and

Biotechnology (BIOTECH), University of the Philippines in Los Baños, the PNRI continued its studies on the use of radiation-modified carrageenan and chitosan to promote plant growth. Radiation-modified oligochitosan, combined with Bio-N was applied on tomato plants. Preliminary results showed an increase in weight of harvested tomatoes by 12.4 percent. On the other hand, initial results on the plant growth promoting effect of radiation-modified kappa-carrageenan on corn indicated a 12 to 28 percent increase in yield as compared to the control (without spraying of oligo-carrageenan) upon application with the recommended rate of fertilizer. The increase depended on the number of sprays of the plant growth promoter.

Health Applications

The efficiency of different irradiated hemostats were evaluated by blood clotting index. The hemostats were formulated from blends of polysaccharide derivatives and polyvinyl pyrrolidone (PVP) and irradiated at doses of 15 to 30 kGy at the PNRI Multipurpose Irradiation Facility to effect crosslinking. Results showed that swelling of



A combined formulation of carboxymethyl cellulose (CMC) and kappa-carrageenan shows high hemostatic property than that of the CMC and chitosan formulation. (bottom)

irradiated hemostats in water for eight hours prior to freeze drying increases their efficacy. Among the formulations, carboxymethyl cellulose/k-carrageenan combination showed high hemostatic property as indicated by a low blood clotting index value.

Radiation Induced Grafting of Water Hyacinth Fibers

To help impart additional functionalities to natural fibers, the Chemistry Research Section started a project on using gamma irradiation to graft polymers based from a vinyl molecule (glycidyl methacrylate) onto a mixture of the fibers derived from water hyacinth.



Grafted water hyacinth fibers



Grafted water hyacinth fibers with adsorbed copper ions

Results showed that radiation-induced grafting and subsequent chemical modification of the grafted fibers improved the ion sorption behavior of water hyacinth fibers.

NUCLEAR APPLICATIONS IN FOOD AND AGRICULTURE

Crop Improvement Through Radiation-Induced Mutation

Rice

The Agricultural Research Section takes an active part in the project "Composition or Quality Crop Breeding in Rice" under



Unirradiated plants



Early maturing lines from plants irradiated at 200 Gy

the Forum for Nuclear Cooperation in Asia. The project involves the development of rice mutants with low to intermediate amylose content, characterized as having a sticky texture, a tendency to remain soft when cooked, and glossy appearance when used for baking cakes or cookies.

This year, activities focused on planting such mutant plants in the PNRI experimental field. Using qualitative method of analysis, a total of 13 plants were selected from the 7th generation (M_7) of plants (IR-72 variety) which were previously irradiated at doses of 200 and 300 Gy by cobalt-60. Also planted in the PNRI experimental field were desirable plants selected from the fourth generation (M_4) of IR 72 seeds previously irradiated at 20 Gy by heavy ion beam at Takasaki Ion Accelerator for Advanced Radiation Application in Japan.

Results of further selection and analysis of these irradiated plants using a quantitative method of amylose content determination indicated that there are some lines with low to intermediate amylose content. Those irradiated with ion beam produced plants that flowered about a week earlier than the control or unirradiated ones. Moreover, irradiation by ion beam at doses of 20 and 40 Gy yielded plants that were shorter, early maturing (one week earlier than the control), high

yielding, and had higher tillering and longer panicle than the control.

Mungbean

PNRI's agricultural researchers continued studies on the use of mutation breeding to develop mungbean varieties with increased protein content and desirable agronomic traits such as early maturity and high yield. Two out of five high-yielding varieties previously irradiated with varying doses of gamma radiation were identified as having the abovementioned characteristics. The two varieties were VC 2917A (irradiated at 800 Gy dose) and Psj-B-11-176 (irradiated at doses of 400 and 600 Gy). Seeds obtained from the fourth generation planting (M_4) of these varieties were grown at the PNRI experimental field as fifth generation (M_5) for further selection and evaluation.

trees, 27 were irradiated at doses ranging from 5 to 40 Gy.

In-vitro germination of irradiated and control mangosteen seeds in Murashige and Skoog's (MS) nutrient medium was carried out at the PNRI tissue culture laboratory to produce sufficient sterilized plantlets for research studies.

Cashew and Mangosteen

Research studies on these crops aim to obtain varieties with higher yield, improved quality, and more desirable agronomic traits, such as short stature for ease in harvesting and all - year-round fruiting.

This year, efforts were focused on continuous growing of the first generation (M_1) plantings of cashew trees which survived vigorously from seeds irradiated at doses 100 to 400 Gy

by cobalt-60. The survival and growth characteristics of the irradiated and unirradiated (control) trees were evaluated.

In mangosteen, a total of 34 trees in the first generation (M_1) planted in the field are presently being maintained and evaluated. Of these



Ornamentals

New or improved varieties of selected ornamental crops—*Spathoglottis* orchids, foliage-type anthuriums and hoyas are being developed at PNRI's facilities through gamma irradiation.

Spathoglottis Orchids and

Anthurium. Statistical analyses of data on radiosensitivity of different *Spathoglottis* species to gamma radiation using the MS Excel Add-In file developed by A. Onofri (2007) showed significant differences between treatments of control and different dose levels of gamma radiation. The analyses also showed that the length of shoot and longest root of *Spa. kimballiana* var. *angustifolia*, *Spa. plicata*, and *Spa. tomentosa* were directly affected by increasing dose levels of gamma radiation at 10 to 50 Gy. Data on the clonal propagation of a *Spathoglottis* orchid will be provided in 2013.

Hoyas. The Patent Application No. 1-2011-000184 for "Production of Mutant Philippine Endemic *Hoya* by Gamma Irradiation of Stem Cuttings" filed by PNRI in May 2011 has been published in the Intellectual Property Office of the Philippines (IPOPHL) E-Gazette Vol. XV No. 22 in June 2012. The Patent Application relates to the procedure of producing mutant Philippine endemic *Hoya* by gamma irradiation of various stem cuttings obtained from different species, subspecies, varieties, forms and hybrids of *Hoya* that can be found only in the Philippines.

Research studies on *Hoya* showed significant differences in the number of roots and also in the length of the longest roots of *H. madulidii* nodal cuttings irradiated with different dose levels of gamma rays. Statistical analysis (Onofri, 2007) of data on radiosensitivity of *Hoya crassicaulis* and *H. multiflora* seedlings from irradiated seeds had no significant differences between treatments in terms of shoot length.



A total of 116 digital images of *Hoya* species photographed by PNRI researchers were contributed to Co's Digital Flora of the Philippines (www.philippineplants.org), a non-profit website of digital checklist of native plants of the Philippines.

As part of PNRI's commercialization/promotion of hoyas, a total of 49 species of native and introduced hoyas were sold as established plants or rooted cuttings to a private grower.

Foliage Ornamentals. Multiplication of radiation-induced mutants, namely *Murraya* 'Ibarra Santos', *Dracaena* 'Marea', *Cordyline* 'Medina', and all other registered mutant varieties was continuously done through seeds and cuttings to maintain a steady supply of mutant ornamentals for promotional purposes.

The application for registration of another mutant variety *Acalypha* 'Excitement' was submitted to the National Seed Industry Council (NSIC). This mutant was obtained by treating three-node shoot tip cuttings of *Acalypha* 'Brownie' with acute gamma radiation from a cobalt-60 source.

Putative Mutants of Other

Ornamental Plants. The experimental plants being observed, evaluated and advanced to next vegetative generation were the following: (1) two putative mutants of irradiated *Adenium obesum* that

have shown changes in leaf shape and chlorophyll mutation on leaf blade margins (*albo-marginata*); and (2) a putative mutant of *Bigney* (*Antidesma bunius*) seedling at first planting and vegetative generation (M_1V_1) that showed changes in leaf shape and form. This plant is a native ornamental tree which is very attractive especially when fruiting.



Acalypha 'Brownie' (original variety)



Acalypha 'Excitement' (mutant variety)

Pest Control

Effect of Gamma Irradiation on the Sterility of *B. longissima* (Gestro)

In collaboration with the Philippine Coconut Authority – Department of Agriculture, the PNRI worked on determining the radiation dose that will cause sterility in *B. longissima* – one of the most destructive insect pests of coconut and other palm species. The process involved the exposure or irradiation of male or female adult of *B. longissima* with varying doses of radiation at the PNRI Multipurpose Irradiation Facility.

Initial results of irradiation of adult males showed that: (1) egg hatch in adult females mated with irradiated adult males decreases as the radiation dose increases; (2) eggs laid by females, which mated with one- to two- day old adult males irradiated at 40 Gy dose, hatched into larvae but did not develop into adult; (3) at 50 Gy, about 30 percent adult mortality was observed at 14 days after irradiation.



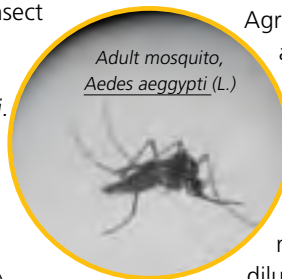
Adult coconut leaf beetle, *Brontispa longissima* (Gestro)-Actual size: 9 mm

Preliminary results of irradiation of adult females showed that: (1) each female irradiated at 40 Gy dose laid less than five eggs which did not hatch into larvae; (2) egg hatchability was observed only from adults treated at doses of 20 and 30 Gy; and (3) pupae were more radiosensitive than adults in terms of mortality.

Development of Sterile Insect Technique for Dengue Mosquito

To offer solutions to the dengue problem, the PNRI initiated the study on the use of gamma radiation to develop a sterile insect technique for the dengue mosquito vector, *Aedes aegypti*.

The following were carried out in 2012: (1) establishment of a PNRI laboratory for *Aedes aegypti*; (2) field collection of pupae and larvae of *Aedes aegypti* for the establishment of stock colony at PNRI; (3) identification of adult specimens by the Research Institute of Tropical Medicine; (4) screening of dengue virus at the University of the Philippines – Manila School of Medicine using polymerase chain reaction (PCR) analysis to ensure that the stock colony is virus-free; and (5) trial irradiation of the *Aedes* pupae to obtain baseline data for the actual irradiation studies once a stock colony has been established at PNRI.



Adult mosquito, *Aedes aegypti* (L.)

Preliminary results from the irradiation of pupae of *A. aegypti* at doses ranging from 25 to 150 Gy showed no pupal recovery starting at 100 Gy. Irradiation of pupae from a single source at 100 Gy resulted to 20 percent adult male mortality one day after irradiation (DAI) and no adult mortality even at five DAI of pupae from mixed sources.

SOIL FERTILITY MANAGEMENT

Effects of Biofertilization and Nitrogen Levels on Nitrogen Nutrition of Grain Cereals

The associative biological nitrogen fixation (BNF) of the bacteria *Azospirillum spp.* contributes to the availability of nitrogen to plants

thereby enhancing growth and increasing its yield.

The PNRI, in collaboration with Philippine Rice Research Institute (PhilRice) and Department of Agriculture-Bureau of Soils and Water Management conducted this study to assess and directly quantify the BNF potential of different available inoculants for rice and corn using the nitrogen-15 (^{15}N) isotope dilution technique as well as to establish the best management method for increasing the crop nitrogen nutrition uptake efficiency.

This year, plant tissue and soil samples were collected and analyzed for macro and micronutrients. Isotopic analysis of nitrogen nutrition is also being done in the PNRI environmental isotope laboratory.

Nuclear Analytical Techniques in Evaluating Nitrogen – and Water-Use Efficiency of Different Rice Varieties

Under the International Atomic Energy Agency (IAEA) Program “Supporting Climate-Proofing Rice Production Systems (CRIPS) based on Nuclear Application”, the PNRI in collaboration with the Philippine Rice



Application of ^{15}N isotope-labelled fertilizer for fertilizer nitrogen use efficiency

Research Institute (PhilRice) undertakes this project to (1) determine nutrient and water-use efficiency of rice under varying irrigation technologies using nitrogen-15 stable isotope technique, carbon-13 isotope discrimination and other related methods, and (3) demonstrate the best fertilizer and water management technologies for mutant variety of rice.



Experiment on corn at the PNRI screenhouse for biological nitrogen fixation



Monitoring of soil water content using automated frequency domain reflectometer

An experimental field with isotope microplots has been established at the PhilRice central experimental station to directly quantify nitrogen nutrition and losses to the environment of the crops. Ongoing activities include fertilization, plant tissue sampling and agronomic as well as agro-meteorological data gathering. Analyses of plant tissues and soil samples are being done in both PNRI and PhilRice laboratories.

Nuclear Analytical Techniques for Efficient Nutrient and Irrigation Management in Corn Production

The project is under the "Smart Farming-Based Nutrient and Water Management for Rice and Corn Program" funded by the DOST Grants – in-Aid and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development Council.

This project aims to increase nutrient uptake and reduce loss of soil nutrients and water resources, and to identify smart-farming technologies with high soil nutrient and water use efficiency through nuclear analytical technique that uses nitrogen-15 (^{15}N) isotope as tracer. The technique can directly quantify crop nitrogen uptake from different sources such as atmospheric nitrogen, soil organic matter, and fertilizer. Thus, management practices, such as when



Layout of the mainline pipes for drip irrigation set-up for water and use efficiency

and how to apply fertilizer materials, can be modified to increase the utilization efficiency of crops.

The PNRI, in collaboration with the Bureau of Soils and Water Management (BSWM) and the Central Luzon State University (CLSU), has identified nine farmer cooperators for on-farm experimental sites in Isabela and Cagayan Valley in Region 2. In these identified sites, basal application of fertilizer and initial irrigation were performed. The established ^{15}N isotope microplots were maintained and monitored regularly. Preparation for isotopic analyses of soil and plant tissue samples collected at different crop growth stages of corn are being done at PNRI. An experimental field at

CLSU-Water Resources Management Center (WRMC) research station was also set-up for the water use efficiency studies.

Isotope Techniques and Fertilization to Improve Water and Nutrient-use Efficiencies of Mungbean Mutant

The Institute undertakes this project under the IAEA program entitled "Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change". The study aims to increase uptake efficiency and reduce loss of soil nutrient and water resources in mungbean production through isotope techniques and fertilization.

This study employs the most direct method of quantifying crop nitrogen uptake with tracer techniques using nitrogen-15 (^{15}N) isotope. The method allows partitioning of the nitrogen contribution of different sources (i.e. atmospheric nitrogen, soil and fertilizer) utilized by the plant. Crop water use efficiencies and historical water availability during the entire crop cycle will be evaluated through carbon-13 isotope discrimination.

The project is being implemented at the Bulacan and Tanay stations of the Bureau of Soils and Water Management - National Soil and Water Resources Research and Development Center (BSWM-NSWRRDC). Experimental sites for fertigation have been set-up and labeling of fertigation water with ^{15}N isotope have been initiated. The standing crops are maintained and monitored regularly.

HEALTH AND MEDICINE

Use of Gamma Radiation for Shelf-life Extension of Brown Rice

This project aims to investigate the efficacy of irradiation technology on the physico-chemical, nutritional and sensory qualities of brown rice and to determine the shelf-life extension of irradiated brown rice during storage at ambient condition.

The irradiation of brown rice in polyethylene pouches at doses of 0, 1, 3 and 5 kGy gamma radiation had the following initial effects on the quality and cooking time of the rice: (1) rice irradiated up to a dose of 3 kGy have comparable firmness with non-irradiated rice; (2) at a dose of 5 kGy, there was noticeable softness of grains; (3) the irradiated brown



Brown rice (RC 162) in polyethylene pouches which were irradiated at 0, 1, 3 and 5 kGy

rice became non sticky (the control has a sticky texture); (4) the control and irradiated lots, up to a dose of 3 kGy, retained their whitish brown color while those irradiated at 5 kGy became darker in color; and (5) the irradiated rice at 1:2 ratio cooked faster than the non-irradiated rice. Irradiation doses of 1 and 3 kGy maintained the cooking quality of brown rice.

Development of Radiation-Processed Honey-Wound Dressing

The institute has filed a patent for the PNRI-developed radiation – sterilized wound dressing at the Intellectual Property Office under Patent Application Number 1-2012-000219. The wound dressing consists of alginate fiber sheet with organic honey obtained from the University of the Philippines in Los Baños (UPLB) as main ingredient. Honey was used in the study because of its antimicrobial property and some bioactive compounds.

Based on physico-mechanical tests done by PNRI, the radiation-sterilized wound dressing has: (1) acidic pH which is significant for wound healing; (2) low moisture content

which allows for a higher shelf-life; and (3) rapid absorption rate property and permeability to water vapor.

From the inhibition zone test carried out for *Staphylococcus aureus*, it was found that the honey from UPLB is comparable with other commercial honey in terms of antimicrobial property. It has also shown negative microbial growth at zero and three months shelf-life based on initial sterility test conducted by PNRI.



In cooperation with the Veterinary Medicine Institute - Dela Salle Araneta University, initial tests conducted on rabbits showed the efficacy of sterilized dressing versus the use of antibiotics in the healing process of exudating wounds in rabbits.

Consumer Taste Test of Irradiated Chicken Adobo for Immuno-compromised Patients

Food irradiation has been proven effective in providing safe and quality food by killing the pathogenic microorganisms that cause spoilage without significantly altering the physico-chemical, sensory and nutritional qualities of the irradiated food. PNRI uses this technology to develop safe, shelf-stable and ready to eat food for immunocompromised patients and for victims of calamities such as typhoons and earthquakes.

In 2012, researchers investigated the effect of irradiation at various doses (2, 4, and 6 kGy) on vacuum-packed chicken adobo. The microbial safety and sensory quality of heated food

Consumer taste test of irradiated chicken adobo



Technology Transfer of PVP Carageenan Hydrogels for Burn/Wound Dressing and Bed Sores

In 2011, PNRI researchers completed the conduct of stability testing, market acceptability study and technology transfer of the radiation processed polyvinyl pyrrolidone (PVP) carageenan hydrogel dressing (for burns, wounds and bedsores) to Biotecos Company, Inc – a private cooperating agency which expressed interest in the commercialization of the hydrogel dressing.

This year, the following were undertaken: (1) formulation of the draft Licensing Agreement between PNRI and Biotecos for the commercialization of PVP carageenan hydrogels for approval of both parties; (2) finalization of the process flow of production of the hydrogels at Lloyds Laboratories – a toll manufacturing plant; (3) extension of PNRI assistance to Lloyds

Laboratories in determining actual cost of hydrogel production for the purpose of finding out the manufacturing fees for Biotecos; (5) holding of meetings between Biotecos and Lloyds for product registration application at the Bureau of Food and Drugs; and (6) finalization of the technology manual containing information relevant to the Licensed Product as well as other relevant data that may be required to enable the proposed licensee to correctly manufacture, test/analyze, and adequately sell the licensed product.

products were evaluated. Results indicated that irradiation at 4 kGy is effective enough to reduce the microbial load in chicken adobo to an acceptable level of less than 500 colony forming unit (cfu)/g while retaining its sensory characteristics (taste, texture, juiciness, odor, flavor and overall acceptability) up to 10 days of storage.



Sterility test of hydrogel after irradiation



Preparation and Quality Control of ^{99m}Tc and ^{99m}Tc Radiopharmaceuticals for Nuclear Medicine Applications

Technetium -99m (^{99m}Tc) is a medical radioisotope currently imported to the Philippines in the form of Molybdenum-99/Tc-99m (^{99}Mo - ^{99m}Tc) generators. This radioisotope makes up for about 80 percent of nuclear medical procedures in the country like the diagnosis of metabolic disorders as well as imaging and scanning of various internal organs such as the brain, lungs, kidneys, liver, thyroid and bone.

In 2011, the PNRI developed the capability to locally prepare and produce ^{99m}Tc with the setting up of the ^{99}Mo - ^{99m}Tc generator production facility at the Institute.



The Technetium-99m (^{99m}Tc) hot cell facility inside the Radioisotope Laboratory building

This year, PNRI is securing all necessary permits and/or licenses for the product and the operation of the production facility.

When fully operational, the ^{99m}Tc generator plant will be able to supply the local ^{99m}Tc requirements of around 35 hospitals with nuclear medicine centers at lower costs than that of imported radiopharmaceuticals, and may be extended at a subsidized cost to government hospitals, especially for charity patients.

ENVIRONMENTAL PROTECTION AND MANAGEMENT

Nuclear Analytical Techniques in Harmful Algal Bloom Studies

Field Detection System For Saxitoxin

With funding support from the DOST and the International Atomic Energy Agency (IAEA), the PNRI further developed a nuclear analytical tool using the laboratory-based Receptor Binding Assay (RBA) for on-site detection of paralytic shellfish toxins during harmful algal bloom (HAB) or "red tide" events. The technology will eventually complement existing techniques for monitoring shellfish to prevent cases of paralytic shellfish poisoning (PSP).

The Chemistry Research Section has successfully produced a radioligand using a conotoxin analog and a radioactive isotope of iodine-125 (^{125}I) for use in a gamma-based RBA. Radiochemical and competition binding studies of this radioligand shows positive results comparable to that of the standard radioligand (tritiated saxitoxin). RBA will be pursued next for its optimized application in PSP monitoring.



Production and characterization of Iodine-125 (^{125}I) – labeled ligand for Receptor Binding Assay application

Nuclear and Isotope Techniques Applications in Water Resources Management

IAEA Water Availability Enhancement (I-WAVE) Project

The Philippines undertakes activities to develop plans for sustainable and socially responsible water resources management as a commitment for being one of the pilot countries for the Water Availability Enhancement (I-WAVE) Project of the International Atomic Energy Agency (IAEA). This is being carried out through a collaborative work among the National Water Resources Board (NWRB), Mines and Geosciences Bureau (MGB), the Water Districts of Regions 2 and 10, and the PNRI.

In 2012, the PNRI hosted a four-day National Workshop on Hydrogeological Data, Data Compilation and Management and Aquifer Characterization in the Philippines in support of the MGB project on Groundwater Resources and Vulnerability Assessment of the Philippines. The workshop was conducted by international experts from the IAEA, United States Geological Survey, and the International Institute for Hydraulic and Environmental Engineering (IHE)-UNESCO and participated in by 45 local representatives from

government agencies and the academe.

As a result of this workshop, action plans were drawn up on the implementation of the activities that would help address hydrological gaps and produce the groundwater availability map and groundwater vulnerability maps of the country.

Philippine Hydrological Gap Plan

As a result of the National Workshop on "Development of Philippine Hydrological Gap Plan" conducted in 2011, a report entitled: "Investment Needs for Resource Assessment Capability in the Philippines to Improve the Planning and Management of Water Infrastructure" was developed in August 2012 and published in September 2012. The report identified the gaps in knowledge and data and recommended specific actions to address said gaps. Remedies and investments were also proposed, including the



specific capabilities that must be strengthened, and the expertise, technology and infrastructure support required.

This year, the PNRI was awarded with an IAEA Technical Contract entitled "Application of Isotope Hydrology Techniques by the PNRI in Water Resources in Regions 2 and 10".



