PHILIPPINE NUCLEAR RESEARCH INSTITUTE

ANNUAL REPORT 2014

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About Us

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

Our Vision

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

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."

MESSAGE FROM THE SECRETARY

I would like to commend the Philippine Nuclear Research Institute (PNRI) for a fruitful 2014.

This year marked the Department of Science and Technology's (DOST) aggressive drive to navigate the Philippines towards becoming a science nation through technology self reliance.

The PNRI, with all its vast network and programs, have remained steadfast in pushing the success of the Department's priority programs. The DOST is proud of PNRI's efforts to serve a larger sector of the society as its radiation processing facilities continue to improve the services and products of the industry, especially the food sector. With its inauguration of the Electron Beam facility, the PNRI will pave the way for full-scale radiation research on food, medicine, agriculture, industry, and wastewater treatment as well as semi-commercial e-beam services.

Along with its services for the food industry, PNRI has also developed medical products to help enhance the medical sector's services. The Institute also assists in improving the quality of agricultural products with precision farming, plant growth promoters, mutation breeding and quarantine treatment against pests.

In line with its regulatory mandate, PNRI has always proven steadfast in keeping the peaceful uses of nuclear and radioactive materials within safe and secure limits through its regulations, licensing, inspection, emergency preparedness and response.

Congratulations to the PNRI for further strengthening its role in the continuing progress of the country to become a Science Nation.

Mabuhay!

MARIO G. MONTEJO
Secretary

MESSAGE FROM THE DIRECTOR

On behalf of the officials and staff of the Philippine Nuclear Research Institute (PNRI), it is my great pleasure to submit our agency's accomplishments for 2014.

For PNRI, this year has been defined by success as we achieved many of our long-term goals and completed several priority projects. 2014 was also a year of firsts for the Institute, as we undertake our dual mandate of promoting and regulating the peaceful uses of nuclear science and technology.

The new 2.5 MeV Electron Beam Facility recently inaugurated this December, will pave the way for more commercial as well as research applications of radiation. The facility, which received technical and financial assistance from the United States and Japanese governments, the International Atomic Energy Agency (IAEA) and DOST, is the first in the country that will be geared for full-scale research and development and semi-commercial services.

Our Technetium-99m Generator Facility will soon begin producing the radiopharmaceutical as the Food and Drug Administration has already given PNRI the license to operate the facility, which will help make nuclear medicine more available in hospitals and medical centers throughout the Philippines.

In the field of research, PNRI scientists and researchers were once again prolific in conducting their projects and studies in a wide range of technologies. In agriculture, PNRI develops precision farming methods for staple food crops such as rice and corn, plant growth promoters from irradiated natural polymers, and mutation breeding. A quarantine treatment against the mango pulp weevil using irradiation was developed at PNRI, and was already approved this year by the United States Department of Agriculture as the US markets have been recently opened to our Philippine Super Mangoes.

PNRI also does its part in sustaining our environment and natural resources. Nuclear and isotope techniques play a huge part in analyzing air as well as water pollutants, particularly in the Manila Bay and Pampanga River Basin, as well as in Boracay Island. Through PNRI, the Philippines continues to be a pilot country for the IAEA Water Availability Enhancement (IWAVE) Project as it helped map the groundwater systems in Regions 2 and 10. The PNRI also monitors environmental radioactivity. We have recently received one radiation

monitor from South Korea which will be part of an initial real time environmental radiation monitoring system being set up with the assistance of the IAEA and DOST.

As for its regulatory mandate, PNRI, with support from legislators and the IAEA, has taken another step towards the creation of a new and independent regulatory body in line with the changing international standards. The bill for creating the independent nuclear regulatory body is currently before the House of Representatives. In the meantime, PNRI remained steadfast in its regulatory mandate by crafting new regulations, issuing licenses and conducting inspections on the facilities of clients who use radioactive materials and equipment, and continuously improving the Radiological Emergency Preparedness and Response Plan (RADPLAN) for nuclear safeguards/security. PNRI has also succeeded in keeping the Philippines compliant with its commitments in international treaties and agreements geared for the preservation of nuclear safety, security and safeguards across the globe through stronger cooperation with other countries.

2014 marked a milestone in sharing the achievements of the Philippines in the nuclear field to the international community. This September, PNRI conducted the first full-blown exhibit of Filipino applications of nuclear science and technology at the 58th IAEA General Conference in Vienna, Austria. Hundreds of representatives of the nuclear and scientific community, the IAEA Secretariat including IAEA Director General Yukiya Amano and the IAEA Member States at large visited the Philippine Exhibit. It was with great pride and pleasure that PNRI was able to represent the country during the conference and exhibition.

All in all, 2014 has indeed proven to be a successful year, and we look forward to reaching new heights as we continue to fulfil our dual mandate.