Field investigations in water resources in Regions 2 and 10

As part of this contract, the PNRI-NWRB-MGB team conducted field investigations in Region 2 (Cagayan, Isabela, Nueva Viscaya, and Quirino) and in Region 10. Through awareness seminars and training on the application of isotope techniques in water resources assessment, the Institute successfully engaged the Water Districts, the regional offices of DOST, DENR-MGB, DPWH, NIA and the various local government units in data collection activities.

The study areas are within the Cagayan River basin in Region 2 and the Cagayan de Oro River basin in Region 10. In Region 2, a total of 45 sampling sites were covered while three rain sampling reservoirs were designed for use by the Cagayan Water District to set-up precipitation collection stations for isotopes. Field investigations in 69 sampling sites were conducted in Region 10 covering the provinces of Bukidnon, Misamis Oriental, Agusan Del Sur and Agusan Del Norte. Collection of stable isotope data for hydrogen and oxygen in water

using the PNRI Isotope Ratio Mass Spectrometry facility is underway.

Radiotracers and Stable Isotopes for the Assessment of Nutrient Loading from Various Sources into the Manila Bay

In collaboration with PNRI, the Department of Agriculture – Bureau of Soils and Water Management (DA-BSWM) conceptualized a project in line with the Supreme Court (SC) Decision G. R. Nos. 171947-48 ordering the Department of Environment and Natural Resources (DENR) to clean up, rehabilitate, restore and maintain the waters of Manila Bay to “SB level I” or Class B sea water as defined in Water Classification Tables under DENR Administrative Order No. 34, so that its bathing waters will be “fit for

swimming, skin-diving, and other forms of contact recreation”. The project involves the use of stable isotope technique to identify and trace sources of nutrients in Manila Bay and to quantify nutrients loaded from different sources into the bay.

In October 2012, a Memorandum of Agreement (MOA) was signed among DENR, DENR-Manila Bay Coordinating Office, DA-BSWM and DOST-PNRI wherein PNRI shall provide the necessary technical expertise in the conduct of the studies. In relation to this agreement, PNRI made a presentation on the collection and preparation of environmental samples (biota, sediments and particulate organic matter from water) for analyses of stable isotopes of carbon and nitrogen to DENR, DA-BSWM, National Irrigation Administration, and other project collaborators.



Engagement of the Water Districts, local government units, Regional offices of MGB, NIA, DPWH, DOH, DOST in the data collection for groundwater resources assessment

Likewise, PNRI conducted a three-day hands-on training on similar operations/activities in the Pampanga River Basin in May 2012. The Institute also continued to facilitate the preparation/processing of environmental samples prior to carbon and nitrogen stable isotope analyses at GNS Science – New Zealand's leading provider of earth, geoscience and isotope research and consultancy service.

Isotope and Geochemical Techniques to Uncover Sources of Organic Nutrient Contamination in the Neritic Zone of Boracay Island

This is a new project funded by DOST Grants-in-Aid where nuclear analytical and isotopic techniques are used to study the health status of Boracay island's waters, corals, and white sand and to trace the origin of nutrient contamination responsible for the algal bloom in the neritic zone. Results of this investigation will be useful in the reformulation of the comprehensive land use plan, siting and zoning policies, and development plans of the local government units for Boracay Island.

In May 2012, PNRI representatives successfully conducted reconnaissance work and consultation with the Aklan

Governor to solicit local support for the sampling trips and other related activities. As a result of this, field data measurements and collection of pre-and-post monsoon samples of seawater, biota, sediment, sewage, surface water and groundwater were completed in 12 sites in Boracay and nearby islands.

Results showed that the seawater samples in two sites were contaminated with *E. coli/coliform* bacteria. In specific sediment and coral samples, the elements identified were mostly associated with the soil matrix in the area, but with significant concentrations of copper and nickel. These elements represent several processes which are recognizable in the neritic area. Samples consisting of white sand/sediment, terrestrial soil, volcanic ash, coral, and algae revealed elemental as well as isotope (carbon, hydrogen, oxygen, nitrogen) composition, which were distinctive/ divergent from each other. The compositions of white sand and coralline were, however, found to be agreeing which indicated that white sand is the degraded product of corals. In seawater, significant nitrate and nutrient concentrations were measured in some sites of the island. Tracing the path of septic water discharges into seawater was also conducted. The presence

of carbon, nitrogen, and oxygen isotopes in the samples reveal that some algae get nutrients from septic discharges, while some are nourished by inorganic nitrate sources.

Historical Sedimentation Rate and Radiometric Fingerprinting of Suspended-Sediment in Selected HAB Areas

Sediments often serve as sinks of nutrients and other contaminants that regularly recharge overlying waters and, together with other favorable environmental conditions, could favor growth of particular algal species which may lead to harmful algal blooms (HABs) or red tide.

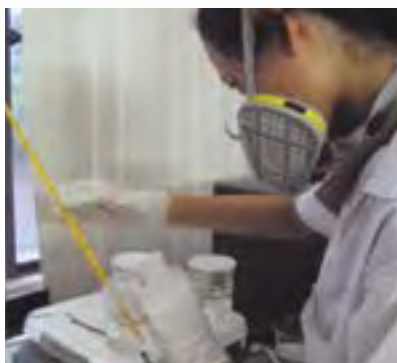
In Sorsogon Bay, the PNRI uses the lead-210 (^{210}Pb) dating technique to gain an insight on the sedimentation processes occurring in the Bay and to establish the historical profile of nutrients and other contaminants which can contribute to increased occurrence of HABs.

The results of the study demonstrated the potential of the ^{210}Pb dating technique for the establishment of sedimentation/deposition rates at selected areas in Sorsogon Bay. Analyses of the ^{210}Pb data successfully identified enhanced sedimentation rates in areas adjacent to a population center (Sorsogon City), in an area near an open dump site (offshore the municipalities of Buenavista and Rizal) and nearby Cadacan River which carries volcanic matter and debris from Mount Bulusan.

Based on statistical tests, titanium, calcium, total carbon and delta carbon-13 ($\delta\text{C}13$) are the fingerprint properties that will differentiate most source types of sediments in Sampaloc River in Sorsogon City. Results of a mathematical mixing model showed that channel banks are the largest sediment load contributors in Sampaloc River, followed by cultivated



Sample collection in Boracay and nearby islands



Processing of sediment samples for lead-210 analyses

areas and woodlands. These suggest that sediment control strategies in Sampaloc River should focus more in channel bank areas.

Air Pollution Source Apportionment by Nuclear and Related Analytical Techniques

Air Pollution Studies in Metro Manila

PNRI continues to use nuclear analytical techniques to obtain data on the major sources of air pollution and to estimate the relative contribution of these sources to air pollution in Metro Manila.

Air Monitoring Stations. As in previous years, PNRI collected air particulate samples at its established monitoring stations/sampling sites in Ateneo de Manila University (ADMU) in Quezon City (in collaboration with the Australian Nuclear Science and Technology Organization (ANSTO), Poveda Learning Center in Pasig City, and in Valenzuela City. The Institute also collected air particulate samples at another site at the Notre Dame de Vie in Angat, Bulacan which was established in 2011 primarily to assess the site for air pollution impact from tire pyrolysis facilities in the area. The collected samples were analyzed for particulate mass by gravimetry and black carbon by reflectometry. Samples from ADMU have been analyzed for elemental levels by

photon-induced x-ray emission at ANSTO. The sampling sites in Valenzuela City and in Angat were also maintained for the collection of air particulates on quartz filters for the determination of organic carbon/elemental carbon by thermal-optical reflectance.

Organic Carbon/Elemental Carbon

Data. Results on the determination of organic carbon/elemental carbon (OC/EC) show a ratio of about 1.33 at the Valenzuela City site and about 1.78 at the Angat site. The low OC/EC ratio (closer 1) in Valenzuela supports the claim that combustion sources dominate the site and also suggests minimal secondary organic aerosol formation.

Black Carbon Levels. The results on black carbon levels from the PNRI data have been highlighted in a poster paper entitled "PM_{2.5} black carbon profile in Metro Manila (Philippines)" which won the Best Scientific Poster for Climate Science Session during the National Academy of Science and Technology (NAST) First National Conference on Research in Climate Change and Variability, held at Traders Hotel, Pasay City on 27 September 2012. Data gathered showed that the annual percentage of black carbon levels at the ADMU sampling site for the period 2001 to 2011 range from 33 to 59 percent with individual points reaching up to more than 80 percent of the PM_{2.5} levels. A large reduction in the percentage of black carbon is seen after 2007 and further reduction is observed until 2010.

PM_{2.5} black carbon soot is an indicator of combustion-related air pollution. Its health effects have been associated with cardiopulmonary morbidity and mortality (Janssen et al 2012). Recent studies have identified black carbon as a short-lived climate forcer; its reduction has been considered as a short term solution to climate change while waiting for mitigation measures for greenhouse gases to take effect.

Addressing problems regarding traffic-related activities can greatly reduce pollution problems with fine particulates, including black carbon, resulting to a healthier air quality and contributing to the mitigation of climate change.

Setting up of the Philippine

Guideline Value for PM_{2.5}. The PNRI actively participated in the Inter-agency Technical Committee (IATC) of the Environmental Management Bureau of the Department of Environment and Natural Resources (EMB-DENR), in drafting the Department Administrative Order for setting-up the Philippine Guideline value for PM_{2.5} which are referred to as "fine particles" and are believed to pose the greatest health risks. The guideline values set by the World Health Organization were adopted starting with the interim guideline values of 35 $\mu\text{g m}^{-3}$ for the long term and 75 $\mu\text{g m}^{-3}$ for the short term.

The IATC is composed of EMB-DENR, Department of Health, Department of Transportation and Communication, Department of Energy, Department of Trade and Industry, DOST-PNRI, DOST-PCIEERD, Clean Air Initiative for Asian Cities, and the Presidential Management Staff. The PNRI also participated in drafting an Administrative Order in response to the tire pyrolysis-related environmental and health problems being experienced by the Notre Dame de Vie community in Encanto, Angat in Bulacan Province.

Elemental Characterization in Rice Using Nuclear Analytical Techniques

Under the Forum for Nuclear Cooperation in Asia, PNRI undertakes a project on determining toxic and trace element in rice samples using nuclear and other related analytical techniques.

Rice samples, both polished and unpolished, were taken from Nueva Ecija, Bulacan and Aklan to better understand isotopic signatures and distinguish inter-varietal and/or geographical differences. Likewise, soil samples of rice sample sources were collected to study the uptake mechanisms.

Rice samples from Luzon showed a delta carbon-13 ($\delta^{13}\text{C}$) signature distinct from the rice samples in Visayas. Initial data indicate that polished rice would be more useful in provenance studies.

Radiological Assessment of the Impact of the Fukushima Nuclear Accident on Philippine Marine Environment

The project covered the collection of seawater, sediment and biota samples in selected coastal areas (Manila Bay; Subic Bay, Zambales; and Lingayen Gulf) and in West Philippine Sea (Bangar, La Union; Vigan, Ilocos Sur, and Stewart Bank). The sampling in the West Philippine Sea was conducted by PNRI's Health Physics Research Section in collaboration with the National Fisheries University (NFU) of Japan in November 2012 on board the *Koyo Maru* marine scientific research vessel. This activity was undertaken with the cooperation of the Department of Foreign Affairs (DFA) Technical Working Group on Marine Scientific Research and the DFA's Ocean Concerns Office. Researchers from NFU, Southeast Asian Fisheries Development Center, Bureau of Fisheries and Aquatic Resources, and PNRI collected oceanographic data and marine samples during the cruise.

From the selected sampling sites, a total of 19 marine samples

were collected and analyzed for key anthropogenic radionuclides cesium-134 (^{134}Cs) and cesium-137 (^{137}Cs). Cs-134 activity concentration was not detected in any marine samples analyzed. For Cs-137, the average activity concentration detected in seawater samples was 0.81 ± 0.06 and 0.92 ± 0.39 becquerel per kilogram (Bq/kg) in sediment samples. These values are below the level observed in the Asia-Pacific Marine Radioactivity Database which is 4.34 Bq/m^3 and $<0.95\text{--}25.40 \text{ Bq/kg}$, respectively. The water samples collected from the *Koyo Maru* cruise is currently being analyzed.

In connection with the conduct of a full assessment of the levels and effects of radiation exposure due to the nuclear incident after the 2011 Great East Japan earthquake and tsunami, PNRI submitted post Fukushima incident marine radioactivity data on Philippine seawater, sediment and biota to the United Nations Scientific Committee

on the Effects of Atomic Radiation (UNSCEAR).

Enhancing Cytogenetic Biological Dosimetry Capabilities of the Philippines for Nuclear Incidence Preparedness

This project aims to update the technical knowledge and laboratory competence of the biodosimetry team of the Biomedical Research Section on the latest techniques in biological dosimetry to improve its capability in the assessment of absorbed dose of individuals suspected of having accidental gamma radiation exposure or occupational overexposures. This includes conducting in-vitro gamma irradiation of blood samples from normal and healthy donors and then establishing the dose-response curves of blood lymphocytes for each of the techniques. The various established curves can be used in the future in the evaluation of an exposed individual's absorbed dose.



Koyo Maru Marine Scientific Research (MSR) cruise conducted by a team from the National Fisheries University of Japan and researchers from PNRI and the Bureau of Fisheries and Aquatic Resources.

This year, seven healthy individuals aged 25 to 35 years old, without any prior medical/occupational exposure to ionizing radiation in the last six months, were screened and recruited as consenting blood donors. After blood extraction, blood samples were irradiated using the PNRI Gammacell 220 with the following doses: 0.25, 0.5, 0.75, 1, 2, 4 and 6 Gy. Culture, harvesting and slide analysis were based in the IAEA Manual 405.

Partial results show a linear relationship between the dose imparted to the blood sample and the chromosome aberrations (dicentric and rings) observed among the metaphase cells. The frequency of aberrations in metaphase cells increases as the radiation dose increases. However, complete analysis of more cells is needed in order to arrive at a linear-quadratic response, which is the established dose response of lymphocytes to gamma radiation based on International Atomic Energy Agency references.

Environmental Radioactivity Monitoring in PNRI Grounds and Vicinities

As part of PNRI's environmental monitoring program, the Health Physics Research Section (HPRS) conducts measurement of ambient gamma radiation and analysis of radioactivity of environmental samples collected in PNRI grounds and its vicinities.

In January 2012, ambient gamma dose rate survey was conducted from Quezon City to Pagbilao, Quezon aboard a vehicle using a portable sodium iodide gamma-meter of the National Institute of Radiological Sciences – Japan (NIRS). This is part of the collaborative project between the HPRS and NIRS entitled "Commission Work for Investigation of Occupational Exposure Due to Naturally-Occurring Radioactive



SAM 940 portable isotope identifier used for ambient gamma radiation measurements

Material (NORM) Used as Industrial Raw Materials in the Philippines".

Several environmental samples were also collected during the past year. Soil samples were collected inside the PNRI compound for radiometric analysis while samples of soil and vegetation were collected in Subic, Zambales, together with ambient gamma dose rates.

Results of the ambient gamma radiation measurements conducted in 13 sites in Subic using a digital survey meter (Kugelfische) showed dose rate levels ranging from 100 to 150 nanosievert per hour (nSv/hr), with an average of 130 ± 20 nSv/hr. Measurements of gamma dose rates inside PNRI using the newly acquired

portable gamma meter SAM940 (Berkeley Nucleonics) showed dose rate levels ranging from 43.9 to 52.8 nSv/hr with an average of 49.0 ± 3.7 nSv/hr. These are within normal values and do not pose hazard to the general public.

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

The Health Physics Research Section has been tasked to continuously manage the daily operation (24/7) and maintenance of the RN52 radionuclide monitoring station in Tanay, Rizal and the National Data Center (NDC-PH) at PNRI and to transmit data to the International Data Center in Vienna, Austria. The RN52 and NDC-PH are



Radiation measurements at coal pit in Pagbilao Coal-fired Power Plant, Pagbilao, Quezon

part of the International Monitoring System (IMS) of the Vienna - based Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) for global monitoring of radiation released in the environment from nuclear testing and accidents.

For 2012, the following information were transmitted to IMS headquarters in Vienna, Austria: (1) spectral data and all communications between the



Mr. Guillaume Beziat, CTBTO Engineering Development staff installs the Canberra Cryo-cycle Hybrid Cryostat for the HPGe detector at RN52 Station in Tanay, Rizal.

RN52 station and the CTBTO via the global communication infrastructure (GCI) network; (2) filter samples collected at the station for archival; and (3) monthly reports as specified in the Contract for Post-Certification Activities for the CTBTO RN52 Radionuclide Station.

PNRI hosted a 10-day technical visit of two experts from the IMS-CTBTO who came to the Philippines to perform the following activities: (1) install the Canberra® Cryo-Cycle™ Hybrid Cryostat for the 7500SL High Purity Germanium (HPGe) detector; (2) review the status of the RN52's lightning and surge protection systems and other infrastructure repairs; (3) install a new back-up converter for the VSAT antenna to improve GCI performance

at the RN52 station and the NDC-PH. PNRI also hosted the one-day visit of experts from CTBTO National Data Center where experiences of PNRI on the use of CTBTO RN52 data during the Fukushima nuclear crises were discussed.

Radiological Assessment of NORM and TENORM in the Philippine Environment

The general objective of this project is to collect naturally-occurring radioactive materials (NORM) and technologically-enhanced NORMs (TENORM) used as industrial materials and to analyze these materials for radioactivity concentrations of potassium-40 (^{40}K), thorium-232 (^{232}Th) and uranium-238 (^{238}U) progenies.

The Health Physics Research Section (HPRS) conducted a sampling trip at Pagbilao coal power plant in Pagbilao, Quezon as part of the collaborative work with the National Institute of Radiological Sciences (NIRS)-Japan on NORM analysis, Ambient gamma radiation measurements in 22 sites around the vicinity of the plant showed absorbed dose rates ranging from 17.0 to 87.0 nanosievert per hour (nSv/hr). Five soil samples and five NORM/TENORM samples, namely raw coal, milled coal, fly ash, bottom ash and mixed ash were taken and analyzed for natural radioactivity using a gamma spectrometer with HPGe detector. Results show that activity concentrations for the following naturally-occurring radionuclides are: ^{40}K : 28.2 to 364.0 becquerel per kilogram (Bq/kg); ^{226}Ra : 1.6 to 39.7 Bq/kg; and ^{232}Th : 8.4 to 56.6 Bq/kg. External exposures to these radiation levels do not pose harm to the public.

HPRS also conducted sampling at Northern Cement Corporation in Sison, Pangasinan. Ambient gamma radiation measurements were performed around the vicinity of the

plant site in seven locations. Dose rates vary from 25.0 - 43.0 nSv/hr. Six NORM/TENORM samples, namely raw coal, shale, gypsum, limestone, silica and cement, were taken and analyzed for natural radioactivity. Results show that activity concentrations for the following naturally-occurring radionuclides were: ^{40}K : 17.8 to 256.7 Bq/kg, ^{226}Ra : 1.0 to 38.0 Bq/kg, ^{232}Th : <2.0 to 5.4 Bq/kg. External exposures to these radiation levels do not pose harm to the public.



Collection of NORM/TENORM samples and measurement of ambient gamma radiation at Northern Cement Corporation, Sison, Pangasinan

INDUSTRY AND ENERGY

Extraction of Uranium and Other Valuable Materials from Phosphoric Acid

Through the International Atomic Energy Agency (AEA) Interregional Project on "Supporting Uranium Exploration, Resource Augmentation and Production Using Advanced Techniques", the PNRI hopes to enhance its capacity in uranium exploration, resource evaluation, mining and processing of uranium ores, and extraction of uranium



In-situ gamma measurement of phosphate rock storage area in Philphos, Isabel, Leyte with the use of a portable gamma spectrometer

and other valuable resources from phosphate rock/phosphoric acid using well-established techniques. The Institute also aims to eliminate potential risk from the build-up of the radioactive elements uranium and possibly thorium in the soil due to continuous application of phosphate fertilizers.

Initial activities under the project included a plant visit by the Nuclear Materials Research Section staff to Philippine Phosphate Fertilizer Corporation (PHILPHOS) in Isabel, Leyte to undertake a feasibility study of extracting uranium, rare earth, and other valuable elements from phosphates and phosphoric acid. The NMRS also performed preliminary characterization and analyses of different types of samples obtained from PHILPHOS for trace metals and uranium concentration by Fluorimetry, X-ray Fluorescence, Gamma Ray Spectrometry, and Atomic Absorption Spectrometry.

The results of the analyses of phosphate rocks yielded the following range of values: Phosphate raw ore (58.7 – 68.7 ppm); uranium (62.9 – 68.3 ppm); and other sources of phosphate ore sent by PHILPHOS (57.9 – 93.9 ppm).

Characterization of the Natural Radioelement Signatures of Porphyry Copper-Gold Deposits

This project seeks to establish the possibility of whether a relationship exists between the natural radioelements (potassium, uranium, thorium and their ratios) vis-à-vis copper within known porphyry copper-gold deposits in the country. A total of 167 soil samples previously taken from the Dipidio, Kasibu, Nueva Vizcaya were analyzed for silver, copper, lead, zinc, cobalt, manganese, nickel, cadmium and iron for a total of 1,351 measurements. The analysis of samples is still ongoing.

Recovery of REE and Nuclear Materials from Allanite and Monazite

Several trials were conducted to potentially maximize the extraction of the rare earth elements (REE) from the allanite and monazite beach sand minerals in northern Palawan. So far, solvent extraction using tributyl phosphate (TBP) had separated radioactive minerals uranium and thorium from rare earth elements (REE). REE obtained by using ammonium hydroxide as precipitant was 7.46 percent. By using oxalic acid as precipitant, the REE obtained

was 22.60 percent. Several trials will be undertaken to separate the other REE individually.

Radon Monitoring of the Valley Fault System and Its Implication as an Earthquake Precursor

In line with the seismic monitoring program of the Philippine Institute of Volcanology and Seismology (PHIVOLCS) in seismically active areas, the PNRI continued to monitor the levels of radon in the northern segment of the Philippine Fault (Central Luzon Section) and the Valley Fault System which transect a major portion of Metro Manila. Radon is a naturally-occurring radioactive gas that could be used as indicator of possible seismic activity.



Durridge RAD7 radon detector

Using two approaches (the in-situ radon monitoring system and alpha track detector system), PNRI conducted monthly measurements of radon emanations, potassium, uranium and thorium, including dose rates along the 28 established stations (comprising of 14 stations on the west and four on the east, including the 10 traverse stations in the east valley fault systems). Radon measurements in soil were performed using Durridge RAD7 radon monitor, while gamma-ray spectrometric survey was done using RS-230 spectrometer. Measurements obtained during the whole year showed no major deviations from previous readings which may suggest none to very low seismic activities within the Valley Fault System.



RS-230 spectrometer used for gamma-ray spectrometer survey



GAMMA IRRADIATION SERVICES

Clients from the research and development organization (RDO), industrial sectors and academe submitted various product samples for gamma irradiation. Using the Gammacell 220 irradiator for small volumes and the Multipurpose Gamma Irradiation Facility (MIF) for bulk irradiation, the samples were exposed to a predetermined dose of gamma radiation from a cobalt-60 source for either microbial load reduction or for research purposes.

Gammacell 220

For 2012, a total of 589 samples from 15 clients (6 from RDO and 9 from academe) were irradiated using the Gammacell 220 for research purposes. The samples consisted of: (1) seeds of calamansi, adlai, cashew, rice, onion, mungbean; (2) banana shoot tips and cultures of banana, mangosteen, rice, orchids; (3) ornamental and aquarium plants; (4) fruits like mangoes, oranges/ponkan; (5) chicken eggs and sago beads; (6) carrageenan and chitosan; (7) coconut leaf beetle and dengue mosquito pupae; and (8) human blood.

Multipurpose Irradiation Facility

A total of 49,316 samples from 54 clients (45 from industry, 7 from academe and 2 from RDO) were irradiated at the MIF – a 16 percent increase from the previous year. Products irradiated for sterilization and microbial load reduction consisted of

PROVISION OF QUALITY S&T SERVICES

Service remains a key component of the Institute's myriad activities. In seeking to maintain responsiveness and relevance to the Filipino, PNRI strives to ensure that its services – such as products and materials irradiation, radiation protection and monitoring, and nuclear analytical and measurement services– are of the highest quality and reliability.

RADIATION PROTECTION SERVICES

The Institute renders the following services to licensed users of radioactive materials and nuclear instruments, to workers who are occupationally exposed to radiation, and to the public upon request. These services are being carried out to prevent unnecessary exposure to ionizing radiation and to ensure that radiation doses received by these personnel are controlled within the safe limits.

- Issuance of personal dosimeters to 14,448 workers who are occupationally exposed to radiation to monitor and assess their external radiation exposures. These dosimeters consisted of film badges, thermoluminescent dosimeters (TLDs) and optically stimulated luminescence (OSL) dosimeters
- Calibration and standardization of radiation/nuclear instruments and equipment used in various institutions/hospitals to ensure accurate and reliable measurements
- Radiation control services such as area/air monitoring and leak testing

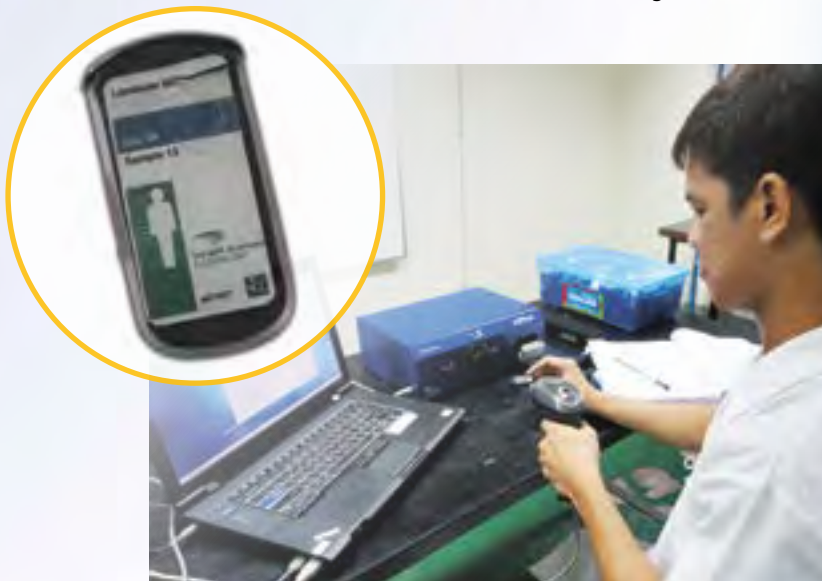
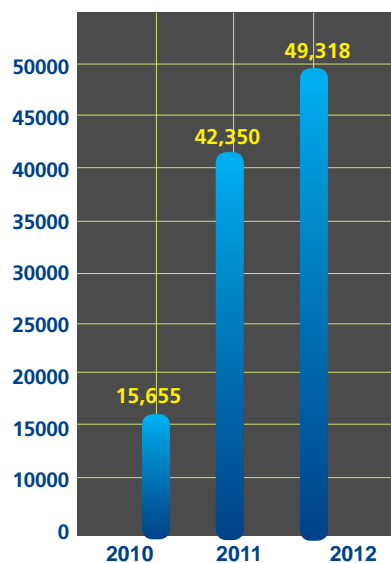


Dr. Lucille Abad (left) Chemistry Research Section head briefs Dr. Rainier B. Villanueva, (2nd from left) President of Chamber of Herbal Industries of the Philippines Inc., during his visit at the Multipurpose Irradiation Facility.

(1) spices, herbal products, dehydrated vegetables, food seasonings; (2) cosmetics/cosmetic raw materials and accessories; (3) packaging materials, (4) dye powder; (5) frozen bone graft; and (6) empty aluminum tubes. The samples irradiated for research and development purposes consisted of (1) hydrogel, polyvinyl chitosan gel, injectable hydrogel, carrageenan

powder; (2) honey alginate dressing; (3) ground meat, pork and chicken adobo; (4) biofertilizer carrier; (5) water hyacinth fiber; (6) brown rice; and (7) other samples such as plastic bags, Ag-PAA nanocomposites, polyglycerol, co-lactic acid, algal culture, lactose powder, mushroom, onion bulbs, frozen fruits and bacteria.

Total Number of Samples Irradiated at the Multipurpose Irradiation Facility 2010 to 2012



A newly launched personal monitoring service that makes use of an optically stimulated luminescence (OSL) dosimeter (inset) is one of the personal monitoring services extended by PNRI.



Dismantling of nuclear gauges containing spent/disused sealed radioactive sources

of sealed radioactive sources to make sure that work areas and operation conditions of radiation-emitting devices in authorized facilities are in accordance with national radiation safety standards

- Radioactive waste management which covers the collection and proper/safe disposal management of spent (unused) sealed sources and solid wastes generated by licensed users of radioactive materials
- Rental of radiation detection instruments (such as survey meters) by authorized users/facilities for area monitoring around radiation emitting devices in their workplace

NUCLEAR-BASED ANALYTICAL SERVICES

The Nuclear Analytical Techniques Applications Section analyzed 722 samples provided by 80 clients using nuclear-based and related techniques for research as well as regulatory purposes, especially for non-radioactivity certification of products prior to trading and export. As in previous years, the analyses included four procedures: (1) gross-alpha beta analysis of drinking water and well water samples by liquid scintillation counting; (2) gammametric analysis of food and foodstuff and related samples by gamma spectrometry; (3) detection of synthetic acetic acid adulteration in locally-produced vinegar by liquid scintillation counting and isotope ratio mass spectrometry;

RADIATION PROTECTION SERVICES • 2012		
Personnel Radiation Monitoring	<ul style="list-style-type: none"> • 36,886 film badges issued • 12,427 TLDs issued • 1,301 OSLs issued 	<ul style="list-style-type: none"> • 2,150 institutions served • 12,333 individuals served • 135 clients served • 36 clients served
Calibration of radiation detection instruments	<ul style="list-style-type: none"> • 630 units of survey meters • 68 units of contamination meter • 490 units of pen dosimeters • 19 units of dose calibrators • 7 brachytherapy calibrators 	<ul style="list-style-type: none"> • 260 institutions served • 59 institutions served • 93 institutions served • 18 institutions served • 4 institutions served
Leak testing of sealed radioactive sources	93 on-site leak testing 23 off-site leak testing	6 institutions served
Management of spent sealed sources	9 spent sealed sources	3 institutions served
Output calibration of brachytherapy sources	7 high dose rate units calibrated	4 institutions served
Iodine-131 activity measurement	19 measured	1 institution
Iodine-125 activity measurement	11 measured	1 institution
Area/Air monitoring	1 service rendered	1 institution served
Rental of survey meters and moisture density gauge	163 survey meters 4 moisture density gauges	1 institution served

and (4) radon analysis in water. The first two are ISO/IEC 170 25:2005 accredited procedures.

The Applied Physics Research Section also performed analysis of 181 samples provided by 30 clients, mostly from the academe. The samples were analyzed to determine their structural forms using X-ray diffractometer. The samples included rare earth elements, nanofibers, thin films and metal alloys.

MICROBIOLOGICAL TESTS

A total of 182 microbiological tests of various samples were performed for 62 clients. The tests included: aerobic plate count, mold yeast count, bioburden test to determine microbial load, sterility test and chemical analysis. The samples included brown rice and chicken/pork adobo, among others.



Microbiological analysis of food samples (chicken adobo)

CYTOGENETIC COUNSELLING

A total of 50 individuals availed themselves of the Institute's expertise in cytogenetic analysis. This service was done to detect the presence or absence of genetic disorders like Down's syndrome and



This year, the Section completed a low-cost prototype of a radiation detection device that can be used for radiation area and personnel monitoring, rental services and also for educational purposes.

The Section was also involved in the design and installation of electrical components of facilities such as the Electron Beam and the Technetium-99m generator.

the electron beam (EB) technology for the development of functional materials for industrial, health and environmental applications.

In January, the details of the design, installation, commissioning and training needs for the implementation of the project were discussed by the PNRI project staff, consultant and representatives from EB Tech (the Korean supplier of electron beam accelerator), MERALCO, Office of the Assistant Secretary for Special Projects – DOST and Metals Industry Research and Development Center-DOST. The rehabilitation of the existing irradiation facility for the shielding component of the EB accelerator is now ongoing and the EB accelerator from South Korea has been delivered.



Harvesting of cultured blood in preparation for microscopy analysis

to monitor the radiation received by workers who were occupationally exposed to radiation.

ENGINEERING SERVICES

The Engineering Services Section provided assistance in the repair and maintenance of nuclear and non-nuclear equipment and instruments for PNRI and other clients.



Isotope Technologies Dresden (ITD) experts show to PNRI research specialists who visited ITD, the electrical and other components of the technetium-99m hot cell assembly to be installed in Tc-99m Generator Facility at PNRI.



Visit of the EB-Tech Co. representative (supplier of the electron beam [EB] accelerator) at PNRI to inspect the ongoing renovation of the Multipurpose Irradiation Facility for the shielding component of the EB accelerator



REGULATIONS AND STANDARDS DEVELOPMENT

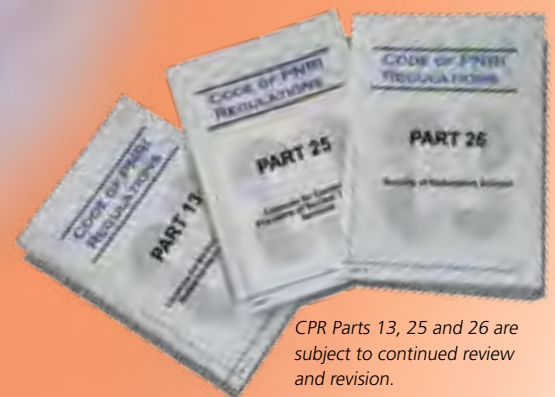
The PNRI, through the Nuclear Regulatory Division (NRD) is authorized to impose binding legal requirements to persons, organizations and facilities that possess, use, handle, store or transport radioactive and nuclear materials based on rules, regulations, and standards developed by the Regulations and Standards Development Section (RSDS). In carrying out its tasks, the RSDS has, among others, developed, reviewed, and revised regulations including provisions of relevant technical inputs to stakeholders.

Code of PNRI Regulations (CPRs)

Five CPRs were reviewed, evaluated, and revised, including two that are currently being developed in collaboration with the Nuclear Security and Safeguards Section (NSSS). CPR Part 25, “Licenses for Commercial Providers of Nuclear Technical Services” awaits the approval of the PNRI Director. The draft revision of CPR Part 13, “Licenses for Medical Use of Radiopharmaceuticals” was disseminated for internal comments and recommendations while CPR Part 5, “Nuclear

ENSURING the SAFETY and SECURITY of RADIOACTIVE SOURCES

Nuclear regulations are crafted and enforced based on internationally accepted standards and best practices to ensure safety and security in the peaceful applications of radioactive materials for commercial, medical, industrial and research purposes. The regulations are also enforced to ascertain non-diversion of the said materials for illegal or malevolent purposes.



CPR Parts 13, 25 and 26 are subject to continued review and revision.

Power Reactor Site Criteria" was disseminated for external consultation and review. CPR Part 26, "Security of Radioactive Sources" and the new CPR Part 27 "Security Requirements in the Transport of Radioactive Material" are now subject to review and consultations.

Other Regulatory Documents

The RSDS developed regulatory guides, administrative orders and information notices to provide PNRI licensees with necessary information and technical support aimed at improving understanding of regulatory requirements. In support of CPR Part 16 "Licenses for the Use of Sealed Sources Contained in Industrial Devices", PNRI Information Notice 2012-01 has been issued to licensees. Its accompanying regulatory guide has been drafted and is currently under review. The administrative order on "Regulatory Requirement in Determining Severity of Violation(s)" was developed to further enhance the enforcement mechanisms of the PNRI. Its final manuscript was endorsed to the Office of the PNRI Director for approval and publication in the Official Gazette.

Technical Assistance

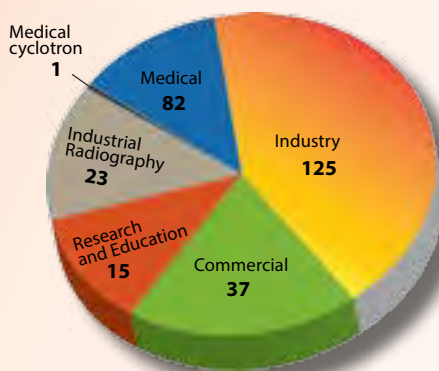
The RSDS provided technical assistance to the Department of Foreign Affairs on the proposed ratification of the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel and Radioactive Waste Management, particularly on its importance and the commitments to be expected from the Philippine government. In addition, a proposed Philippine position paper on the draft statement prepared by Indonesia regarding the position of Non-Aligned Member Countries on the Non-Nuclear Proliferation Treaty was also prepared. The Section also addressed the request of the Department

of Justice regarding the legal requirements of the issuance entitled "Transfers of Nuclear-Related Dual-Use Equipment, Materials, Software and Related Technology", one of PNRI's most important administrative orders.

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, produce, store, sell or import radioactive materials.

DISTRIBUTION OF RADIOACTIVE MATERIAL LICENSES ISSUED BY PNRI



Out of the 374 license applications, PNRI issued 283 licenses (20 new, 35 amended and 228 renewed) for the following purposes: (1) industrial applications such as density, level and thickness gauging; (2) medical applications such as diagnosis and treatment of diseases; (3) commercial applications such as the sale and distribution of radioactive materials; (4) industrial radiography; (5) research and education; and (6) operation of a medical cyclotron.

This year, PNRI has terminated the licenses of 20 institutions and granted license exemption certificates to 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.

INSPECTION AND ENFORCEMENT

To ensure compliance by different PNRI licensees with regulations and standards on radiation safety and security, the Inspection and Enforcement Section (IES) conducts announced, unannounced, special and investigative inspections through actual field verification and interface activities.

For the year 2012, IES conducted 147 announced inspections of licensed facilities, of which about 24.5 percent were found in full compliance at the time of inspection; unannounced inspections of seven facilities to verify whether licensees conform to and implement their approved radiation safety program and procedures; and special inspections of six facilities.

From among the non-compliant facilities, PNRI issued Notice of Violation to five licensees. The licensees fully addressed the violations and inadequacies by submission of corrective actions to PNRI. Other licensees with findings of non-compliance also submitted evidences and corrective actions in response to concerns found during the inspection. From these inspections, 157 evaluation reports were generated for issuance to licensees.



PNRI inspector verifies the radiation level of a nuclear industrial gauge

PNRI regulators also monitored the transport of high-risk radioactive sources, which were previously stored in a foreclosed facility in Luzon, to the PNRI Radioactive Waste Interim Management Facility.

The Institute issued a total of 4,594 authorizations for transporting radioactive materials to authorized destinations to 72 licensees for commercial, industrial, research and training applications.

As part of the PNRI Internal Regulatory Control Program, the Institute's facilities and laboratories were inspected to verify compliance with nuclear regulations, including adherence to standards of radiation safety and security.

RADIOLOGICAL IMPACT ASSESSMENT

Emergency Preparedness and Response

National Radiological Emergency Preparedness and Response Plan.

In line with PNRI's emergency preparedness program, the

Radiological Impact Assessment Section (RIAS) continued the review and revision of the Radiological and Emergency Preparedness Plan (RADPLAN) based on the experiences and lessons learned from the Fukushima-Daiichi nuclear power plant incident and the recommendations of the International Atomic Energy Agency Emergency Preparedness Review (EPRev) Mission. The latest draft revision was presented during the first consultative meeting of RADPLAN inter-agency agency representatives.

Training, Drills and Exercises. The RIAS, in cooperation with the Australian Nuclear Science and Technology Organization (ANSTO), successfully facilitated the five-day National Workshop on Emergency Preparedness and Response of the PNRI Radiological Emergency Monitoring and Control (REMCON) Team held in February 2012 in Baguio City, Benguet Province. The workshop was participated in by 26 PNRI REMCON members, one expert from ANSTO and two local experts who served as consultants.

Four training lectures with drills and exercises on Emergency Preparedness

and Response were likewise conducted as part of the PNRI nuclear training courses.



Preparation of personal protection equipment system (PPES) and supplies for use in the exercises



Search and rescue exercise for missing source is conducted by PNRI Response team wearing personal protection equipment system and using radiation monitoring instruments.

Response to Radiological Incident.

Committing to a ready response to radiological and nuclear incidents, PNRI has designated Radiological Emergency Monitoring and Control (REMCON) Teams on duty on a 15-day cycle.

To further increase the teams capabilities, the Procedure Manual for REMCON was also finalized and implemented for this purpose.



NUCLEAR SAFEGUARDS AND SECURITY

The Nuclear Security and Safeguards Section (NSSS) is responsible for the implementation of tasks relative to the Philippines' obligations in the Non-Proliferation of Nuclear Weapons Treaty (NPT) which ensures that nuclear materials are not diverted to non-peaceful applications. These tasks included the following:

IAEA Nuclear Safeguards Inspections and Nuclear Material Accounting

Pursuant to the Safeguards Agreement, NSSS assisted the IAEA Safeguards Inspectors in carrying out annual physical inventory verification inspection at the Philippine Research Reactor -1 (PRR-1) at PNRI. NSSS submitted five nuclear material accounting reports for PRR-1 to the IAEA through the same secure system.

Location Outside Facility (LOF) for Depleted Uranium

In response to the requirement by the International Atomic Energy Agency (IAEA) under INF/CIRC/153 entitled "The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons", NSSS submitted to the IAEA the Design Information Questionnaire (DIQ) for the newly created LOF for depleted uranium used in hospital and industrial facilities as shielding material. Subsequently, NSSS submitted to the IAEA the accounting reports for the depleted uranium through the PNRI-IAEA secure communication system

Additional Protocol (AP) to the Agreement Between the Philippines and the IAEA for the Application of Safeguards

As part of the Philippines' reporting obligations under Articles 2a of AP, the NSSS submitted an update of AP declarations for the period January to December 2011 including the quarterly reports of Export of Annex II items for the same period.



Physical Inventory Verification inspection at the temporary storage of slightly irradiated fuels at PRR-1 with IAEA safeguards inspectors

US DEPARTMENT OF ENERGY FUNDED PROGRAMS/PROJECTS

Megaports Initiative

The PNRI, through the NSSS, continued to participate in this United States Department of Energy (US DOE) initiative in coordination with the Bureau of Customs and the Philippine Ports Authority. The Megaports Initiative involves screening for illicit shipment of nuclear and other radioactive materials in container vans and cargo from abroad using the radiation monitoring system at the Ports of Manila.

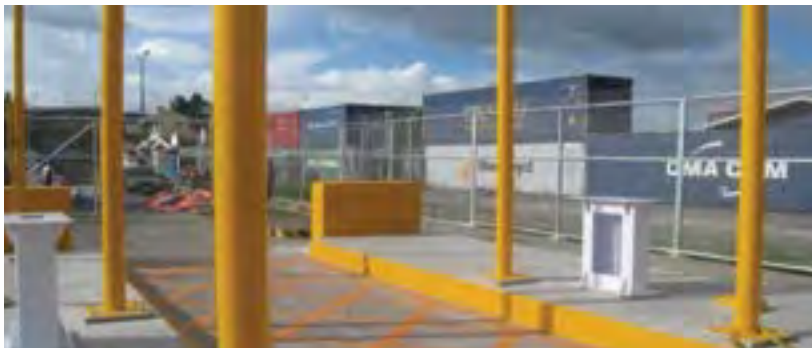


Tertiary inspection at the Manila International Container Terminal

From a total of three tertiary inspections conducted for the whole year, one confirmed the presence of a cobalt-60 industrial source among shipments of mobile (whip) antennas imported from Hong Kong. Tertiary inspections involved



Meeting on the ongoing construction of the Radiation Portal Monitor (RPM) systems at the Cebu International Port in October 2012.



Location of radiation portal monitors at the Cebu International Port

the stripping of containers positive for the presence of radioactive materials.

In October, NSSS participated in inspecting the ongoing construction of the Radiation Portal Monitor (RPM) systems at the Cebu International Port together with the United States Megaports Team and Cebu Port Authority senior officials. The construction of RPM systems in Metro Cebu is in line with the Megaports Initiative's expansion following its implementation in Metro Manila.

Global Threat Reduction Initiative (GTRI)

The Philippines, through the PNRI, participates in this initiative which aims to address nuclear security around the world, particularly on reducing the threat of nuclear terrorism.

Activities undertaken under this initiative include the evaluation of the quarterly preventive maintenance activities of G4S contractor for security upgrades at eight hospitals/

medical centers and PNRI facilities. A total of four quarterly reports on the results of the inspections/evaluations were submitted to the US DOE through the Pacific Northwest National Laboratory (PNNL).

This year, PNRI, through NSSS, received the new Transport Control Center (TCC) installed at the PNRI Central Alarm System from the US DOE through the Oak Ridge National Laboratory experts. The TCC would ensure continuous surveillance during transport of radioactive material by land.

NSSS assisted the US Global Threat Reduction Initiative (GTRI) Team in the assessments of six sites with Category 2 radiation facilities (e.g., high dose brachytherapy and industrial radiography facilities) in Metro Manila, Pampanga and Metro Cebu. The new assessments are in line with the expansion of the GTRI project to cover Category 2 fixed radiation facilities covered by the Code of Conduct in the Safety and Security of Radioactive Sources.

NSSS also assisted the US GTRI Team in the conduct of a vendor evaluation for the custom-made truck to be donated by the US to the Philippines, for use in the transport of radioactive materials. The high security-equipped truck is to be provided by the US to complement the TCC in ensuring the security of radioactive materials during transport.

In September, NSSS conducted a three-day Stakeholders Consultation Meeting on the draft regulation, CPR Part 27, "Security Requirements in the Transport of Radioactive Material". It was attended by representatives from the Bureau of Customs, the Land Transportation Franchising and Regulatory Board, the Land Transportation Office, the Office for Transportation Security, the Philippine National Police, and US DOE experts. The draft regulation was presented to solicit comments from the concerned agencies and the US DOE experts on the language, applicability and practicability of the regulation. Following the Stakeholders Consultation Meeting, NSSS conducted a one-day Regulatory Consultative Meeting on the draft regulation which was attended by representatives from 18 radioactive material licensees and US DOE experts, bringing the same issues on the draft to the licensees.