We thank the DOST, the IAEA and all our partner agencies for joining us in pushing our projects and programs to completion. Most of all, we thank Mang Juan and Aling Juana for believing in the potential of nuclear science and technology.

ALUMANDA M. DELA ROSA, PhD
Director

GENERATION OF NEW KNOWLEDGE AND TECHNOLOGIES

With our scientists at the forefront of developing new technologies that would prove useful in improving the life of every Juan, PNRI continues to be a very productive research and development institute of the DOST. Beyond advancing the country's agricultural, medical, industrial and environmental interests, the Institute's diverse range of projects also continue to contribute to the body of knowledge for the benefit of the national as well as the global scientific community.

Adlai grains

FOOD AND AGRICULTURE

Enhancing Agricultural Productivity Using Mutation Breeding and Biotechnology

Adlai *(Coixlacryma-jobi L)*

Adlai grows in many parts of the country but is underutilized. It comes from the family *Poaceae*, the same family of grass to which wheat, corn and rice belong. Adlai is considered nutritious and potentially a good substitute to rice and corn.

Improving Adlai by Gamma Irradiation. This year, PNRI researchers selected and further evaluated putative mutant lines obtained from the second generation planting. Statistical analysis showed significant results on the number of days to flower, plant height at maturity, number of sterile seed per panicle and 100 seed-weight. Results also indicated that plants irradiated with 100 Gy dose flowered 29 days earlier (within 86 days from planting) than unirradiated plants. Plants irradiated with 200 Gy dose flowered 94 days after planting, or 21 days earlier than the control. Irradiation resulted in the reduction of plant height. In treatment with 100 Gy dose, the plant height decreased to about 46.58 percent and 29.44 percent in 200 Gy over the control. The grain yield was also significantly affected by the treatment. The 100 seed-weight in treatment of 100 Gy dose was the heaviest with 10.82 grams.

Improving Productivity Using Stable Isotope Technique. The PNRI, in collaboration with the Bureau of Soils and Water Management of the Department of Agriculture conducted two simultaneous experiments to assess the growth performance and the efficiency of Guinampay, an established variety of adlai, in using nitrogen

fertlizer. One experiment used inorganic nitrogen (N) while the other experiment used inorganic N with organic based fertilization. Commercially available organic fertilizer was used in organic based fertilization. Nitrogen-15 (^{15}N) isotope tracer technique was used in the assessment of growth performance and nitrogen use efficiency. The field experiments were conducted at the National Soils Water Resources Research and Development Center (NSWRRDC) in Cuyambay, Tanay, Rizal.

Initial agronomic data showed that inorganic N fertilization has improved the growth and productivity of adlai and is comparable with that of using inorganic N with organic fertilization. The results will be validated in terms of Fertilizer Nitrogen Use Efficiency (FNUE) using ^{15}N isotope tracer techniques based on the analysis using Isotope Ratio Mass Spectrometer .

Rice *(Oryza sativa L.)*

PNRI agricultural researchers further evaluated the agronomic traits of rice mutant lines with low to intermediate amylose content from the ninth generation (M_9) planting. Results indicated that plants irradiated with 200 and 300 Gy doses flowered earlier than the control, (85 days from planting) while the control took 93 days before flowering. At 300 Gy dose, the plant height was reduced to 74 centimeters, around 13.24 percent less than the control, making the mutant very resistant to lodging. The treatment of 300 Gy also resulted in a higher number of seeds per panicle. In this study, the optimum dose for inducing mutation, especially the grain quality (amylose content) of variety IR 72, is 200 Gy.

Researchers also continued to select and confirm potential mutant lines with desirable agronomic traits on those plants (variety PSB Rc 10) irradiated with 20 and 40 Gy ion beam in the sixth generation (M_6). Statistical analysis showed significant results in the number of days to flower and number of sterile seeds per panicle. Plants irradiated with 20 and 40 Gy flowered 80 days from planting, which was about 10 days earlier than the control. Plants irradiated with 40 Gy dose showed increased sterility.

Early maturing plants from rice seeds irradiated at 300 Gy dose

The second generation (M_2) planting (using organic farming) of two native varieties, Umangan and Native borie, which were previously irradiated with 200 and 300 Gy gamma rays improved in some of the agronomic traits. PNRI also carried out the selection on the segregating population of the second generation (M_2) plants for lines with desirable agronomic traits such as early maturity, high tillering, long panicle and high yielding.