NSSS Hosting Activities

NSSS hosted and/or participated in the following fora on radiological safety and security in collaboration with the US DOE, ANSTO and IAEA: (1) WINS Workshop on Sharing Best Practices for Enhancing the Security of High Activity Radioactive Sources-Exploring the Role of Professional Associations; (2) Third Regional Review Meeting of Radiological Security Partnerships; (3) Peer Review of the Revised CPR 26; (4) Radiological Security Incident Response Training (for PNP); (5) AP Outreach Seminar for

universities; (6) Training Course for Radioactive Source Security Inspectors; (7) National Workshop on the Requirements for a State's Physical Protection Regime under the IAEA INFCIRC 225 Rev. 5; and (7) Pilot Training Course on Physical Protection and Security Management of Radioactive Sources.

NATIONAL RADIOACTIVE WASTE DISPOSAL PROGRAM

Status of the Drilling Campaign for the Disposal of Disused Radioactive Sources

The PNRI and its collaborators are conducting an intensive investigation into a proposed site for borehole disposal of disused radioactive sources. Borehole drilling is being carried out for investigation purposes, but with an option to develop it into a disposal borehole at a later stage of the program. The primary objective of the drilling campaign would be to drill up to a depth of approximately 100 meters to characterize the subsurface soil, rock and water level. Ideally, it is expected to intersect a monolithic block of intact rock formation suitable for deep disposal of canisters containing the radioactive sources. Confirmation of the site's suitability requires the presence of a host formation characterised by a sufficiently low hydraulic conductivity and hydraulic gradient, absence of groundwater aggressive to the engineered barriers, and good sorption properties.

Initially, a topographic survey of the 40 -hectare site at one meter interval was conducted using an advanced GSI survey equipment in April 2012. Drilling of the deep borehole designated as DDH5 to a target depth of 100 meters along with two shallow boreholes was



GIS equipment used during the topographic survey

then undertaken. The borehole is located at PTM coordinates of 2,002,878,1600 N, 579 7DDH5. Geologic logs and interpretations of DDH5 have been recorded.

Further site characterization, including preparation of geologic maps and the development of updated hydrogeologic model, is in progress.

Information Campaign

While drilling campaign was taking place, the PNRI, as proponent of this project, conducted a stakeholder meeting/seminar at the project site and its vicinities. This was attended by representatives from the local government units and key officials of the Department of Science and Technology Regional Office in Tuguegarao City. An International Atomic Energy Agency (IAEA) expert was also present during the stakeholder forum.



Project presentation on the proposed site for borehole disposal of disused radioactive sources at the DOST Regional Office II, Tuguegarao City



NUCLEAR TRAINING

The PNRI, through its Nuclear Training Center (NTC), regularly conducts training courses for various sectors as part of its human resource development program in the field of nuclear science and technology.

For 2012, the NTC conducted 38 training courses, participated in by 633 professionals and technicians from different government and private institutions. The courses held this year consisted of 13 radiation safety courses for industrial radiographers and on use of nuclear equipment/devices/radioactive materials; 18 on nondestructive testing techniques (including three welding courses) in partnership with the Philippine Society for Nondestructive Testing; two training courses for high school teachers and college/university faculty; three on radioisotope techniques; one on safety and security of radioactive materials; and one training course on nuclear power. (Please see Appendices, Table 1, on page 45 for PNRI Training Courses).

A special Radioisotope Techniques Training Course and a tour of the Bataan Nuclear Power Plant in Morong, Bataan were also organized for new PNRI staff.

As part of PNRI's program for undergraduate students, NTC arranged/coordinated the acceptance of 91 students/researchers from 21 schools/colleges to the different laboratories/facilities of PNRI. Meanwhile, nine students from four schools were accommodated for nuclear-related thesis/research advisorship. (Please see Appendices, Table 2 on page 46).

DIFFUSION OF KNOWLEDGE AND TECHNOLOGIES

Nuclear technology is one of the most relevant matters that our people need to understand more clearly, and we are exploring diverse avenues to bring nuclear information in a manner that common people would better appreciate.



Students from Philippine Science High School participate in a workshop conducted at the Nuclear Training Center as part of their elective subject on nuclear science..



A Nuclear Training Center staff (left) gives instructions to participants from Oceanagold, Nueva Vizcaya during a practical exercise on radiation measurement.



Nondestructive Testing Training Course: Participants perform a practical exercise on eddy current testing.

NTC developed a Moodle-based Distance Learning Management System (LMS) in collaboration with the PNRI Management Information System Section. This LMS is currently available exclusively through the PNRI intranet but can be utilized for distance learning in the future.

INFORMATION, EDUCATION AND COMMUNICATION ACTIVITIES

To inform, educate and communicate the various aspects of nuclear science and technology to different stakeholders, the PNRI implements various activities:

Development/Distribution of Information Materials.

The Nuclear Information and Documentation Section developed/produced the 2011 PNRI Annual report and three flyers on nuclear technology applications. Around 19,500 of these materials were distributed to more than 10,000 clients. Exhibit banners (7 ft by 8 ft) on the following technologies were also produced and were exhibited during six science and technology fairs and other events: (1) Enhancing Export Competitiveness of Philippine Super Mangoes through Irradiation Technology; (2) Safe Foods for Immunocompromised Patients through Radiation Technology; (3) Radiation-Processed Materials from Natural Polymers for Agricultural, Health and

other Applications; (4) Using Nuclear Analytical Techniques to Serve You; and (5) Establishment of Facility for Local Production of Technetium-99m Medical Radioisotope. The production of these exhibit banners received partial financial assistance from the Technology Application and Promotion Institute-DOST.

Educational Tours and Nuclear Awareness Seminars.

In coordination with the PNRI technical staff, the Nuclear Information and Documentation Section conducted guided tours at PNRI facilities for around 2,700 visitors (mainly students) during their educational tours at PNRI. The tours consisted of lecture-demonstrations



New PNRI employees tour the Bataan Nuclear Power Plant in Morong, Bataan.



Opening ceremonies of the Mindanao Cluster S&T Fair at KCC Mall, General Santos City

and video showings. Information assistance was likewise provided to more than 1,000 walk-in visitors and individuals who inquired through phone and e-mail. A total of 45 nuclear awareness seminars for 2,700 high school and college students and teachers in Metro Manila were also provided in cooperation with the Nuclear Training Center and PNRI technical staff.

Library Services.

The PNRI Library facilities/materials were made available to 1,740 PNRI and non- PNRI clients for the year.



The PNRI exhibit displayed during the 2012 National Science and Technology Week at SMX, Mall of Asia and in four regional cluster S & T fairs.

Participation in Special S & T Events.

This year, the PNRI promoted nuclear technologies and services through the Institute's participation in six science and technology events in Metro Manila and in the regions in Luzon, Visayas and Mindanao. More than 5,000 clients were provided with

information on nuclear science and technology through these special events.

Nuclear S & T Promotion Through Media Linkages.

PNRI arranged and coordinated 32 radio and television interviews of PNRI officials and staff and held

Science and Technology Event	Date	Venue
National Science National Science and Technology Week (NSTW) – Expo Science 2012	July 10-14, 2012	SMX Convention Center, Pasay City
Northern Luzon Cluster Science and Technology (S & T) Fair	July 30 - August 3, 2012	Mariano Marcos State University Batac City, Ilocos Norte
Visayas Cluster S&T Fair	September 24-28, 2012	Tacloban City Convention Center, Tacloban City, Leyte
Mindanao Cluster S&T Fair	October 10-14, 2012	KCC Mall, General Santos City
Southern Luzon Cluster S & T Fair	November 22- 24, 2012	Waltermart, City of San Fernando, Pampanga
40 th Atomic Energy Week	December 10 - 14, 2012	PNRI, Diliman, Quezon City

a press conference attended by 38 media representatives during the 40th Atomic Energy Week (AEW) Celebration at PNRI in December 2012. PNRI Director Dr. Alumanda M. Dela Rosa presented updates on the accomplishments in nuclear research and development, services and regulatory activities. News releases were likewise prepared on PNRI technologies, services and regulatory activities for dissemination to the public through the media.

MANAGEMENT INFORMATION SYSTEM

The PNRI Management Information System (MIS) Section pilot-tested the personnel management component of the Information Systems @PNRI (is@P.PM) including the use of the Biometrics Fingerprint Recognition Technology for the Institute's time and attendance monitoring system. An Open Course Management System (CMS) MOODLE MIS was installed, configured and customized for the Institute's Nuclear Training Center's Learning Management System. The MIS staff also developed the project plan, requirements specifications, and designs of the

following proposed information systems: (1) Radiation Personnel Monitoring; (2) Regulatory Management, Irradiation Services Management; and (3) Nuclear Training Management and Radiation Sources and Dose Registry. In addition, the following were continued: (1) enhancement of the Institute's local area network (LAN) infrastructure; (2) digitization of critical Philippine Nuclear Power Plant and relevant documents in support of the preservation of nuclear knowledge; and (3) provision of information and communication technology (ICT) technical support to the operation and maintenance of the RN52 monitoring station in Tanay, Rizal and maintenance of the National Data Center (N7) station at PNRI. This is in line with the Philippines' commitment to the Comprehensive Nuclear Test-Ban Treaty Organization.

BUSINESS DEVELOPMENT

To achieve self-reliance and a higher degree of the Institute's sustainability, the PNRI pursues activities geared towards the commercialization of its technologies and services. This year the following were undertaken by the Institute:

(1) Conduct of progressive meetings with an identified potential technology adaptor to finalize signing of licensing agreement for the commercialization of hydrogel, a dressing for burns, wounds, and bedsores developed by PNRI.

(2) Development of a commercialization plan for the setting up of the Technetium-99 Generator Production Facility, and worked on the signing of the memorandum of agreement between PNRI and Technology Resource Center for wholesale product distribution of the Tc-99m generator.

(3) Scientific visit of PNRI staff to its counterpart in Indonesia and conduct of benchmarking and ocular at the facilities of producer of raw material for Tc-99m generator.

(4) Participation in the technical working group that crafted the proposed 2013 IP Policy of DOST as prescribed in the 2010 IRR of RA10055 also known as The Philippine Technology Transfer Act of 2009.

(5) Provision of advice to interested parties on the regulatory requirements for establishing a Centralized Medical Cyclotron Facility.



PNRI Director Dr. Alumanda M. Dela Rosa being interviewed at GMA News TV program "Tonight with Arnold Clavio" (left photo) and at ZOE Broadcasting Network, Inc.'s "Diyos at Bayan" program hosted by Bro. Eddie Villanueva and Kata Inocencio (center photo). Dr. Lucille V. Abad, Head of the Chemistry Research Section, talks about the PNRI – developed hydrogel wound dressing at Net-25's "APRUB" TV program hosted by Ellaine Fuentes (right photo).



Photo: IAEA

S&T LINKING AND NETWORKING

PPNRI continues to seek and maintain linkages with local and international organizations to ensure the safe, secure and peaceful applications of nuclear technology in our research and development, services, regulatory functions, and information dissemination activities.

LOCAL S&T Networking

This year, linkages were forged with the following private and government institutions/ organizations to foster cooperative research and development on the beneficial applications of nuclear science and technology.

Nutrient and Water Management in Rice

Philippine Rice Research Institute (PhilRice) for the research project on "Application of the Nuclear Analytical Techniques in Evaluating Nitrogen and Water Efficiency of Rice"

Fisheries and Aquatic Studies

Southeast Asian Fisheries Development Center, Aquaculture Department for the research program on "Potential Uses of Irradiated Low Molecular Weight Carrageenans in Aquaculture"

Nuclear Analytical Techniques for Water Sample Analysis

Davao City Water District for the project "Determination of Gross Alpha and Beta Activities in Water"

Soil Fertility Management

Bureau of Soils and Water Management for the project "Nuclear Techniques and Fertigation to Improve Water and Nutrient-use Efficiencies of Mungbean Mutant"

FOREIGN S&T Networking

The PNRI also nurtured its cooperative links with the following:

*International Atomic Energy
Agency (IAEA), Vienna, Austria*

*Regional Cooperative Agreement
(RCA) for Research, Development
and Training Related to Nuclear
Science and Technology for Asia
and the Pacific, Vienna, Austria*



Ministry of Science and Technology of Japan

Forum for Nuclear Cooperation in Asia (FNCA), Japan

RCA Regional Office in Korea

Nuclear Safety Research Association of Japan

Japan Atomic Energy Agency

United States Department of Energy

United States Department of Agriculture

Australian Nuclear Science and Technology Organization

Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Vienna

European Commission

Other organizations from Australia, Japan, Canada, United States, Korea, France and other countries through bilateral agreements/institute agreements

PNRI's linkages and networking enabled the implementation of nuclear science and technology projects and provided support to the development of human resources. Through these collaborative efforts, the Institute availed of:

6 IAEA Technical Cooperation projects,
7 IAEA research contracts
29 IAEA experts/missions.
200 fellowship grants for PNRI and non-PNRI personnel

In cooperation with other agencies, PNRI also hosted 7 regional seminars/meetings/workshops.



The annual 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.

Wreath Laying

at the Monument of General Medina, considered as the "Father of Atomic Energy in the Philippines".

Thanksgiving Mass

Officiated by Rev. Father Gerry Orbos, SVD

Opening Ceremonies

DOST Secretary Mario G. Montejo was the keynote speaker during the AEW opening ceremonies on December 10.

Opening of AEW Exhibits

Sec. Mario G. Montejo, assisted by PNRI Director Alumanda M. Dela Rosa, formally opened the 2012 AEW Exhibit.

Press Conference

Some 35 media representatives attended the press conference on December 5. PNRI topics presented included updates on

the Fukushima nuclear power plant accident, highlights of PNRI activities in 2011, and new projects in 2012

Technical Sessions

The topics presented at the technical sessions on December 11- 12 include the following: Energy Situation in the Philippines; Nuclear Energy; The Comprehensive Nuclear-Test-Ban Treaty Verification Regime; Technetium-99m Production: Issues and Options; Application of Radioactive and Stable Isotopes in Environmental Forensic Investigation; and Food Traceability and Food Safety through the Use of Nuclear Analytical Techniques.

These topics were discussed by experts from the Department of Energy, National Power Corporation, Comprehensive Nuclear Test Ban Treaty Organization, International Atomic Energy Agency, and the PNRI.

Launching and Blessing of the Radioisotope Laboratory

The Technetium-99m generator production

facility, which was set up by PNRI for local preparation and production of Technetium-99m, was inaugurated on December 10. Technetium-99m is the most commonly-used radioisotope in nuclear medicine for diagnostic and therapeutic purposes.

Guided tours at PNRI Facilities and Laboratories

Visitors viewed the exhibits, had guided tours and film showing and participated in the exhibit quiz during the five-day AEW celebration.

Employees Day

PNRI employees and invited guests had fun during this event which was coordinated by the PNRI Employees Union.

Closing Ceremonies

Former Representative of 5th District of Pangasinan Mark Cojuangco in his message during the AEW closing ceremonies on December 14 expressed his hope that Philippine society will one day be able to make the right choices regarding nuclear power "because of knowledge and awareness of the truth and realities, rather than the unfounded fears, of nuclear technology".

40th ATOMIC ENERGY WEEK

10-14 December 2012, PNRI

"Nuclear Science, Technology and Innovation: Engine for Growth and Development"



AEW SPECIAL AWARDS FOR 2012

**"Renewable Energy" Award
(Contractual of the Year)**

Enrico C. Bondoc, Jr.

'for showing consistent dedication, commitment and enthusiasm to his work and serving always with a smile.'



**"Kuya ng Bayan" Award
(Guard of the Year)**

Florence Sahulga

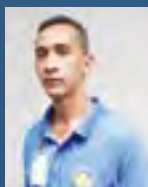
'for being diligent and cautious in implementing PNRI security rules. As they say, "You're in good hands with Kuya Guard".'



**"Tunay na Maasahan" Award
(Janitor of the Year)**

Joselito Morales

'for being an honest and dependable worker, a true embodiment of someone who is "Laging Maasahan".'



"Sports Achievement Award"

In photo (standing L-R) **Rollie Ilao; Gerardo Robles;**
(seated L-R) **Efren Sta. Maria; Sofronio Enriquez;**
Dante Bajet



Not in photo **Davison Baldos; Guilzam Besa; Raymond Beredo; Bernard de Lara; Carl Nohay; Joseph Tugo**

PNRI Table Tennis Team A: Over-all Champion of 2012 DOST-wide Table Tennis Tournament

PHILIPPINE NUCLEAR SCIENCE QUIZ (PNSQ)



December 13, 2012

One of the highlights of the Atomic Energy Week (AEW) ruby anniversary in December 2012 was the Philippine Nuclear Science Quiz (PNSQ) which aims to enhance awareness and understanding of the Filipino youth on nuclear science and technology and its beneficial applications. The PNSQ, participated in by 195 schools from 11 regions in the country, was conducted by DOST-PNRI in collaboration with the DOST Regional Offices

Former Congressman Mark Cojuangco, AEW closing ceremonies keynote speaker (middle), and PNRI officials Dr. Christina A. Petrache (extreme right), PNRI Officer-in-Charge, and Victoria Fe O. Medina (third from left), Technology Diffusion Division chief and 2012 AEW Executive Committee Chairperson, awarded the winners at the AEW closing ceremonies at PNRI.

WINNERS OF THE PNSQ:

- 1st Place** – Pastor Memorial High School, Dumaguete Science High School in Region 7
Alec Benjamin G. Ramirez and Hannah Jael Cadusale
Coach: Lourdes D. Lee
- 2nd Place** – Philippine Science High School (Western Visayas Campus) in Region 6
Andre They C. Haro and Sharmaine M. Grande
Coach: Rowena M. Labrador
- 3rd Place:** Philippine Science High School (Southern Mindanao Campus) in Region 11
Glynis Robert C. Aguilar and Regiel Christina Q. Magusara, Coach: Michael V. Nalitan

POP QUIZ WINNERS:

To complement the PNSQ and maximize the participation of schools within Metro Manila, PNRI, in cooperation with the DOST, also conducted a POP Quiz.

- 1st Place** - Caloocan City Science High School
– *Christian Jay P. Balboa*
- 2nd Place** - Parañaque Science High School
Neomi Weine A. Latoza
- 3rd Place** - Muntinlupa Science High School
– *Gabriel Niccolo D. Matibag*



PNSQ judges were : (L-R) Dr. Vangeline K. Parami, Dr. Lucille V. Abad and Dr. Christrina A. Petrache.



The PNSQ quarter final, semi-final and final rounds and the Pop Quiz were held at Nido Fortified Science Discovery Center at SM Mall of Asia in Pasay City.

Other PNRI Activities

DIRECTOR'S CUP

TREE PLANTING'

• Establishment of the *PNRI Hardin ng Mga Katutubong Halaman*

The Philippine government's National Greening Program encourages every Filipino citizen of legal age, especially every government official and employee to plant at least ten tree seedlings per year until 2017. Native forest tree species were prioritized to help prevent its extinction.

PNRI started to help in this endeavor by producing seedlings of selected native ornamental trees and maintaining a garden of some native tree species, shrubs and herbaceous plants in its compound. The garden, referred to as *Hardin ng mga Katutubong Halaman*, showcases native trees planted by PNRI officials themselves in January 2012.

• Opening activity

• The over all champion



2012 CHRISTMAS PARTY



TEAM BUILDING



HUMAN RESOURCES DEVELOPMENT

The PNRI gives priority attention to its manpower development to have a workforce capable of efficiently responding to challenges in the implementation of its nuclear research and development activities, promotion of nuclear technology applications and in the enforcement of its nuclear regulatory functions, among others.

2 PNRI staff obtained their doctorate and masteral degrees from the University of the Philippines-Diliman:

Ph.D. in Environmental Science
Dr. Soledad S. Castañeda
Chief Science Research Specialist
Atomic Research Division (ARD)

M.S. in Chemistry
Jordan F. Madrid
Science Research Specialist II
Chemistry Research Section, ARD

32 PNRI staff pursued post graduate degrees on local/foreign scholarships

38 Nuclear training courses conducted by PNRI with **633** participants

91 Students from 21 schools were accommodated for on-the-job training at PNRI.

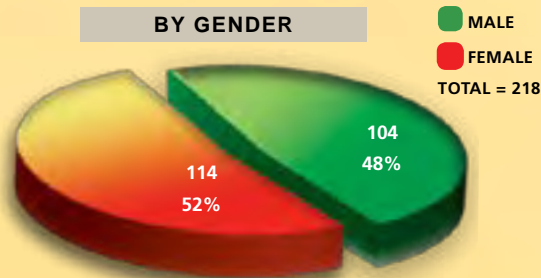
9 Students from 4 schools were accepted for thesis advisorship at PNRI

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

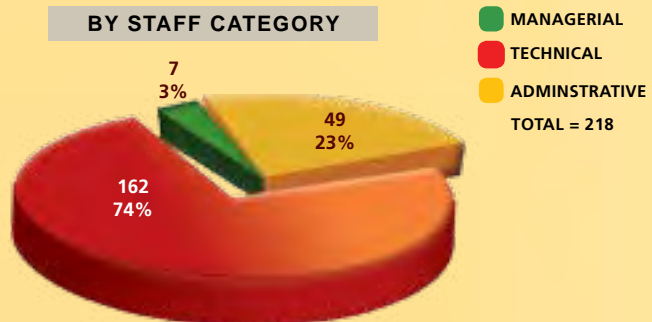
200 Trainings/fellowship grants availed of by PNRI and non-PNRI personnel through linkages with foreign institutions/agencies

DISTRIBUTION OF PERSONNEL

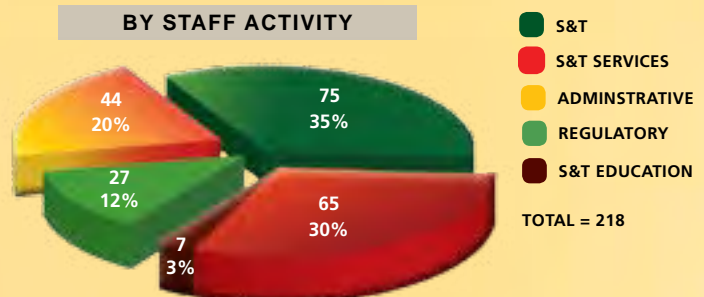
BY GENDER



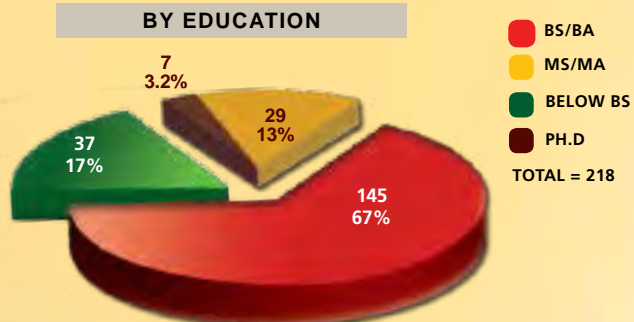
BY STAFF CATEGORY



BY STAFF ACTIVITY



BY EDUCATION



PNRI gave the following recognition awards to ten of its staff during the 40th AEW Closing Ceremonies at PNRI: (1) The PRAISE Special Award for expertise shared to the Institute on matters relating to nuclear technology, (2) Director's Choice Award based on the employee's contributions to the institute and commitment to service, and (3) Division Award for contributing greatly to the accomplishment of the division's functions and goals.

MODEL EMPLOYEES

DIRECTOR'S CHOICE AWARD



Nuclear Services Division
ADELINA D.M. BULOS

Supervising Science Research Specialist
Isotope Techniques Research Section
Atomic Research Division

DIVISION AWARDEES



Atomic Research Division
ROLAND V. RALLOS (Top left)
Science Research Specialist I
Agricultural Research Section

Technology Diffusion Division
SALVADOR P. FLORES, JR. (Top right)
Science Research Specialist II
Management Information Section



Nuclear Regulatory Division
NELSON P. BADINAS (Bottom left)
Senior Science Research Specialist
Nuclear Safeguards & Security Section

Finance & Administrative Division
BEVERLY G. BRIONES (Bottom right)
Administrative Aide IV
Human Resources Management Section

PRAISE WORTHY AWARD - Bidding & Awards Committee Secretariat:



HIDIE S. GOCUYO

Administrative Officer V
Property and Procurement Section
Finance and Administrative Division (FAD)

LUZVIMINDA B. MUYCO

Administrative Assistant III
Property and Procurement Section, FAD

MERIAM F. REJAS

Administrative Aide VI
Planning Section, Office of the Director

ANA N. VILLANUEVA

Administrative Officer III
FAD

Best Scientific Poster for Climate Science Session

PM_{2.5} Black Carbon Profile in Metro Manila
by Preciosa Corazon B. Pabroa, Flora L. Santos,
Angel T. Bautista VII, Joseph Michael D. Racho,
and Ryan P. Morco. The award was given during the
NAST First National Conference on Research in Climate
Change and Variability at Traders Hotel
on September 27, 2012.



Nuclear Services Division

Multipurpose Irradiation Facility Group, Irradiation Services
Seated (L-R) Franklin Pares (*Science Research Specialist II*) • Haydee Solomon (*Senior Science Research Specialist*) • Aurelio Maningas (*Senior Science Research Specialist*)
• Luvimina Lanuza (*Supervising Science Research Specialist*)
and • Giuseppe Filam Dean (*Senior Science Research Specialist*)
Standing (L-R) Adrian Cruz (*Science Research Analyst*) • Efren Maat (*Science Aide*)
• Arnaldo Valenzuela (*Science Research Specialist I*) • Crisol Villanueva
(*Science Research Analyst*) • Rehajie Panes (*Science Aide*) • Geoffrey Tranquilan (*Science Research Assistant*) • and Gonzalo Madera, Jr. (*Science Research Specialist II*).

"Best Technical Paper 2011-2012"

**"Radiation Inactivation of
Paenibacillus Larvae and
Sterilization of American Foul
Brood (AFB) Infected Hives
Using Co-60 Gamma Rays"** by
De Guzman; Cervancia, Dimasuay;
Tolentino; Abrera; Cobar; Fajardo;
Sabino; Manila-Fajardo; and Feliciano.
The award was given by PNRI during
the Closing Ceremonies of the
40th Atomic Energy Week Celebration
at PNRI on December 14, 2012.

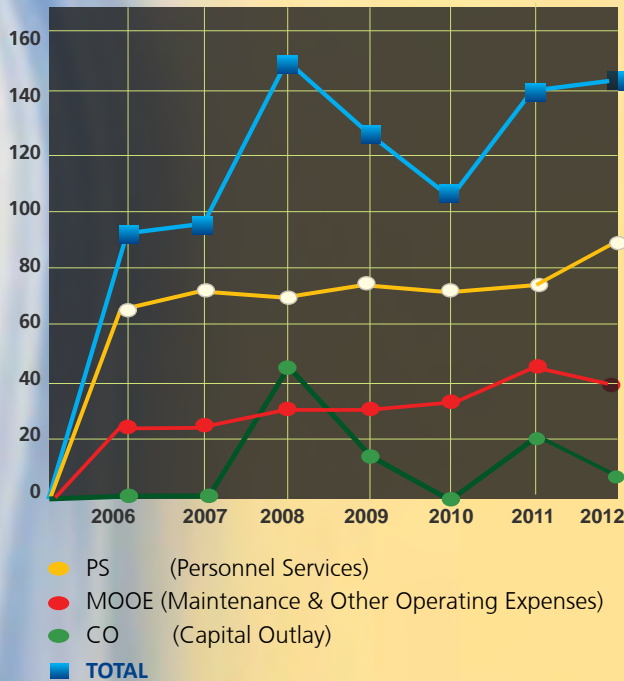
Certificate of Recognition to PNRI Biomedical Research Section for ISO/IEC 17025:2005

Accreditation of the Microbiological
Testing Laboratory on 8 July 2012.
The certificate was presented by the
Philippine Accreditation Office (PAO)
during ceremonies
at the PNRI.

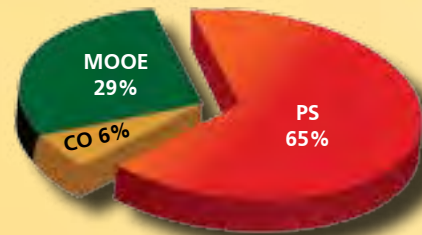
FINANCIAL RESOURCES

This year, PNRI had a budget allotment of Php 140,461,000.00. It generated an income of Php 24,395,000.00 from licensing fees and fees from the Institute's nuclear and allied services, among others. Additional resources were also generated through local and foreign-funded projects on the applications of nuclear science and technology.

ANNUAL PNRI BUDGET (2006-2012)

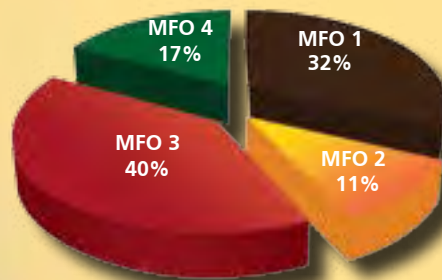


2012 ALLOTMENT BY EXPENSE CLASS



PS	91,892,749.00
MOOE	40,089,251.00
CO	8,479,000.00
TOTAL	140,461,000.00

**2012 EXPENDITURES
BY MAJOR FINAL OUTPUT (MFO)**



● MFO 1	Nuclear Research and Development	44,106,000.00
● MFO 2	Technology Transfer Services	15,755,000.00
● MFO 3	Nuclear S & T Services	56,136,000.00
● MFO 4	Nuclear Regulatory Services	24,464,000.00

TOTAL 140,461,000.00

APPENDICES

TABLE 1. TECHNICAL TRAINING COURSES/SEMINARS CONDUCTED IN 2012

TITLE OF TRAINING	TRAINING VENUE/ LOCATION	NO. OF PARTICIPANTS	INCLUSIVE DATES CONDUCTED	FUNDING SCHEME
RADIOISOTOPE TECHNIQUES				
Radioisotope Techniques Training Course (General) – 98 th session	PNRI Diliman, Quezon City	12 (11*)	Jan 30 – Feb 24	PNRI-sponsored
Radioisotope Techniques Training Course (Medical) – 99 th session	PNRI	35	June 4 – 29	Individual fee-paying
Radioisotope Techniques Training Course (Medical) – 100 th session	PNRI	38	Sept 17 – Oct 12	Individual fee-paying
NUCLEAR SCIENCE AND TECHNOLOGY				
Seminar in Nuclear Science for High School Science Teachers – 36 th session	PNRI	15	April 23 – May 25	PNRI-sponsored
Nuclear Technology for University/College Faculty – 45 th session	PNRI	4	April 23 – May 25	PNRI-sponsored
RADIATION SAFETY				
Safety in the Use of Nuclear Equipment and Devices Training Course – 53 rd session	Oceanagold Phils., Inc. Nueva Vizcaya	7	Feb 6 – 10	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course – 54 th session	Coral Bay Nickel Corp. Palawan	11	Feb 13 – 17	Company-sponsored
Radiation Safety Officer Refresher Course	PNRI	35	Feb 27 – 29	Individual fee-paying
Radiation Safety Course (2 Days)	PNRI	25	March 6 - 7	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course – 55 th session	PNRI	34	March 26 – 30	Individual fee-paying
Radiation Safety Course for Industrial Radiographers	PNRI	10	April 10 – 23	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course – 56 th session	Philippine Gold Processing & Refining Corp., Masbate	12	May 21 – 25	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course – 57 th session	Rapu-Rapu Poly-metallic Project Albay	20	June 24 – 28	Company-sponsored
Safety in the Use of Nuclear Equipment and Devices Training Course – 58 th session	PNRI	23	July 9 – 13	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course – 59 th session	Private Infra Development	9	July 30 – Aug 3	Company-sponsored
Radiation Safety Course for Industrial Radiographers	PNRI	10	Sept 3 – 14	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course – 60 th session	PNRI	29 (2*)	Nov 5 – 9	Individual fee-paying
Safety in the Use of Nuclear Equipment and Devices Training Course – 61 st session	Oceanagold Phils, Inc. Nueva Vizcaya	3	Nov 19 – 23	Company-sponsored
SAFETY AND SECURITY OF RADIOACTIVE MATERIALS				
Pilot Training Course on Physical Protection and Security Management of Radioactive Sources	PNRI	15 (15*)	May 29 – 31	PNRI- sponsored
NUCLEAR POWER				
IAEA Follow-up Training Course on Reactor Engineering (Level 1) – 1 st session	PNRI	14 (14*)	Oct 15 – 26	PNRI-sponsored
NONDESTRUCTIVE TESTING COURSES - in cooperation with the Philippine Society for Nondestructive Testing, Inc. (PSNT)				
Ultrasonic Testing – Level 2	PNRI	12	Jan 16 – 30	Individual fee-paying
Surface Methods – Level 2	PNRI	10	Feb 6 – 17	Individual fee-paying
Radiographic Testing – Level 2	PNRI	26 (2*)	Feb 27 – March 9	Individual fee-paying
Ultrasonic Testing – Level 2	PNRI	23	April 10 – 23	Individual fee-paying
Eddy Current Testing – Level 2	PNRI	11	May 21 – June 1	Individual fee-paying
Radiographic Testing – Level 2	PNRI	34	May 28 – June 8	Individual fee-paying
Eddy Current Testing – Level 2	PNRI	9	June 25 – July 6	Individual fee-paying
Ultrasonic Testing – Level 2	PNRI	31	July 16 – 27	Individual fee-paying
Surface Methods – Level 2	PNRI	10	Aug 6 – 17	Individual fee-paying
Radiographic Testing – Level 2	PNRI	15	Sept 10 – 21	Individual fee-paying
Infrared/Thermal Testing – Level 1	PNRI	8 (3*)	Sept 24 – 28	Individual fee-paying
Ultrasonic Testing – Level 2	PNRI	13	Oct 1 – 12	Individual fee-paying
Surface Methods – Level 2	PNRI	12	Oct 15 – 29	Individual fee-paying
Radiographic Testing – Level 2	PNRI	15	Nov 5 – 16	Individual fee-paying
Ultrasonic Testing – Level 2	PNRI	11	Dec 3 – 14	Individual fee-paying
WELDING TECHNOLOGY COURSES – in cooperation with the PSNT				
Welding Inspectors' Course	PNRI	9 (1*)	Jan 9 – 13	Individual fee-paying
Welding Inspectors' Course	PNRI	10	May 14 – 18	Individual fee-paying
Welding Inspectors' Course	PNRI	13	Sept 3 – 7	Individual fee-paying
TOTAL NO. OF COURSES/SEMINARS: 38		TOTAL: 633 (48*)		

*- Number of PNRI participants

TABLE 2. NUCLEAR S & T ON-THE-JOB TRAINING FOR UNDERGRADUATES IN 2012

FIELD OF TRAINING	PNRI SECTION/UNIT	SCHOOL	COURSE	NO. OF STUDENTS
ATOMIC RESEARCH DIVISION				
Soil-plant studies; fruit fly research activities; orchid embryo culture; and rearing of coconut leaf beetle	Agricultural Research Section	Philippine Normal University; Rizal Technological University	BS Biology for Teachers; BS Biology; BS Biology major in Biotechnology	15
Anti-oxidant assay; food irradiation; radiation processing of hydrogel dressing for wounds	Biomedical Research Section	Rizal Technological University; St. Paul University Quezon City; Univ. of the Philippines - Manila	BS Biology; BS Biology major in Biotechnology	5
Development of radiation grafted water hyacinth in powder form; Production of low molecular weight carrageenan seaweeds with water; Radiation processing of chitosan fractionation	Chemistry Research Section	University of the Philippines -Diliman; University of San Carlos	BS Chemistry	3
Radioactivity measurements using the High Purity Germanium detector system and portable gamma meter	Health Physics Research Section	Philippine Science High School (PSHS)-Main Campus; PSHS-Southern Mindanao Campus	High School	2
Development and applications of neutron spectroscopic and other related techniques; project on testing electron flux	Applied Physics Research Section	Polytechnic University of the Philippines; University of California (UCLA); UP-Los Baños; University of Santo Tomas	BS Physics ; BS Applied Physics; BS Electrical Engineering	10
NUCLEAR SERVICES DIVISION				
Radon and gross alpha-beta determination in water; ion chromatography analysis; nuclear and isotopic techniques; determination of element composition ; air pollution transboundary studies; performance evaluation of PNRI tritium electrolytic enrichment system; authentication of origin and method of production of amino acids as iron	Nuclear Analytical Techniques Applications Section	Philippine Science High School (PSHS)-Cagayan Valley Campus; Polytechnic University of the Philippines ; University of the Philippines -Diliman ; and University of Santo Tomas	High School; BS Chemistry; BS Physics	14
Calibration/maintenance of radiological equipment; thermoluminescent dosimeter (TLD) reading	Radiation Protection Services	De La Salle University-Manila	BS Pre-Med Physics	4
TECHNOLOGY DIFFUSION DIVISION				
Assistance during conduct of training courses on nuclear science and technology	Nuclear Training Center	Philippine Normal University	BS Biology for Teachers; BS Physics for Teachers	4
Program development for recording, monitoring and retrieving documents; administrative services activities	Office of the Director; Finance and Administrative Division; International Cooperation Section; Management Information System Section; Nuclear Information and Documentation Section; Nuclear Training Center; Inspection and Enforcement Section; Licensing, Review & Evaluation Section	AMA Computer College; Best Link College of the Philippines; New Era University; Pamantasan ng Lungsod ng Valenzuela; Pamantasan ng Montalban; STI Novaliches; St. Joseph College of Bulacan	AB Psychology; BS Business Administration – HRDM; BS Computer Science; BS Information Technology; BS Public Administration; Computer Electronics Technician Course	34
TOTAL NO. OF SCHOOLS SERVED: 21 • NO. OF STUDENTS: 91				

TABLE 3. THESIS/RESEARCH ADVISORSHIP IN 2012

FIELD OF TRAINING	PNRI SECTION	SCHOOL	COURSE	NO. OF STUDENTS
ATOMIC RESEARCH DIVISION				
Optimization of surface sterilization protocol and medium components for the in vitro of <i>Spathoglottis plicata</i>	Seed Laboratory, Agriculture Research Section, Atomic Research Division	University of the Philippines -Manila	BS Biology	2
Cell analysis in the cytogenetic department	Biomedical Research Section	De La Salle Araneta University	MS Biology	1
Determination of oligomeric and non-oligomeric products of gamma radiation treated with K-carrageenan	Chemistry Research Section	University of the Philippines -Diliman	Bs Chemistry	1
Synthesis and characterization of poly (glycerol sebacate)-co-lactic using gamma radiation	Chemistry Research Section	Polytechnic University of the Philippines	BS Chemistry	1
NUCLEAR SERVICES DIVISION				
Authentication of origin and method of production of amino acid by carbon and nitrogen isotope provenance determination	Nuclear Analytical Techniques Application Section	Polytechnic University of the Philippines	BS Chemistry	1
Run-through, modification, optimization and feasibility evaluation – A procedure for carbon dating using direct absorption technique	Nuclear Analytical Techniques Application Section	Polytechnic University of the Philippines	BS Chemistry	2
Determination of origin of volatile organic compound using liquid scintillation counting	Nuclear Analytical Techniques Application Section	Polytechnic University of the Philippines	BS Chemistry	1
TOTAL NO. OF SCHOOLS SERVED: 4 • NO. OF STUDENTS: 9				

TABLE 4. IAEA RESEARCH CONTRACTS* IMPLEMENTED IN 2012

TITLE/DESCRIPTION OF RESEARCH	PROJECT DURATION		NAME OF RESPONSIBLE AGENCY STAFF
	START	END	
Enhancing Cytogenetic Biological Dosimetry Capabilities of the Philippines for Nuclear Incidence Preparedness	2 Feb '12	2 Feb 2 '13	Celia O. Asaad PNRI
Completion and Release of the Philippine I-WAVE Pilot Study Gap Report and Implementation of Specific Remedies for Identified Gaps in Hydrological Understanding	10 Feb '12	9 Feb '13	Susan Abano National Water Resources Board
Mutation Breeding and Molecular Genetics of Adaptation to High Temperature in Rice	15 Feb '12	14 Feb '13	Thelma Padolina Philippine Rice Research Institute
Application of Isotope Hydrology Techniques by the Philippine Nuclear Research Institute in Water Resources – Regions 2 and 10 in Support of the Groundwater Resource and Vulnerability Assessment Project in the Department of Environment and Natural Resources	30 April '12	29 April '13	Soledad S. Castañeda PNRI
Use of Sentinel Lymph Node in Breast, Melanoma, Head and Neck and Pelvic Cancers	30 Nov 30 '12	12 Oct '13	Jonas Santiago St. Luke's Medical Center
Development of Safe, Quality and Shelf-Stable Foods for Immunocompromised Patients and Calamity Victims	11 Dec '12	12 Nov '13	Zenaida M. De Guzman PNRI
Improving Capability in Detecting Early Breast Cancer Using Diagnostic Imaging Modalities	14 Dec '12	13 Dec '13	Orestes Monzon Philippine Heart Center

*IAEA Research Contracts are grants under the IAEA Contract Research programme whose funding is sourced from the IAEA Regular Budget and also from the 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 2012

NAME OF PNRI CONTACT PERSON	TITLE/DESCRIPTION OF RESEARCH	PROJECT DURATION		PROJECT COST (IN PESOS)
		START	END	
Alumanda M. Dela Rosa,	Assessing the Development of a Nuclear Power Programme	2012	2013	4,260,637.00
Lucille V. Abad	Using E-beam Technology for Industrial, Environmental and Agricultural Applications	2012	2013	7,776,019.00
Adelina DM. Bulos	Building Capacity for the Preparation and Quality Control of Radiopharmaceuticals for Enhanced Nuclear Medicine Applications	2012	2013	11,827,777.00
Pablo P. Saligan	Preparing Plans for an Ion Beam Accelerator Facility for Research, Training, Education and Applications in Nuclear Science and Technology	2012	2013	3,618,909.00
Teofilo San Luis, Jr.	Establishing a Cyclotron/Positron Emission Tomography (PET) Facility	2012	2013	2,789,411.00
Teofilo V. Leonin, Jr.	Upgrading the National Infrastructure and Strengthening Capabilities for an Independent Regulatory Authority	2012	2013	3,412,009.00

*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 into three components, namely expert assistance, equipment donation and overseas training.