Mungbean *(Vigna radiate [L.] RWilczek)*

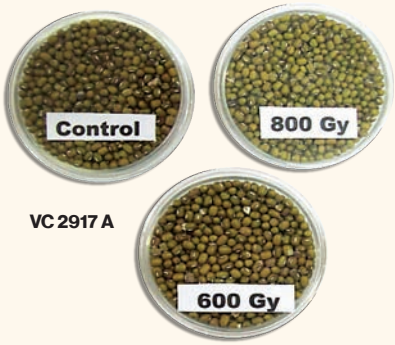
The seventh generation (M_7) of selected promising mutant lines with improved agronomic traits in varieties Psj-B-11-176 and VC 2917A were planted in the field for further selection, confirmation of mutants and for grain yield evaluation. The pod length and 1000 seed-weight in Psj-B-11-176 variety showed significant results. For the VC 2917A variety, significant results were gathered on plant height at maturity, pod length, number of seeds per pod and 1000 seed-weight. The irradiated plants produced bigger and heavier seeds in these two varieties.

Mangosteen

PNRI obtained tissue cultures of irradiated mangosteen seeds from Digos, Davao by inoculating in freshly prepared Murashige and Skoog's (MS) medium with full strength and half strength concentration treatments. One-half mangosteen seeds (explants) were planted in 32 test tubes containing fresh MS medium treatments. Almost 100 percent formation of calli and protocorms was observed in these explants 21 days after inoculation. Shoots were later observed 30 days after inoculation. Shoot formation increased faster in half strength concentration MS medium than in MS medium full strength. A comparable study done for whole seeds planted in soil *(in-vivo)* resulted only in 2.8 percent germination for 40 days after sowing or planting.

Researchers conducted a parallel study on irradiation dose of *in-vitro* germinated mangosteen seeds cultured as half seeds, which were in MS basal half and full strength concentration. Results showed formation of shoots at 10 Gy and 20 Gy doses as well as in control. Percentage

An increase in the number of seeds per pod was observed in VC 2917 A mungbean variety irradiated with 800 Gy dose.



The irradiated mungbean plants produced bigger seeds as compared with the control.

shoot formation in 10 Gy dose planted in MS medium with half strength concentration was higher than in 20 Gy dose cultures one month after inoculation. No shoots developed from cotyledons irradiated with 30 and 40 Gy doses and cultured in MS medium.

Maintenance of mangosteen cultures in the laboratory was continuously done through reflasking or transferring in freshly prepared media, along with the regular collection of data and evaluation of results.

Cashew

Cashew seeds harvested from four selected first generation (M_1) putative mutants were planted in individual plastic pots as second generation (M_2) plants. These seeds were from trees irradiated with 100 Gy, 300 Gy, 400 Gy doses and the control ('Makiling' strain). Around 30 to 50 seeds were planted per tree. Four weeks after sowing, PNRI researchers observed seed germination in all four putative mutants ranging from 26 to 77 percent. The lowest germination percentage was observed in seeds from trees irradiated at 400 Gy dose. One hundred fifty (150) days after planting, percentage survival was recorded at 96 to 100 percent, those irradiated with 100 Gy and 400 Gy doses yielding the highest.

Results showed that irradiated putative mutants have slow germination on the first phase of its growth but eventually catch up on its growth 100 days after planting.

Dracaena 'Sun Beam' *(NSIC 2014 Or-85)*

Schefflera 'Sparkles' *(NSIC 2014 Or-84)*

Ornamentals

Multiplication and maintenance of radiation-induced mutants were continuously done through seeds and cuttings with the application of routinary cultural practices.

Two new ornamental mutant varieties have been registered and approved by the National Seed Industry Council (NSIC) on August 29, 2014 namely: *Schefflera* 'Sparkles' (NSIC 2014 Or-84) and *Dracaena* 'Sun Beam' (NSIC 2014 Or-85). *Schefflera* 'Sparkles' is a chlorophyll mutant developed from the seed of native *Schefflera* species that was treated with 15 Gy dose of gamma radiation. *Dracaena* 'Sun Beam' is also a cholorophyll mutant which was developed from a cutting of *Dracaena barunii* (formerly *Dracaena sanderiana* car. *Virescens*) that was subjected to 20 Gy dose of gamma radiation in the same batch where *Dracaena* 'Marea' originated.

Researchers also obtained two new batches of foliage-type anthurium (*Anthurium* 'Wave of Love') which were subjected to increasing dose levels of gamma radiation in April and May to confirm previous results. Radiosensitivity studies on native fruit trees like "bignay" (*Antidesma bunius*) and "katmon" (*Dillenia philippinensis*) were also conducted in June.

Researchers also obtained two second generation (M_2) seedlings from seeds of *Cordyline* 'Aleta', the proposed name for a putative mutant Ti plant at second vegetative (V_2) stage. The stability and uniqueness of the mutant 'bagawak na puti' *(Clerodendrum calamitosum*) are being verified.