TABLE 6. IAEA EXPERTS/OTHER MISSIONS

FIELD/PURPOSE	NAME OF EXPERT	DATE OF VISIT
Collaborating Center	Maria Betti	27 Jan '12
United States Nuclear Regulatory Center (USNRC) experts	Charles Miller, Robert Haag, David Fischer, Patrick Milano	13 Feb '12
Progress of RAS8108 Project (Field/Purpose- Assessing Trends in Freshwater Quality Using Environmental isotopes and Chemical techniques for Improved Resource Management)	Kshitij Mahadev Kulkarni	
Progress of National Projects	Kesrat Sukasam	20– 22 March '12
	Kwaku Aning - Deputy Director-General, IAEA -	
Memorandum of Understanding Between the Philippines and Pakistan Regarding Short Term Courses on Nuclear Power	Ahmad Munim	10 May '12
Comprehensive Nuclear-Test-Ban Treaty Organization	Malcolm David	6 June '12
Independent Regulatory Authority: Human Resource Development of the Regulatory Body	Pierre Mignot Moritz Zimmermann	16 – 19 July '12
Performance Evaluation and Testing of ^{99m} Tc Generator Production Facility	Azizul Haque	23 July – 3 Aug '12
Preparing Plans for an Ion Beam Accelerator Facility for Research Training, Education and Applications in Nuclear Science and Technology	Mark Breeze	30 July – 3 Aug '12
Advise on Sustainability of Distance Assisted Training for Nuclear Medicine Professionals	Ravi Kashap	10 – 14 Aug '12
Project on Medical Cyclotron	Paul Mikekcz	27 – 31 Aug '12

TABLE 6. IAEA EXPERTS/OTHER MISSIONS (continuation)

FIELD/PURPOSE	NAME OF EXPERT	DATE OF VISIT
Assessing the Development of a Nuclear Power Programme	Resource speakers to the National Workshop: Ahmed Irej Jalal; Fanny Bazile; Juan Jose; Rivas Porter -	
Preparing Plans for an Ion Beam Accelerator Facility for Research, Training, Education and Applications in Nuclear Science and Technology	Aliz Simon Technical Officer	5 – 8 Nov. 2012
Gamma Column Scanning	Siripone Chu-Inta	26 – 30 Nov '12
Safeguards Inspectors	Mazibur Rahman) Melo Moitta	26 – 28 Nov '12
Harmful Algal Bloom (HAB) Project	Michel Warnau, Head, Radioecology Section, Monaco Lab.; Nakamura; Nakagawa	25 – 27 Nov '12
Follow-up Training Courses on Environmental Radioactivity Monitoring and Nuclear and Radiologic Emergency Preparedness Courses	Yukiko Yabuuchi)	3– 4 Dec '12
Building Capacity for the Preparation and Quality of Radiopharmaceuticals for Enhanced Nuclear Medicine Applications	M. Haji-Saeid	11– 13 Dec '12
Using E-beam Technology for Industrial, Environmental and Agricultural Applications,	S.M. Kim - EB Tech Engineer	20– 22 Dec '12

TABLE 7. PNRI HOSTINGS IN 2012

FIELD	PHILIPPINE PARTICIPANT	AGENCY/INSTITUTE	ORGANIZER/S	VENUE	DATE
REGIONAL MEETING					
Initial Project Coordination Meeting of RAS9071 "Establishing a Radioactive Waste Management Infrastructure"	Editha A. Marcelo	PNRI	IAEA	Crowne Plaza Galleria Manila	7 – 11 May '12
First Coordination and Steering Meeting of RAS5063 Project on "Supporting Climate Proofing Rice Production Systems (CRIPS) Based on Nuclear Applications	Roland Rallos Thelma Padolina	PNRI Philrice	IAEA	Crowne Plaza Galleria Manila	14 – 18 May '12
IAEA/RCA Project Coordination Meeting of RAS6063 Project on "Strengthening the Application of Nuclear Medicine in the Management of Cardiovascular Diseases"	Orestes Monzon, MD.	Philippine Heart Center	IAEA	Crowne Plaza Galleria Manila	2 – 6 July '12
RCA-UNDP Project Annual Review	Francis Gerard Estrada, MD	St. Luke's Medical Center	RCARO	Radison Blue Hotel, Cebu City	7 – 8 Nov '12
Asian Nuclear Safety Network Steering Committee Meeting	Corazon C. Bernido Victoria Fe O. Medina	PNRI	IAEA	Richmonde Eastwood Hotel	12 – 16 Nov '12
REGIONAL WORKSHOP/TRAINING COURSE					
2012 FNCA Workshop on Radiation Safety and Radioactive Waste Management	Ma. Visitacion B. Palattao and Editha A. Marcelo	PNRI	NSRA	Crowne Plaza Galleria, Manila	10 – 13 July '12
IAEA/RCA Regional Training Course on Advanced Environmental Isotope Techniques Applicable to Groundwater Studies	Ryan Joseph Aniago; Jennyvi Dayaon; Wendy Lim; Charles Darwin Racadio; Christine Jeiselle Guarino; and Gina Flor Resubal	PNRI Mines & Geosciences Bureau	IAEA	Crowne Plaza Galleria Manila	3 – 7 Dec '12
4th Annual Meeting of Governmental Regulatory Infrastructure (GRI) Topical Group and Regional Workshop on Continuous Improvement of GRI in the Member States Through Self-Assessment	Alan Borrás, Ma. Visitacion B. Palattao, Sylvia Busine, Luzviminda Venida	PNRI	IAEA	Crowne Plaza Galleria Manila	15–19 Oct '13
NATIONAL ACTIVITIES HOSTED					
I-WAVE National Workshop on Hydrogeological Data, Data Compilation and Management and Aquifer Characterization in the Philippines	Soledad S. Castañeda, Rolando Y. Reyes, Lourdes G. Fernandez, Angelito F. Ramos, Raymund J. Sucgang, Norman DS. Mendoza	PNRI		Sulo Hotel, Quezon City	12–16 March '12
Distance Assisted Training for Nuclear Medicine Professional On-Line Workshop	Nuclear Technologists	Philippine Heart Center	Philippine Heart Center	Quezon City	10 – 12 Aug '12
National Workshop on Evaluation of Alternative Energy Strategies and Establishing a National Position on Nuclear Power	Representatives from Congress, DOE, NPC, NEDA, PCIEERD, PCC	PNRI, Congress, DOE, NPC, NEDA, PCIEERD, PCC	IAEA, PNRI, DOE, NPC	PNRI	29–31 Aug '12
National Workshop on the Conduct of Self-Assessment Using IAEA Specific Safety Guide No. 16 (SSG 16): Establishing the Safety Infrastructure for Nuclear Power Program	Representatives from PNRI, DOE, NPC, DOH	PNRI, DOE, NPC, DOH	IAEA and PNRI	PNRI	17–20 Dec '12

Table 8. NON - PNRI HUMAN RESOURCES DEVELOPMENT (Foreign) in 2012

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
TRAINING COURSE					
Regional Training Course for QUATRO Auditors	Mary Ann Genina Reyna, Norberto Abella Jr. and Isagani Mayuga	Jose R Reyes Memorial Medical Center	Indonesia, Jakarta	2 – 6 July '12	IAEA
Regional Training Course on Leadership and Management for Introducing and Expanding Nuclear Power Programs	Froilan A. Tampinco	National Power Corporation	Argonne, Illinois, USA	6–17 Aug '12	IAEA
Regional Training Course on Radiotherapy Techniques with Emphasis on Imaging and Treatment Planning	Raquel Louise G. Munsayac	University of Perpetual Help Medical Center	Beijing, People's Republic of China	3 – 7 Sept '12	IAEA
Technical Training Program on Guralp Equipment for Station Managers	Alex C. Cabrera	Philippine Institute of Volcanology & Seismology	Vienna, Austria	10 – 14 Sept '12	CTBTO
Training Course on Image Based RT for Head and Neck and Breast Cancer	Jake John Galingana and Anthony Albert Abad	Jose R Reyes Memorial Medical Center Lung Center of the Philippines	Mumbai, India	1 – 5 Oct '12	IAEA
Regional Training Course on Molecular Diagnostics for Transboundary Animal Diseases	Rachel Azul	Bureau of Animal Industry	Lanzhou, China	15 – 19 Oct '12	IAEA
Regional Training Course on Quality Assurance in Radiotherapy	Kathleen Baldivia Marivic Bacaling	Makati Medical Center Lung Center of the Philippines	Bangkok, Thailand	19 – 23 Oct '12	IAEA
Regional Training Course on Quality Reporting of Hybrid Imaging Procedures (SPECT and PET/CT) in Oncology	Patricia A. Bautista	St. Luke's Medical Center	Melbourne, Australia	19 – 23 Nov '12	IAEA
Regional Training Course on Stereotactic Body Radiotherapy: Basic Concepts and Early Implementation	Maria Lourdes Lacanilao and Joseph Michael Nepomuceno	Davao Doctors Hospital	Singapore	3 – 7 Dec '12	IAEA
Regional Training Course on Imaging in Ischemic Heart Disease and Cardiac Failure	Joe Ryan Agga	University of Sto. Tomas Hospital	Yangon, Myanmar	10 – 14 Dec '12	IAEA
Training Course on Basic Concepts of 3D Image-Guided Brachytherapy for Cervical Cancer	Mary Ann Genina Reyna Kathleen Jane Cortez	Jose R Reyes Memorial Medical Center St. Luke's Medical Center	Mumbai, India	10 – 14 Dec '12	IAEA
WORKSHOP / SEMINAR					
Regional Workshop on Radiological Crime Scene Management and Introduction to Nuclear Forensics	Sonia S. Cayrel Liz Ann S. Succang	Philippine National Police	Canberra, Australia	19 – 23 March '12	IAEA
ANSN Regional Workshop on Site Evaluation and Safety Improvement Focusing on Post Fukushima Nuclear Power Plant Accident Actions	Edmundo Vargas Roy Anthony Luna	University of the Philippines (UP) – National Institute of Geological Sciences UP – Institute of Civil Engineering	Republic of Korea	11 – 15 June '12	IAEA
Comprehensive Nuclear Ban Treaty Organization (CTBTO) East Asia Regional National Data Center Workshop	Baby Jane Punongbayan	Philippine Institute of Volcanology and Seismology	Tokyo, Japan	30 Oct – 1 Nov '12	CTBTO
Workshop on Operational Coordination for Effective Response to Border Monitoring of Nuclear and Other Radioactive Materials for ASEAN Countries	Armando V. Razon	Philippine Ports Authority	Vienna, Austria	7 – 9 Nov '12	IAEA
Second South East Asia Regional Workshop on Radioactive Source Security for Industrial Radiography and Well Logging Practices	James Serafin Allan Porter, Jr. Crispin Leyva Noime Manalo	FILCONFAB Incorporated Construction and Drilling Specialist, Inc. Industrial Inspections, Inc.	Putrajaya, Malaysia	3 – 6 Dec '12	DFAIT, Canada
Regional Workshop on Building a National Position on a New Nuclear Power Program	Efren T. Cortez Bernie Justimbaste	House of Representatives DOST	Bangkok, Thailand	11 - 14 Dec '12	IAEA
MEETING					
First Coordination Meeting of the Project entitled "On Supporting Decision Making for Nuclear Power Planning and Development"	Salvador Sarmiento Jr.	National Power Corporation	Beijing, China	8 – 10 May '12	IAEA
First Coordination Meeting of the Project entitled "Supporting Early Warning, Response and Control of Transboundary Animal Diseases"	Emelinda L. Lopez	Bureau of Animal Industry	Lanzhou, China	3 – 6 July '12	IAEA

Table 8. NON - PNRI HUMAN RESOURCES DEVELOPMENT (Foreign) in 2012 (continuation)

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
MEETING					
Regional Coordination Meeting of the Project entitled "Strengthening Nuclear Medicine and Diagnostic and Therapeutic Applications in Oncology in the Asia Region"	Jerry Obaldo	Philippine General Hospital	Ulaanbaatar, Mongolia	23 – 27 July '12	IAEA
Planning Meeting of the Project entitled "Supporting 3D Image-Guided Brachytherapy Services"	Miriam Joy Calaguas	Jose R Reyes Memorial Medical Center	Hidaka, Saitama, Japan	27 – 30 Aug '12	IAEA
Regional Executive Meeting for Policy-Makers and End-Users on Green Radiation Technology Processing for Agricultural, Environmental and Industrial Applications	Rodolfo Ilao	Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development	Ho Chi Min City, Vietnam	27 – 31 Aug 12	IAEA
	Gil Magsino	Megamanila Pest Management Specialist Inc.			
Meeting on Raising Awareness for the Medical Physics Profession	Lilian V. Roriguez	Jose R Reyes Memorial Medical Center	Vienna, Austria	29 Oct - 1 Nov '12	IAEA
Regional Meeting on Successful Launching of Nuclear Power Programme	Antonio A. Orquia	National Power Corporation	Seoul, Republic of Korea	29 Oct – 9 Nov '12	IAEA
Mid-term Project Review Meeting of RAS 6053 entitled Improvement of Image Based Radiation Therapy for Common Cancers in the RCA Region	Nonnete Cupino	University of the Philippines-Philippine General Hospital	Kuala Lumpur, Malaysia	26 – 29 Nov '12	IAEA
Technical Meeting on Underground Research Laboratories for Geological Disposal of High-Level Waste	Carlo Arcilla	University of the Philippines-National Institute of Geological Sciences	Albuquerque, USA	3 – 7 Dec '12	IAEA
Project Design Meeting for Two Regional Projects in Nutrition (2014-2015) entitled "Providing Pre-Project Assistance"	Trinidad Trinidad Aida Mallillin	Food and Nutrition Research Institute	Vienna, Austria	17 – 20 Dec '12	IAEA
SYMPOSIUM/CONFERENCE					
13 th International Symposium on Biological and Environmental Reference Materials	Ma. Fatima A. Molina	Environmental Management Bureau	Vienna, Austria	25 – 29 June '12	IAEA
	Teresita R. Portugal	Food and Nutrition Research Institute			
International Conference on the Safe and Secure Transport of Radioactive Materials	Dante Lantin	Department of Transportation and Communication	Vienna, Austria	17 – 21 Oct '12	IAEA
13 th Forum for Nuclear Cooperation in Asia (FNCA) Ministerial Level Meeting and Senior Official Meeting	Carol Yorobe	Department of Science and Technology	Jakarta, Indonesia	23 – 24 Nov '12	Cabinet Office of Japan
SCIENTIFIC VISIT					
Assessing the Development of a Nuclear Power Programme	Raymund Liboro	Science and Technology Information Institute	Vienna, Austria	8 – 11 Oct '12	IAEA
Radiation Protection in Diagnostic and Interventional Radiology	Bayani San Juan	Bureau of Health and Devices and Technology	Udine, Italy	7 – 13 Nov '12	IAEA

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012

FIELD	NAME	PLACE	DURATION	SPONSOR
ON-THE-JOB-TRAINING				
Marine Environment and Coastal Zone Management	Rhett Simon Dc. Tabbada	Papeete, Tahiti, French Polynesia	9 May – 8 June '12	IAEA
Fellowship Training in the Field of Radiation Processing Facilities and Applications	Ma. Llorina O. Rañada	Ankara, Turkey	1 March – 30 June '12	IAEA
Fellowship Training in the Field of Radiation Processing Facilities and Applications	Celia O. Asaad	Texas, USA	1 April – 30 June '12	IAEA
Hands on Training in Nuclear Forensics Core Capabilities	Wendy G. Lim and Charles Darwin T. Racadio	Karlsruhe, Germany	16 – 20 April '12	Joint Research Centre, European Commission
Fellowship Training in the Field of Radiation Processing Facilities and Applications	Gonzalo G. Madera	Port Coquitlam, British Columbia, Canada	2 May – 1 July '12	IAEA
Fellowship Training under the project entitled "Setting-Up of a Facility for the Production of Molybdenum-99/ Technetium-99m Generators"	Paolo Tristan F. Cruz	Dhaka, Bangladesh	3 June – 2 Aug '12	IAEA
Group Fellowship Training on Agricultural Water Management to Support Crop Production in Asia and the Pacific	Faye G. Rivera	Seibersdorf, Vienna Austria	23 July – 17 Aug '12	IAEA

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012 (continuation)

FIELD	NAME	PLACE	DURATION	SPONSOR
REGIONAL/INTERREGIONAL TRAINING COURSE				
Capacity Building for Enhanced Gamma Scanning of Industrial Process Columns	Denis D. Aquino Janice P. Mallillin Ramoncito F. Sulit	Bangkok, Thailand	20 – 24 Feb '12	IAEA
Nuclear Facility Decommissioning and Environmental Remediation Skills	Lorna Jean H. Palad	Illinois, USA	16 – 27 April '12	IAEA
Radiation Emergency Consequence Management	Maria Teresa A. Salabit	Vienna, Austria	21 – 25 May '12	IAEA
Introduction to Nuclear Forensics Training Course	Rolando Y. Reyes	Tokai-Mura, Japan	22 – 24 May '12	IAEA
Operation and Maintenance for IMS Radionuclide Station Managers	Teofilo Y. Garcia	Vienna, Austria	18 – 21 June '12	CTBTO
8 th Annual World Nuclear University (WNU) Summer Institute	Kristine Marie D. Romallosa	Oxford, United Kingdom	7 July – 18 Aug '12	IAEA
Advanced Training Course on Marine Radioactivity: Analytical Techniques and Quality Management	Ryan Joseph Aniago	Karlsruhe, Germany	9 – 20 July '12	IAEA
Nuclear Power Plants Site Regulatory Requirements and Licensing	Carl M. Nohay	Rome, Italy	14 – 22 July '12	EU
Instructor Training Course on Reactor Engineering I	Alvie J. Asuncion	Tokai, Japan	20 Aug – 12 Oct '12	IAEA
Safety Evaluation for Radioactive Waste Management and Decommissioning	Mary Rose Q. Mundo	Rome, Italy	17 – 28 Sept '12	EU
Security of Nuclear Research Reactors	Sylvia S. Busine	Jakarta, Indonesia	8 – 12 Oct '12	IAEA
Effective and Sustainable Regulatory Control of Radiation Sources	Teofilo V. Leonin Jr. Edgar C. Racho	Jakarta, Indonesia	15 – 19 Oct '12	IAEA
Technical Training Programme for Radionuclide Station Operators on Canberra Equipment	Teofilo Y. Garcia	Meriden, U.S.A	16 – 18 Oct '12	CTBTO
Application of Digital Radiography & Computed Tomography to Metal, Automotive, Aviation, Oil and Chemical Industries	Andrew C. Barrida	Daejeon, Republic of Korea	22 – 26 Oct '12	IAEA
Reducing the Risks from Indoor Radon: Establishing a National Radon Strategy	Fe M. Dela Cruz Norman Ds. Mendoza	Jakarta, Indonesia	29 Oct '11 – 2 Nov '12	IAEA
Application of Molecular Markers to Mutation Breeding Programme with Focus on Traits Contributing to Better Adaptation	Arvin O. Dimaano	Perth, Australia	5–9 Nov '12	IAEA/RCA
Integrated Management Systems and Development of Safety Culture	Ma. Celerina M. Ramiro	Argonne, Illinois, USA	5–16 Nov '12	IAEA
Uranium Deposit Models and Exploration	Charles Darwin T. Racadio	Beijing, China	12–16 Nov '12	IAEA
Assessment of Radiological Risks at the Basic Level	Rosario R. Encabo Juanario U. Olivares	Bangkok, Thailand	12–23 Nov '12	IAEA
Ageing and Mechanical Analysis	Carl M. Nohay	Cologne, Germany	19–23 Nov '12	ENSTTI
Application of Stable Isotopes (Carbon-13, Nitrogen-15 and Oxygen-18) and Trace Elements as Tracers of Biogeochemical Change in the Marine Environment	Efren J. Sta Maria Norman DS. Mendoza	Wellampitiya, Sri Lanka	21 – 30 Nov '12	IAEA
Quality Assurance of Fingerprint and Source Apportionment Data	Preciosa Corazon B. Pabroa Joseph Michael D. Racho	Yogyakarta, Indonesia	26 – 30 Nov '12	IAEA
Nuclear Power Plant Safety Training Module II	John Richard A. Fernandez	France	26–30 Nov '12	ENSTTI
Reactor Safety Training Module I	Joseph R. Tugo	Italy	26–30 Nov '12	ENSTTI
Atomic Table-Top Exercise	Cecilia M. De Vera	Netherlands	27–29 Nov '12	Ministry of Security and Justice of the Netherlands
Development Cooperation-Europe Aid (DEVCO) Training Course on Fire Protection	Renato T. Bañaga	Cologne, Germany	3–7 Dec '12	DEVCO
Regional Training Course on Monte Carlo Simulation for CT, RTP, SPECT and Design of Radiotracer Experiments	Denis Aquino Janice Mallillin	Daejeon, Republic Of Korea	3–7 Dec '12	IAEA
Interregional Training Course on Uranium Production from Phosphate Rocks	Wendy G. Lim Estrellita U. Tabora	Amman, Jordan	10–14 Dec '12	IAEA
REGIONAL/INTERREGIONAL SEMINAR/WORKSHOP				
Nuclear Safety Seminar: Site Location of Reactor Facility Course	Angelito F. Ramos Alfonso A. Singayan	Tokai, Japan	16 – 20 Jan '12	IAEA
Short-term Seminar on the Fukushima Nuclear Accident	Victoria Fe O. Medina	Japan	12 – 18 Feb '12	Government of Japan
Forum for Nuclear Cooperation in Asia Workshop on Mutation Breeding Project	Adelaida C. Barrida	Bangkok, Thailand	20–23 Feb '12	MEXT of Japan
Forum for Nuclear Cooperation in Asia Workshop on Nuclear Security and Safeguards Project	Julietta E. Seguis Nelson P. Badinas	Tokai, Japan	22 – 24 Feb '12	MEXT of Japan

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012 (continuation)

FIELD	NAME	PLACE	DURATION	SPONSOR
REGIONAL/INTERREGIONAL SEMINAR/WORKSHOP				
Seminar on Nuclear Power Generation Infrastructure for Improving Emergency Preparedness	Graceta Dl. Cuevas Estrella S. Caseria Cecilia M. De Vera Ryan Joseph Aniago	Tokai, Japan	27 Feb – 2 March '12	JAIF and JICC
Waste Safety Practices and Establishing Regulations for Near-Surface Disposal (Part 2)	Luzviminda L. Venida Jose N. Calaycay	Jakarta, Indonesia	5 – 9 March '12	IAEA
Considerations of Human Factors in Different Phases of Research Reactor Lifetime	Thelma A. Artificio	Vienna, Austria	12 – 16 March '12	IAEA
Establishment and Maintenance of the Radiation Monitoring Information System	Teofilo Y. Garcia	Vienna, Austria	19 – 21 March '12	IAEA
Radiological Crime Scene Management	Paolo Tristan F. Cruz	Canberra, Australia	19 – 23 March '12	IAEA
Safety Analysis Practice and Exercise Using Computer Codes for In-Depth Understanding of the Loss of Coolant Accident (LOCA) and Modelling of LOCA Test	Alfonso A. Singayan Giuseppe Filam O. Dean Joseph R. Tugo	Daejeon, Republic of Korea	9 – 13 April '12	IAEA
Basic Professional Training in Nuclear Safety	Roel A. Loterina Eileen Beth A. Hernandez Romelda P. Azores	Daejeon, Republic of Korea	9 – 20 April '12	IAEA & KINS
International Additional Protocol (AP) Workshops	Julietta E. Seguis Nelson P. Badinas	Illinois & New York, USA	16 – 20 April & 23 – 27 April '12	INSEP of the DOE/ NNSA
IAEA General Safety Requirements Part 3: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards	Thelma A. Artificio	Kuala Lumpur, Malaysia	17 – 20 April '12	IAEA
International Workshop on Nuclear Energy and Nuclear Safety	Vangelina K. Parami	Singapore	20 April '12	Konrad Adenauer Foundation Singapore
International Seminar on the Essential Elements of Nuclear Security	Vangelina K. Parami	Illinois, U.S.A.	30 April – 11 May '12	IAEA
Preparation for Conducting Decommissioning Action	John M. Marquez	Sydney, Australia	7 – 11 May '12	IAEA
Asian Nuclear Safety Network (ANSN) Regional Workshop on Emergency Preparedness and Response	Teofilo V. Leonin, Jr. Mary Rose Q. Mundo	Jakarta, Indonesia	21 – 25 May '12	IAEA
Regulatory Control of Nuclear Power Plants	Vangelina K. Parami Lynette B. Cayabo Teresita G. De Jesus	Daejeon, Republic of Korea	21 – 25 May '11	IAEA & KINS
Safety Case and Safety Assessment on Predisposal Facilities	Abelardo A. Inovero	Hanoi, Vietnam	28 May – 1 June '12	IAEA
Fukushima Lessons Learned: Detailed Scientific and Engineering Review Workshop	Alumanda M. Dela Rosa	Vienna, Austria	14 – 15 June '12	PNNL of USA
Additional Protocol and Human Capital Development in Safeguards	Julietta E. Seguis	Hanoi, Vietnam	18 – 19 June '12	INSEP – DOE/NNSA
Special On-The-Job Training Workshop for Nuclear Power Plant (NPP) Newcomers	Thelma P. Artificio Luzviminda L. Venida	Daejeon, Republic of Korea	21 – 29 June '12	IAEA
Highlights and Lessons Learned from EPREV (Emergency Preparedness Review) Missions	Teofilo V. Leonin, Jr.	Vienna, Austria	25 – 29 June '12	IAEA
Practice and Experience of Safety Analysis Licensing Review and Exercise using Computer Codes	Giuseppe Filam O. Dean Joseph R. Tugo	Bangkok, Thailand	9 – 13 July '12	IAEA
Providing Decision Support for Nuclear Power Planning and Development	Christina A. Petrache	Hokkaido, Japan	9 – 20 July '12	IAEA
Implementation of Nuclear Security Legal Instruments	Julietta E. Seguis	Dengkil, Malaysia	28 – 29 Aug '12	Canadian Initiative Project
Nanotechnology Applications for Boosting Agricultural Productivity	Lucille V. Abad	Yilan City, People's Republic of China	3 – 7 Sept '12	APO of Japan & the Council of Agriculture, Executive Yuan and China Productivity Center
Nuclear Safety Tailored for Regulators	Romelda P. Azores	Daejeon, Republic of Korea	3 – 14 Sept '12	IAEA & KINS
Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Human Resources Development	Corazon C. Bernido	Shenzen, China	12 – 14 Sept '12	Japanese Government
National Data Center Evaluation Workshop	Ana Elena L. Conjares	Asuncion, Paraguay	1 – 5 Oct '12	CTBTO
Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Radiation Processing Application for Natural Polymers	Charito T. Aranilla	Almaty, Republic of Kazakhstan	2 – 5 Oct '12	MEXT of Japan
Development of the National Policy on Human Resources Development to Embark on Nuclear Power Programme	Corazon C. Bernido	Vienna, Austria	8 – 12 Oct '12	IAEA
RCARO/KAERI Regional Workshop on Radiation Application Technology	Levelyn M. Tolentino	Daejeon, Republic of Korea	8 – 19 Oct '12	KAERI

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012 (continuation)

FIELD	NAME	PLACE	DURATION	SPONSOR
REGIONAL/INTERREGIONAL SEMINAR/WORKSHOP				
Interregional IAEA-CYTED-UNECE Workshop on Recent Developments in Evaluation of Uranium and Thorium Resources	Rolando Y. Reyes	Lisbon, Portugal	15 – 18 Oct '12	IAEA
Occupational Radiation Protection (ORP) Due to Intakes of Radionuclides	Estrella S. Caseria	Kajang, Malaysia	15 – 19 Oct '12	IAEA
Marine Environment and Monitoring Techniques in the South China Sea	Eliza B. Enriquez	Xiamen, China	16 – 18 Oct '12	Third Institute of Oceanography, State Oceanic Administration of China
Practical Experience for Nuclear Power Plant Construction Phase	Rosalino B. Rejas Giuseppe Filam O. Dean	Beijing, China	17 – 23 Oct '12	IAEA
Best Practice for Phytosanitary Applications of Food Irradiation	Zenaida M. De Guzman	Jeongeup, Republic of Korea	22 – 26 Oct '12	IAEA
Nuclear Safety Seminar: Reactor Plant Safety Course	Raymond P. Beredo	Tsuruga, Japan	22 Oct – 16 Nov '12	WERC
Forum for Nuclear Cooperation in Asia (FNCA) Safety Management Systems Project: Peer Review and Workshop	Renato T. Bañaga	Daejeon, Republic of Korea	29 Oct – 2 Nov '12	ANSTO
CTBTO East Asia Regional National Data Center (NDC) Workshop	Ana Elena L. Conjares	Tokyo, Japan	30 Oct – 1 Nov '12	CTBTO
International Physical Protection Advisory Services (IPPAS)	Sylvia S. Busine	Sydney, Australia	5 – 7 Nov '12	IAEA
Clearance of Decommissioning Waste – Part 1	Maria Visitacion B. Palattao Editha A. Marcelo Estrella S. Caseria	Bangkok, Thailand	5 – 9 Nov '12	IAEA
Communication and Consultation with the Interested Parties	Victoria Fe O. Medina Rhodora R. Leonin	Daejeon, Republic of Korea	5 – 9 Nov '12	IAEA
Regional Workshop on Leadership and Management for Safety (LMS) for Regulatory Bodies	Alan M. Borrás Cecilia M. De Vera	Daejeon, Republic of Korea	5 – 9 Nov '12	IAEA
Operational Coordination For Effective Response to Border Monitoring of Nuclear and Other Radioactive Materials for ASEAN Countries	Julietta E. Seguis	Vienna, Austria	7 – 9 Nov '12	IAEA
Research Reactor Network	Neil Raymund D. Guillermo	Serpong, Indonesia	19 – 22 Nov '12	FNCA
ASEAN National Data Center Development Workshop	Paolo Tristan F. Cruz	Chiang Mai, Thailand	26 – 28 Nov '12	CTBTO
Workshop on the Regulatory Authority Information System (RAIS)	Ana Elena L. Conjares	Vienna, Austria	26 – 30 Nov '12	IAEA
Nuclear Safety Seminar: Basic Knowledge on Radiation and Emergency Medicine for School Education Course	Gloriamaris L. Caraos	Ibaraki, Japan	26 Nov – 7 Dec '12	JAEA
Nuclear Safety Seminar: Nuclear Energy Administration Course	Brenda L. Pineda	Tsuruga, Japan	26 Nov–14 Dec '12	WERC
Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Neutron Activation Analysis	Raymund J. Sucgang	Hanoi, Vietnam	27 – 30 Nov '12	Japanese Government
Regional Workshop on Implementation of Capacity Building IT Modules	Victoria Fe O. Medina	Daejeon, Republic of Korea	28 – 30 Nov '12	IAEA
8 th International Workshop on Ionizing Radiation Monitoring	Teofilo Y. Garcia	Fukushima City, Japan	1 – 2 Dec '12	Government of Japan
Second South East Asia Regional Workshop on Radioactive Source Security for Industrial Radiography and Well Logging Practices	Teofilo V. Leonin, Jr. Alan M. Borrás	Putrajaya, Malaysia	3 – 6 Dec '12	DFAIT of Canada
Decommissioning Project Management and Dismantling Exercise	Lopito A. Caluag	Buffalo, New York, USA	3 – 7 Dec '12	IAEA
ICTP Workshop on Entrepreneurship for Physicists and Engineers from Developing Countries	Elina Salvacion Kristina V. Ramo	Jakarta, Indonesia	3–7 Dec '12	Indonesian Government through BATAN
Notification, Reporting and Requesting Assistance	Mary Rose Q. Mundo	Singapore	4 – 6 Dec '12	IAEA
Use of a Graded Approach in the Application of Safety Requirements for Research Reactors	Edgar G. Racho Thelma P. Artificio Jan Aldrich A. Agustin	Hanoi, Vietnam	10–14 Dec '12	IAEA
Extrapolation of Soil Fallout Radionuclides	Ryan U. Olivares	Beijing, China	10 – 21 Dec '12	IAEA
Nuclear Security Infrastructure Awareness for Senior Officials	Sylvia S. Busine	Kuala Lumpur, Malaysia	17–19 Dec '12	IAEA
Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Nuclear Security and Safeguards Project	Julietta E. Seguis	Hanoi, Vietnam	18 – 21 Dec '12	Government of Japan
MEETING				
Global Initiative to Combat Nuclear Terrorism (GICNT) Implementation and Assessment Group Meeting	Julietta E. Seguis	Marrakech, Morocco	13 – 16 Feb '12	US Dep't. of State, Office of Weapons of Mass Destruction Terrorism

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012 (continuation)

FIELD	NAME	PLACE	DURATION	SPONSOR
MEETING				
Regional Coordination Meeting (Strengthening National and Regional Capabilities for Response to Radiological and Nuclear Emergencies)	Teofilo V. Leonin, Jr.	Kuwait City, Kuwait	13 – 16 Feb '12	IAEA
Asia and the Pacific National Liaison Officers Meeting	Alumanda M. Dela Rosa Nydia C. Medina	Vienna, Austria	21 – 24 Feb '12	IAEA
Final Progress Review Meeting of the Project RAS/81110 entitled "Application of Advanced Industrial Radiography and Tomography in Industry and Civil Engineering"	Renato T. Bañaga	Shanghai, China	27 Feb – 2 March '12	IAEA
Meeting on Transparency, Openness and Involvement of the Public and Stakeholders in the Regulatory Process	Teofilo V. Leonin, Jr. Alan M. Borrás	Vienna, Austria	5 – 9 March '12	IAEA
13 th Forum for Nuclear Cooperation in Asia (FNCA) Coordinators Meeting	Alumanda M. Dela Rosa	Fukui, Japan	7 – 9 March '12	Cabinet Office of Japan (CAO)
Consultancy Meeting to Develop Terms of Reference (TOR) of the Newly- Established Topical Group on the Management System for the Regulatory Body (MSRBGT)	Victoria Fe O. Medina	Vienna, Austria	8 – 9 March '12	IAEA
Consultancy Meeting to Prepare Draft Terms of Reference (ToR) of the Topical Group on Public Communication	Victoria Fe O. Medina	Vienna, Austria	12 – 13 March '12	IAEA
Technical Meeting on Strengthening of Biological Dosimetry in IAEA Member States: Improvement of Current Techniques and Intensification of Collaboration and Networking Among Different Institutes	Celia O. Asaad	Vienna, Austria	21 – 23 March '12	IAEA
Final Progress Review Meeting of the RAS 5050 Project entitled "Irradiation of Enhanced Sanitary and Phytosanitary Treatment of Regional Products for Exports" and Planning Meeting of RAS 5057 Project entitled "Implementing Best Practices of Food Irradiation for Sanitary and Phytosanitary Purposes"	Zenaida M. De Guzman	Hanoi, Vietnam	26 – 30 March '12	IAEA
Project Planning and Coordination Meeting of RAS 5056 entitled "Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change"	Roland V. Rallos	Vienna, Austria	10 – 13 April '12	IAEA
15 th Asian Nuclear Safety Network (ANSN) Steering Committee (SC) Meeting	Corazon C. Bernido	Vienna, Austria	11 – 13 April '12	IAEA
34 th Meeting of National Representatives of the Regional Cooperative Agreement for Research Development and Training in Nuclear Science and Technology for Asia and the Pacific Region (RCA)	Alumanda M. Dela Rosa	Beijing, China	17 – 20 April '12	Philippine Government
Meeting of the RCA Chairs and Meeting of the Standing Advisory Committee (SAC) of the RCA Regional Office	Alumanda M. Dela Rosa	Beijing, China	16 April '12	Philippine Government
RAS 9059 Regional Meeting on Nuclear Power Safety Levels	Teofilo V. Leonin, Jr. Alan M. Borrás	Vienna, Austria	7 – 9 May '12	IAEA
Annual Meeting of the Asian Nuclear Safety Network (ANSN) Emergency Preparedness and Response Topical Group (EPRTG)	Teofilo V. Leonin, Jr. Mary Rose Q. Mundo	Jakarta, Indonesia	21 – 25 May '12	IAEA
9 th IT Support Group Meeting	Christopher G. Halnin	Bali, Indonesia	11 – 13 June '12	IAEA
First Meeting of the Nuclear Security Guidance Committee	Julietta E. Seguis	Vienna, Austria	12 – 14 June '12	IAEA
International Expert's Meeting on Enhancing Transparency and Communication Effectiveness in the Event of a Nuclear or Radiological Emergency	Alumanda M. Dela Rosa	Vienna, Austria	18 – 20 June '12	IAEA
First Coordination Meeting of the RAS/5064 Project entitled "Enhancing Productivity of Locally Underused Crops Through Dissemination of Mutated Germplasm and Evaluation of Soil, Nutrient and Water Management Practices	Adelaida C. Barrida	Kajang, Malaysia	18 – 22 June '12	IAEA
Technical Meeting on Network of Training and Demonstration of Waste Disposal Technologies in International Low Level Waste Disposal (DISPONET)	Maria Visitacion B. Pallatao	Soulaines-Dhuys, France	26 – 28 June '12	IAEA
Training Meeting on Interaction Between Technical and Social Aspects for Waste Disposal Programmes	Maria Visitacion B. Pallatao	Istanbul, Turkey	2 – 5 July '12	IAEA
4 th International Meeting on Next Generation Safeguards: Implementing Comprehensive Safeguards Agreements and Additional Protocols	Julietta E. Seguis	Hanoi, Vietnam	3 – 5 July '12	IAEA DOE/NNSA
Project Planning Meeting of RAS 7023 entitled "Supporting Sustainable Air Pollution Monitoring Using Nuclear Analytical Technology"	Preciosa Corazon B. Pabroa	Kajang, Malaysia	9 – 13 July '12	IAEA
Annual Meeting of the Safety Analysis Topical Group (SATG)	Giuseppe Filam O. Dean Joseph R. Tugo	Bangkok, Thailand	9 – 13 July '12	IAEA
Initial Project Planning Meeting of RAS 7022 entitled "Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resources Management"	Soledad S. Castañeda	Vienna, Austria	16 – 19 July '12	IAEA

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012 (continuation)

FIELD	NAME	PLACE	DURATION	SPONSOR
MEETING				
Project Planning Meeting of RAS/1012 entitled "Characterizing and Optimizing Process Dynamics in Complex Industrial Systems Using Radiotracer and Sealed Source Techniques"	Denis D. Aquino	Jeju City, Republic of Korea	16 – 20 July '12	IAEA
Meeting of the Points of Contact for the IAEA Illicit Trafficking Database (ITB) Programme	Alumanda M. Dela Rosa	Vienna, Austria	24 – 26 July '12	IAEA
4 th Study Panel Meeting on the Approaches Towards Infrastructure Development for Nuclear Power	Corazon C. Bernido Teofilo V. Leonin, Jr.	Bangkok, Thailand	26 – 27 July '12	Cabinet Office of Japan (CAO)
Annual Project Review Meeting of RAS7021 on "Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia Pacific Region"	Eliza B. Enriquez	Dalat, Vietnam	6 – 10 Aug '12	IAEA/RCA
First Coordination Meeting of the Project RAS 5062 entitled "Building Technological Capacity for Food Traceability and Food Safety Control Systems Through the Use of Nuclear Analytical Techniques"	Preciosa Corazon B. Pabroa	Fuzhou, China	7 – 10 Aug '12	IAEA
Consultative Meeting for the Project on "Mutant Variety Development for Rice Through Gamma Irradiation"	Adelaida C. Barrida	Suwon, Republic of Korea	20 – 29 Aug '12	RDA & PCAARRD-DOST
Project Planning Meeting of RAS 7024 entitled "Supporting Nuclear and Isotopic Techniques to Assess Climate Change Impact for Sustainable Marine Ecosystems Management"	Adelina DM. Bulos	Vienna, Austria	21 – 24 ????	IAEA
First Coordination Meeting of the Project RAS 5055 entitled "Improving Soil Fertility, Land Productivity and Land Degradation Mitigation"	Adelina DM. Bulos	Colombo, Sri Lanka	27 – 31 Aug '12	IAEA
Meeting with the Office of Nuclear Security	Julietta E. Seguis	Vienna, Austria	17 –21 Sept '12	IAEA
Bilateral Meeting with the Technical Cooperation Dep't	Alumanda M. Dela Rosa	Vienna, Austria	19 Sept '12	IAEA
Senior Regulators' Meeting	Alumanda M. Dela Rosa Julietta E. Seguis	Vienna, Austria	20 Sept '12	IAEA
Meeting with the Director, Office of Nuclear Security	Alumanda M. Dela Rosa	Vienna, Austria	21 Sept '12	IAEA
Technical Meeting to Discuss Human Intrusion and Future Human Actions in Relation to Disposal of Radioactive Waste	Maria Visitacion B. Palattao	Vienna, Austria	24 –28 Sept '12	IAEA
Technical Meeting on the New Dose Limits for the Lens of the Eye – Implications and Implementations	Thelma A. Artificio	Vienna, Austria	2 – 4 Oct '12	IAEA
Annual Meeting of the ANSN Education and Training Topical Group	Dr. Corazon C. Bernido	Vienna, Austria	8 – 12 Oct '12	IAEA
3 rd Plenary Meeting of the Asia Pacific Safeguards Network (APSN)	Alumanda M. Dela Rosa Julietta E. Seguis	Bangkok, Thailand	29 – 31 Oct '12	NNSA /DOE
Meeting for National Centre Websites	Christopher G. Halnin	Tokyo, Japan	1–2 Nov '12	IAEA
Final Progress Review Meeting of RAS/8/109 entitled "Supporting Radiation Processing of Polymeric Materials for Agricultural Application and Environmental Remediation" combined with the Project Planning Meeting of RAS/1/014 entitled "Supporting Radiation Processing for the Development of Advanced Grafted Materials for Industrial Applications and Environmental Preservation"	Dr. Lucille V. Abad	Jakarta, Indonesia	5–9 Nov '12	IAEA
Annual Meeting of the ANSN Radioactive Waste Management Topical Group	Maria Visitacion B. Palattao Editha A. Marcelo	Bangkok, Thailand	5 – 9 Nov '12	IAEA
Annual Meeting of the ANSN Communication Topical Group	Victoria Fe O. Medina Rhodora R. Leonin	Daejeon, Republic of Korea	5 – 9 Nov '12	IAEA
Plenary Meeting of the Network on Environmental Management and Remediation (ENVIRONET)	Vangelina K. Parami	Vienna, Austria	6 –8 Nov '12	IAEA
1 st Annual Meeting of the ANSN Leadership and Management for Safety (LMS) Topical Group	Alan M. Borrás Cecilia M. De Vera	Daejeon, Republic of Korea	5 – 9 Nov '12	IAEA
16 th Meeting of the United States Council for Security Cooperation in the Asia Pacific (CSCAP) Study Group on Countering the Proliferation of Weapons of Mass Destruction in the Asia Pacific	Alumanda M. Dela Rosa	Ho Chi Minh City, Vietnam	6 – 8 Nov '12	USCSCAP
1 st Meeting of the Nuclear Energy Experts Group (NEEG) in the Asia Pacific	Alumanda M. Dela Rosa	Ho Chi Minh City, Vietnam	9 – 10 Nov '12	USCSCAP
Technical Meeting for Review of the Draft Safety Requirements in Emergency Preparedness and Response	Teofilo V. Leonin, Jr.	Vienna, Austria	12 – 16 Nov '12	IAEA
Technical Meeting of the Radioactive Sources Working Group	Julietta E. Seguis	Vienna, Austria	13 – 15 Nov '12	IAEA
Consultants Meeting on "Lessons Learned in the Area of Stakeholder Dialogue to Strengthen National Competencies for Radioactive Waste Disposal"	Rhodora R. Leonin	Warsaw, Poland	19 – 23 Nov '12	IAEA
13 th Forum for Nuclear Cooperation in Asia (FNCA) Ministerial Level Meeting and Senior Official Meeting	Alumanda M. Dela Rosa	Jakarta, Indonesia	23 – 24 Nov '12	Cabinet Office of Japan (CAO)
Consultancy Meeting on the Drafting of a Technical Manual on "Dismantling of Ionic Smoke Detectors and Conditioning of Associated Radioactive Sources"	Editha A. Marcelo	Vienna, Austria	3 – 7 Dec '12	IAEA

TABLE 9. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2012 (continuation)

FIELD	NAME	PLACE	DURATION	SPONSOR
MEETING				
Meeting for Supporting Nuclear Education and Training through E-Learning	Corazon C. Bernido	Vienna, Austria	10 – 13 Dec '12	IAEA
2 nd Meeting of the Nuclear Security Guidance Committee)	Julietta E. Seguis	Vienna, Austria	10 – 14 Dec '12	IAEA
Technical Meeting on Implementation of the IAEA's Self-Assessment Methodology and Tools	Alan M. Borras	Vienna, Austria	17 – 20 Dec '12	IAEA
CONFERENCE/CONGRESS/SYMPOSIUM/FORUM/SUMMIT				
International Conference on Human Resources Development in Asia and the Pacific	Percedita T. Cansino	Bangkok, Thailand	27 – 28 Feb '12	IAEA
Seoul Nuclear Security Symposium	Alumanda M. Dela Rosa	Seoul, Republic of Korea	23 March '12	KINNC
Second Nuclear Security Summit	Alumanda M. Dela Rosa Julietta E. Seguis	Seoul, Republic of Korea	26 – 27 March '12	Phil. Government – DOST GIA Project US GTRI Project
FAO/IAEA International Symposium on Managing Soils for Food Security & Climate Change Adaptation and Mitigation	Adelina DM. Bulos	Vienna, Austria	23 – 27 July '12	IAEA
41 st Regional Cooperative Agreement (RCA) General Conference	Alumanda M. Dela Rosa	Vienna, Austria	14 Sept '12	IAEA
RCA Panel Discussion	Alumanda M. Dela Rosa	Vienna, Austria	17– 18 Sept '12	IAEA
56 th Regular Session of IAEA General Conference	Alumanda M. Dela Rosa Julietta E. Seguis	Vienna, Austria	17– 21 Sept '12	IAEA
IAEA Forum on Water Availability Enhancement Project (IWAVE)	Dr. Alumanda M. Dela Rosa	Vienna, Austria	20 Sept '12	IAEA
A & WMA Visibility Specialty Conference: Aerosol and Atmospheric Optics: Visibility and Air Pollution	Angel T. Bautista Vii	Montana, USA	24– 28 Sept '12	Institute for a Sustainable Environment at Clarkson University, New York
Fukushima Ministerial Conference on Nuclear Safety and Site Visit to the Fukushima Dai-ichi Nuclear Power Station	Alumanda M. Dela Rosa	Fukushima, Prefecture, Japan	15– 18 Dec '12	IAEA
SCIENTIFIC VISIT				
Technical Visit at PT Batan Teknologi as one of the possible Sources of Molybdenum-99- as part of the Project on Tc-99m and Tc-99m Radiopharmaceuticals	Adelina DM. Bulos Gregory R. Ciocson	Serpong, Tangerang Selatan, Indonesia	16 – 19 April '12	Philippine Government –GIA PCIEERD Project
Scientific Visit to Texas A & M University, National Center for Electron Beam Research	Haydee M. Solomon	Texas, USA	17 – 28 Sept '12	IAEA
Scientific Visit at the Radiation Processing Laboratories at the Technical University of Lodz, Institute of Applied Radiation Chemistry	Lucille V. Abad	Lodz, Poland	14 – 26 Oct '12	IAEA
Site Visit to Decontamination Site in Minami-Soma City and On-Site Meeting at Fukushima City	Teofilo Y. Garcia	Fukushima City, Japan	3 Dec '12	Government of Japan
EXCHANGE PROGRAM				
MEXT Nuclear Researcher's Exchange Program 2012: Development of High Selectivity Absorbent by Radiation Grafting	Jordan F. Madrid	Takasaki, Japan	10 Sept '12 - 1 Mar '13	MEXT- NSRA, Japan

TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2012

FIELD	NAME	DATE	VENUE
TRAINING COURSE			
National Computer Institute Training Course on Network and Information Security and Privacy	Christopher G. Halnin Salvador P. Flores, Jr.	7 – 9 March '12	National Computer Center, Quezon City
Chemical, Biological, Radiological and Nuclear (CBRN) Training	Ma. Teresa A. Salabit	12 – 16 March '12	Lucena City
Training/Workshop on Government Manpower Information System	Alicia F. Lagunzad Susan S. Pascual	11 – 13 April '12	Baguio City
Basic Statistical Analysis Using MS Excel 2007	Gina B. Abrera Arvin O. Dimaano	23 – 27 April '12 23 – 27 April '12	Quezon City, Statistical Research & Training Center
Regional Training Course on Research Management for Executives	Lucille V. Abad	25 – 27 April '12	Los Baños, Laguna
CESB Accredited Leadership Training – “Change Leadership”	Graceta DL. Cuevas	19 – 20 July '12	Human Resource Innovation Solutions Inc.
Distance Assisted Training Course on Line (DAT OL) for Nuclear Medicine Professionals: Basic Application in Nuclear Cardiology	Rizalina G. Osorio Alan M. Borras	20 June '12	Philippine Heart Center, Quezon City
Training of Technical Advisers on the Gender Analysis for PSTD and GAD Focal Persons	Emma L. Cancino Alicia F. Lagunzad	29 – 31 Aug '12	Laguna
Writing Workshop on Technology Disclosure and Claim Drafting	Llorina O. Rañada	29 – 31 Aug '12	PCAARRD, Laguna

TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2012 (continuation)

FIELD	NAME	DATE	VENUE
TRAINING COURSE			
New Leadership Style for the 21 st Century	Soledad S. Castañeda	5 – 7 Nov '12	Human Resource Innovations Inc.
Last Mile Network Hardware Component	Salvador P. Flores, Jr. and Rolie B. Ilao	15 – 16 Nov '12	National Computer Center
Civil Service Commission Training Program on Organization Development	Graceta DL. Cuevas Alicia F. Lagunzad	26 – 28 Nov '12	Civil Service Commission
Training Course on Supervisory Course	Haydee M. Solomon Aurelio L. Maningas	26 – 29 Nov '12	Food and Nutrition Research Institute-DOST
SEMINAR/WORKSHOP			
6 th Jagna International Workshop: Mathematical Analysis; Modelling and Simulation in Interdisciplinary Sciences	Corazon C. Bernido	4 – 6 Jan '12	Jagna, Bohol
TAPI-IPOPHIL Orientation Lecture and Hands-on Thomson Reuter Innovation Database (TRID) Seminar	Gregory R. Ciocson	19 Jan '12	University of Sto. Tomas
Seminar-Workshop on Prior Art Search	Gregory R. Ciocson Rhett Simon DC. Tabbada Ma. Elina Salvacion Kristina V. Ramo	8 – 9 Feb '12	University of Sto. Tomas
Seminar on All You Need to Know About Chemical Safety	Raymund J. Suggang Joseph Michael D. Racho	13 – 14 Feb '12	Camp Crame, Quezon City
DOST-HRDP In-house Training Workshop on Gov't. Procurement	Hidie S. Gocuyo	16 – 17 Feb '12	DOST
ISO:2008 Awareness and ISO Internal Quality Audit Seminar	Levelyn Mito M. Tolentino Ma. Lucia C. Cobar Anie Day DC. Asa	13 & 21 – 23 Mar '12	Metals Industry Research and Development Center -DOST
Internal Quality Audit Seminar for QMS ISO 9001:2008	Cecilia M. De Vera Mary Rose Q. Mundo	21 – 23 Mar '12	Metals Industry Research and Development Center -DOST
Freshman Leveling Workshop for MTM Residential Program 2012	Gregory R. Ciocson	26 – 31 Mar '12	Taguig City
Seminar on Radiopharmaceuticals for the Detection of Diseases: An Introduction	Celestina E. Macatuno Ma. Allis U. Uriarte Ma. Dalia Phylline T. Latido	10 – 11 April '12	St. Luke's Hospital, Quezon City
Seminar-Workshop on Entrepreneurship for Inventors and Innovators	Rizalina G. Osorio Janice P. Mallilin	4 – 5 July '12	Technology Application and Promotion Institute -DOST
Seminar on Internal Control Structure	Gerald DG. Conise	17 – 20 July '12	Commission on Audit
NUTRINET Seminar on Conducting the Review of Related Literature	Gina B. Abrera	23 July '12	Department of Agriculture
Awareness Seminar on Installation of Rainwater Samples for Isotopes in Precipitation Network in Region XI	Soledad S. Castañeda Norman DS. Mendoza	5 – 8 Aug '12	DOST Region XI
National Consultative Workshop on Policy for Institutionalization of Water Safety Plan (WSP)	Fe M. Dela Cruz	22 – 23 Aug '12	Bohol
National Academy of Science and Technology, Philippines (NAST PHIL) Seminar/Workshop on Research Performance Evaluation	Lucille V. Abad Chitho P. Feliciano	29 – 30 Aug '12	Bellevue Hotel
Seminar on "Property and Supply System - National/Corporate"	Hidie S. Gocuyo	4 – 7 Sept '12	Commission on Audit
Food and Drug Administration (FDA) Seminar on Licensing Establishments	Maria Dalia Phylline Latido Rommel D. Mascariñas Ma. Allis U. Uriarte	27 – 28 Sept '12	Food and Drug Administration, Alabang
Seminar on Basic Records Management and the National Inventory of Records and Archives of Government Offices	Nelia M. Montilla Hershy Lou C. Santos	4 Oct '12	Aberdeen Hotel
DOST Branding Workshop for DOST Information Officers	Justina S. Cerbolles	22-25 Oct '12	Dumaguete City
Integrated Chemists of the Philippines Seminar-Workshop on Practical & Cost Effective Solutions to Laboratory Chemical Wastes	Davison T. Baldos Cheri Anne M. Dingle	24 – 25 Oct '12	Metro Club Makati
National Academy of Science & Technology (NAST) Writing Workshop	Adelina DM. Bulos Adelaida C. Barrida Chitho P. Feliciano Gloria Maris L. Caraos Mary Jayne C. Manrique	29 – 30 Oct '12	Traders Hotel
Air Quality Management Workshop	Preciosa Corazon B. Pabroa Joseph Michael D. Racho Angel T. Bautista, VII	22 Nov '12	De La Salle University
Workshop on the Gov't. Manpower Information System	Alicia F. Lagunzad	22 Nov '12	DOST
Capacity Building Workshop System Diagnosis and Strategy Development Approach: Best Practices	Maria Celerina M. Ramiro	28 Nov '12	Heritage Hotel
National Academy of Science and Technology, Philippines (NAST PHIL) Writing Workshop for Journal Editors	Chitho P. Feliciano Kristine Marie D. Romallosa	28 – 29 Nov '12	Acacia Hotel, Alabang
MEETING			
2 nd Technical Working Group Meeting on the Proposed Bills and Strategic Trade Management Act of 2012 and Chemical Weapons Act Ban of 2012	Cecilia M. De Vera	4 July '12	Malacañanang, Manila
2012 NAST Annual Scientific Meeting	Soledad S. Castañeda	11 – 12 July '12	Manila Hotel

TABLE 10. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2012 (continuation)

FIELD	NAME	DATE	VENUE
MEETING			
2012 National Biotechnology Week (NBW) Task Force Meeting	Chitho P. Feliciano	17 July '12	PCIEERD-DOST
DOST-PCAARD Philhab Program Review Meeting	Efren J. Sta. Maria Aileen L. De Leon	23 July '12	PCAARRD-DOST
Meeting with the Proponents of the Proposals Under the Program, "Plant Bio-Stimulants and Elicitor from Radiation Modified Natural Polymers"	Lucille V. Abad Fernando B. Aurigue	26 Sept '12	PCAARD- DOST
Meeting with the Project Coordinator re Development of an Integrated Pest Management Strategies Against <i>Brontispa Longissima</i> Species of Coconut and other Palm Species	Glenda B. Obra	27 Sept '12	PCAARD -DOST
Integrated Government Philippines (iGovPhil) Project Meeting	Christopher G. Halnin	5 Oct '12	National Computer Center
Special Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development Council (PCAARD) Governing Council Meeting	Charito T. Aranilla Fernando B. Aurigue	5 Nov '12	DOST
General Meeting of the Division of Biological Sciences of the National Research Council of the Philippines	Chitho P. Feliciano	19 Nov '12	DOST
Consultative Meeting on Engineering Technology and Engineering Technician Degree Programs	Christina A. Petrache	19 Dec '12	Traders Hotel
OTHERS			
Third Flora Filipina Conference "Achieving Global Competency in Floriculture"	Ana Maria S. Veluz	24 – 25 Feb '12	Bureau of Soil
Computed Radiography (CRX25P) Product Demonstration and Actual X-ray Inspection Using Siefert X-ray Machine	Arturo F. Salih Eduardo T. Cabildo Andrew C. Barrida	1 March '12	MIRDC- DOST, Bicutan, Taguig City
Technical Working Group Discussion on the Proposed Chemical Weapons Convention Bill	Cecilia M. De Vera	16 March '12	Malacañang, Manila
NAST Roundtable Discussion on Philippine Herbal Industry on Active Aging	Zenaida M. De Guzman Chitho P. Feliciano	19 – -20 March '12	Traders and Hyatt Hotel
High Level Forum on Access to Technology for Innovation	Lucille V. Abad Zenaida M. De Guzman	22 – 23 March '12	Manila Hotel
NAST Roundtable Discussion on Active Aging	Emma L. Cancino	29 March '12	Hyatt Hotel
NAST Roundtable Discussion on Water Supply and Sewerage Plans, Drainage and Flood	Soledad S. Castañeda Raymund J. Sucgang	13 April '12	Traders Hotel
14 th Philippine Quality Award Forum	Soledad S. Castañeda	17 April '12	Philippine International Convention Center
NAST Roundtable Discussion on Water and Agriculture	Glenda B. Obra Roland V. Rallos	18 May '12	Hyatt Hotel
2012 National Science and Technology Week (NSTW) Scientific Forum	Chitho P. Feliciano Juan Miguel M. Recto	12 July '12	SMX Convention Center, Pasay City
51 st Annual PAFT Convention and Exhibition	Zenaida M. De Guzman	26 – 27 July '12	SMX Convention Center, Pasay City
DTI's Planning Session on Introducing Traceability in the Philippines	Norman DS. Mendoza	9 – 31 Aug '12	Department of Trade and Industry, Makati City
IAEA Water Availability Enhancement Project (IWAVE) and Isotope Hydrology in Water Resources Management (Resource Speaker - PNRI)	Soledad S. Castañeda	23 – -25 Aug '12	Cagayan De Oro City
Congress/Forum of the Philippine Science Journalists Association, Inc.	Rhodora R. Leonin, Justina S. Cerbolles and Joan L. Tugo	14 Sept '12	SM, Mall of Asia, Pasay City
Science for International Development Conference	Corazon C. Bernido, Christina A. Petrache, Glenda B. Obra and Zenaida M. De Guzman	18 Sept '12	Marriot Hotel, Pasay City
Networking/Fellowship Session	Lucille V. Abad	27 Sept '12	Eastwood, Libis, Quezon City
NAST Roundtable Discussions on Flood Control and Drainage and Water Supply & Sewerage (Sanitation) Closing the MDG Gaps Now	Soledad S. Castañeda	8 Oct '12	Traders Hotel
23 rd Annual PSECP Convention	Paolo Tristan F. Cruz	18 – 21 Oct '12	Davao City

TABLE 11. PNRI GRADUATE PROGRAM IN 2012

NAME	LEVEL FIELD OF STUDY	NAME OF RECEIVING HIGHER EDUCATIONAL INSTITUTION	STATUS
WITH SCHOLARSHIP			
Ryan U. Olivares	Ph.D. in Environmental Science	The University of Tokyo	Ongoing/Asian Development Bank and Japan Scholarship Program
Preciosa Corazon B. Pabroa	Ph.D. in Environmental Science	University of the Philippines (UP) - Diliman	Ongoing/Science Education Institute (SEI)
Ana Elena L. Conjares	Ph.D. in Information Technology	Technological Institute of the Phils. (TIP)	Ongoing/DOST-Human Resource Development Program (HRD)
Ryan P. Morco	M.S. in Chemistry	University of Western Ontario, Canada	Ongoing/University of Western Ontario

TABLE 11. PNRI GRADUATE PROGRAM IN 2012 (continuation)

NAME	LEVEL FIELD OF STUDY	NAME OF RECEIVING HIGHER EDUCATIONAL INSTITUTION	STATUS
WITH SCHOLARSHIP			
Ronald E. Piquero	M.S. in International Nuclear and Radiation Safety	Korea Institute of Nuclear Safety- Korea Advanced Institute of Science & Technology	Ongoing/Korea Advanced Institute of Science and Technology
Roel A. Loterina Lynette B. Cayabo	M.S. in Radiation & Nuclear Safety	Universiti Kebangsaan Malaysia Selangor Darul Ehsan	Ongoing/DOST- Accelerated Science and Technology Human Resource Development Program (ASTHRDP)
Grace M. Carlos	Master in Public Management	Ateneo de Manila University	Ongoing/ DOST- HRDP
Alfonso A. Singayan	Master in Public Management	Ateneo de Manila University	Ongoing/ DOST- HRDP
Ma. Teresa A.Salabit	Master in Public Management	Ateneo de Manila University	Ongoing/ DOST- HRDP
Gerald DG. Conise	Master in Public Administration	Polytechnic University of the Phils. (PUP)	Ongoing/ DOST- HRDP
Hidie S. Gocuyo	Master in Public Administration	Polytechnic University of the Philippines	Ongoing/ DOST- HRDP
Michael P. Hernandez	Master in Public Administration	Polytechnic University of the Philippines	Ongoing/ DOST- HRDP
Gregory R. Ciocon	Master in Technology Management	University of the Philippines-Diliman	Ongoing/ DOST- HRDP
SELF-FINANCED STUDIES			
Soledad S. Castañeda	Ph.D. in Environmental Science	UP – Diliman	Graduated
Thelma P. Artificio	Ph.D. in Technology Management	Technological Univ. of the Phils. – Manila	Ongoing
Alvie J. Asuncion	Ph.D. in Physics	UP – Diliman	Ongoing
Romelda P. Azores	Ph.D. in Environmental Science	UP – Diliman	Ongoing
Wendy G. Lim	Ph.D. in Chemistry	Mapua Institute of Technology	Ongoing
Jordan F. Madrid	M.S. in Chemistry	UP - Diliman	Graduated
Ryan Joseph Aniago	M.S. in Chemistry	UP – Diliman	Ongoing
Ma. Llorina O. Rañada	M.S. in Chemistry	University of Santo Tomas	Ongoing
Anie Day DC. Asa	M.S. in Biochemistry	UP – Manila	Ongoing
Rhett Simon DC. Tabbada	M.S. in Marine Science	UP - Diliman	Ongoing
Adrian D. Cruz	M.S. in Chemical Engineering	UP - Diliman	Ongoing
Lorna Jean H. Palad	M.S. in Environmental Science	UP - Diliman	Ongoing
Angel T. Bautista VII	M.S. in Environmental Science	UP – Diliman	Ongoing
Jennyvi P. Dayaon	M.S. in Environmental Science	UP – Diliman	Ongoing
Charles Darwin T. Racadio	M.S. in Environmental Science	UP - Diliman	On-going
Paolo Tristan F. Cruz	M.S. in Pharmacology	UP – Manila	Ongoing
Cheri Anne M. Dingle	M.S. in Energy Engineering	UP – Diliman	Ongoing
Ma. Elina Salvacion Kristina V. Ramo	M.S. in Medical Physics	University of Santo Tomas	On-going

TABLE 12. ADDITIONAL RESOURCES GENERATED THROUGH LOCAL AND FOREIGN-FUNDED PROJECTS IN 2012

DONOR NAME OF INSTITUTION	PROJECT TITLE	PROJECT LEADER	VALUE OF ASSISTANCE
A. LOCAL GRANTS-IN-AID			
Department of Science and Technology – Grants-in-Aid (DOST-GIA)	Smart Farming-Based Nutrient and Water Management for Rice and Corn Production	Roland V. Rallos	3,080,325.00
DOST-GIA	Smart Farming Project 3- Water Balance and Loss Assessment of the Upper Pampanga River Integrated Irrigation System	Roland V. Rallos	400,000.00
DOST – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development	Development for an Integrated Pest Management Strategy against <i>Brontispa longissima</i> (Gestro, an Invasive Pest of Coconut and Other Palm Species	Glenda B. Obra	327,175.00
Davao City Water District	Determination of Gross Alpha and Beta Activities in Water	Preciosa Corazon B. Pabroa	145,000.00
Davao City Water District	Determination of Gross Alpha and Beta Activities in Water	Preciosa Corazon B. Pabroa	165,000.00
Aklan State University	Determination and Monitoring of Radioactivity — Emitting Nuclides in Sediments and Determination of Dissolved Oxygen and Other Field Parameters in the Water of Aklan River and Related Basins	Raymund J. Sucgang	57,250.00
DOST-GIA	Application of Isotopic and Geochemical Techniques to Uncover Point and Nonpoint Sources of Organic Nutrient Contamination in the Neritic Zone of Boracay Island	Raymund J. Sucgang	908,375.00
DOST-GIA	Field Detection for Saxitoxin: A Novel Approach Using the Receptor Binding Assay Technology for In Situ Monitoring of Paralytic Shellfish Toxins	Aileen L. De leon	2,969,552.00
DOST -GIA	2012 National Science and Technology Week (NSTW) Exhibit	Rhodora R. Leonin	80,000.00
DOST -GIA	2012 NSTW Documentation and Evaluation	Rhodora R. Leonin	258,524.00
		Sub Total	8,391,201.00

DONOR NAME OF INSTITUTION	PROJECT TITLE	PROJECT LEADER	VALUE OF ASSISTANCE
B. FOREIGN GRANTS			
Comprehensive Nuclear Test Ban Treaty Organization (CTBTO)	Post Certification Activities for the IMS Radionuclide Station RN52	Teofilo Y. Garcia	2,361,372.60
Global Threat Reduction Initiative (GTRI)	US DOE/Batelle and PNRI in Support of the Global Threat Reduction Initiative (GTRI) in the Philippines	Julietta E. Seguis	1,685,686.00
International Atomic Energy Agency (IAEA)	Commission Work for Investigation of Occupational Exposure Due To Naturally-Occurring Radioactive Material (NORM) Used as Industrial Materials	Eliza B. Enriquez	104,649.78
IAEA	Application of Radiotracer and Radioassay Technologies in Paralytic Shellfish Poisoning	Adelina DM. Bulos	140,174.61
IAEA	Enhancing Cytogenetic Biological Dosimetry Capabilities of the Philippines for Nuclear Incidence Preparedness	Celia O. Assad	103,955.40
IAEA	Application of Isotope Hydrology Techniques by the PNRI in Water Resources Regions 2 and 10 in Support of Groundwater Resource and Vulnerability Assessment Project of DENR - Mines And Geosciences Bureau (MGBI)	Soledad S. Castañeda	461,676.68
		Sub Total	4,857,515.07
GRAND TOTAL			Php 13,248,716.00

TABLE 13. LIST OF SCIENTIFIC PUBLICATIONS IN 2012

TITLE OF SCIENTIFIC PAPER	NAME/E-MAIL OF MAIN AUTHORS	PUBLICATION/NAME/TYPE OF JOURNAL	DATE PUBLISHED
Updates on Philippine Hoyas	F. B. Aurigue fbaurigue@pnri.dost.gov.ph	In: Philippine Horticultural Primer and Directory Vol. III/ 2012, Philippine Orchid Society, Inc. pp. 28-33	2012
Synthesis and Characterization of Carboxy-methyl Derivatives of Kappa-carrageenan.	Charito Tranquilan-Aranilla ctaranilla@pnri.dost.gov.ph Naotsugu Nagasawa, Aristeia Bayquen and Alumanda Dela Rosa	Carbohydrate Polymers, Volume 87, 2012, 1810-1816 (ISI)	2012
Tributyltin in Marine Sediments and Philippine Green Mussels (<i>Perna viridis</i>) in Manila Bay	Ryan U. Olivares ruolivares@pnri.dost.gov.ph Shigeru Tabeta and Elvira Z. Sombrito	Journal of Marine Science and Technology - Volume 18, Issue 2, pp.213-219	2012
Environmental Isotopes and Major Ions for Tracing Leachate Contamination from a Municipal Landfill in Metro Manila, Philippines	S.S. Castañeda sscstaneda@pnri.dost.gov.ph R.J. Sugang, R.V. Almoneda, N.D.S. Mendoza, C.P.C. David	Journal of Environmental Radioactivity 110 (2012) 30-37, ISI (int'l)	2012
PNRI Mutant Variety: <i>Cordyline</i> 'Afile'	Fernando B. Aurigue fbaurigue@pnri.dost.gov.ph	Philippine Nuclear Journal, V 17, pp. 1-8	2012
National Indoor Radon Survey in Filipino Homes	Fe M. Dela Cruz fmdelacruz@pnri.dost.gov.ph Teofilo Y. Garcia, Lorna Jean H. Palad, Ma. Lucia C. Cobar and Emerenciana B. Duran	Philippine Nuclear Journal, V 17, pp. 9-16	2012
Minimum Detectable Activity of a 5x5 NaI(Tl) Gamma Spectrometer Used for the Radioactivity Clearance Measurements of the PRR-1 Decommissioning Project	Jan Aldrich A. Agustin jaaagustin@pnri.dost.gov.ph Kristine Marie D. Romallosa	Philippine Nuclear Journal, V 17, pp. 17-26	
Minimum Detection Limit of the Sodium Iodine (NaI) Field Gamma Spectrometer Instrument in Thyroid Radioactivity Intake Measurement	C.S. Valgomera K.A.R. Esguerra, J.F. Rumbawa, R.V. Luna, K.M.D. Romallosa, E.S. Caseria	Proceedings of the 30th Samahang Pisika ng Pilipinas, National Physics Congress	October 2012

LIST OF ABBREVIATIONS

IAEA	International Atomic Energy Agency	JICC	International Cooperation Center of Japan
ANSN	Asian Nuclear Safety Network	KAIST	Korea Advanced Institute of Science and Technology
ANSTO	Australian Nuclear Science and Technology Organization	KINNC	Korea Institute of Nuclear Non-Proliferation and Control
APO	Asian Productivity Organization of Japan	KINS	Korea Institute of Nuclear Safety
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization	MEXT	Ministry of Education, Culture, Sports, Science and Technology of Japan
DFAIT	Department of Foreign Affairs and International Trade of Canada	NNSA/DOE	National Nuclear Security Administration/Department of Energy
DEVCO	Development Cooperation-Europe	NSRA	MEXT Nuclear Safety Research Association of Japan
DOST	Department of Science and Technology	PCAARRD	Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development
DOST- ASTHRDP	DOST-Accelerated Science and Technology Human Resource Development Program	PPL	Pacific Northwest National Laboratory of USA
EU	European Union	RDA	Rural Development Administration
ENSTTI	European Nuclear Safety Training & Tutoring Institute	USCSCAP	United States Council for Security Cooperation in the Asia Pacific
FNCA	Forum for Nuclear Cooperation in Asia	US DOE	United States Department of Energy
INSEP	International Nuclear Safeguards and Engagement Program	WERC	Wan Energy Research Center
JAIF	Japan Atomic Industrial Forum		

PNRI ORGANIZATIONAL CHART

61



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- Health Physics Research Section
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- Irradiation Services Section
- Radiation Protection Section
- Nuclear Analytical Techniques Applications Section
- Isotope Techniques Research Section

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- Nuclear Information and Documentation Section
- Business Development Section
- Management Information Section

Nuclear Regulatory Division

- Regulations and Standards Development Section
- Licensing Review & Evaluation Section
- Inspection and Enforcement Section
- Nuclear Safeguards and Security Section
- Radiological Impact Assessment Section

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- Human Resource Management & Records and Communication Section
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