NUCLEAR TECHNOLOGY APPLICATIONS IN PRECISION FARMING TO ENHANCE AGRICULTURAL PRODUCTIVITY

PNRI scientists conducted studies to develop precision farming methods using radioisotopes and stable isotope tracers to determine the right amount and proper timing of fertilizer and water application at different growth stages of crops.

Results of the studies showed that better practices, such as fertilizer splitting, can increase fertilizer utilization efficiency up to 70 percent. Appropriate irrigation scheduling can improve crop water use efficiency and minimize losses by around 25 percent. These will serve as bases for updating the decades–old recommended levels of fertilizer and water inputs in agricultural production.

Efficient Nutrient and Irrigation Management in Corn Production

This project is under the "Smart Farming – Based Nutrient and Water Management for Rice" funded by the Department of Science and Technology – Grants-in-Aid and the Philippine Council for Agriculture and Aquatic Research and Development. It focuses on the utilization of nuclear analytical techniques to identify smart-farming technologies that could increase soil nutrient uptake and reduce loss of soil nutrients and water resources in corn production.

For this project, plants from the third cropping field experiments were harvested for further statistical examination and tabulation of their agronomic and yield components. Soil and plant samples from

The project output on efficient nutrient and irrigation management in corn production was presented to stakeholders and end-users during the Department of Agriculture, Grand Harvest Festival held in Quirino province.

the harvest area and from the plot with tracer were also prepared for routine laboratory and isotopic analysis.

Using the data gathered, PNRI agricultural researchers determined how the different levels of nitrogen, phosphorous and potassium would affect the growth and yield of corn. The researchers have also delineated the patterns for the nutrient uptake of corn. To improve the efficiency of water application for the crops, the the irrigation volume balance model was used.

Helping to boost the potential of agriculture in northern Philippines, PNRI conducted a Seminar on Nutrient and Irrigation Management for Corn Production at the Cagayan Valley Research Center in San Felipe, Ilagan, Isabela last November. The seminar served as a venue for the participating agencies to share to the stakeholders and technology end-users the preliminary findings of the study after two years of research work. The project output was also presented during the Department of Agriculture – Grand Harvest Festival held in Quirino province.

Water Balance and Loss Assessment of the Upper Pampanga River and Magat River Integrated Irrigation Systems

This study aims to assess the water losses in irrigated rice fields of the Upper Pampanga River Irrigation System (UPRIS) and Magat River Integrated Irrigation System (MARIIS) as well as to recommend measures to increase water use efficiency.

Initial results of the study indicated that the systems have sufficient volume of water but are less effective in terms of irrigation delivery and regulation. The low actual conveyance efficiencies of selected lined lateral canals translate to more water loss during distribution. Likewise, the high actual seepage and percolation losses than the National Irrigation Administration design values translate to less area irrigated. It was found that crop transpiration contributes to more than 60 percent of the evapotranspiration losses in the current rice production systems, especially during the wet cropping season.

Nutrient Dynamics Assessment of Inorganic and Organic Rice-Based Farming Systems in the Pampanga River Basin

This project is being undertaken by PNRI in cooperation with the Bureau of Soils and Water Management (BSWM) and the Department of Agriculture Regional Office 3 (DA, RFO 3). The project aims to determine the fertilizer nitrogen-use efficiency of inorganic and organic rice-based farming systems using nitrogen-15 (^{15}N) isotope technique; to determine the nitrogen losses from inorganic and organic rice-based farming system using lysimeter; and to demonstrate the effectiveness of soil and nutrient management technologies for inorganic and organic rice-based farming systems for sustained productivity and environmental benefit.

Through the use of lysimetric and isotopic techniques, the PNRI assessed the nutrient utilization dynamics in lowland and rainfed rice at its experimental fields at the National Soils and Water Resources and Research and Development Center in San Miguel and San Ildefonso, Bulacan.

Results indicated that nitrate leaching in inorganic rice-based farming system was higher compared to organic-based and pure organic farming method. Reduction in yield was commonly observed in pure organic system. However, both organic and inorganic-based methods showed higher nutrient use efficiency as compared to pure organic production system. Application of fertilizer by several splits resulted in higher and significant efficiencies (90 percent increase) compared to one time basal fertilizer application (less than 40 percent).

Isotope/Nuclear Techniques and Fertigation to Improve Water and Nutrient-Use Efficiencies of Mungbean

This project is the counterpart of the International Atomic Energy Agency study entitled "Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change-RAS/5/056". Its main objective is to increase uptake efficiency and reduce loss of soil nutrient and water resources in mungbean production through isotope techniques and fertigation.

Air moisture sampling for evapotranspiration analysis using oxygen -18 tracer in water is part of the study on water balance and loss assessment in irrigated fields.

Lysimeters used for studying leaching losses in different fertilization and irrigation management for rice production system

Fertigation using drip lines for nutrient and water use efficiency of mungbean.

In 2014, PNRI researchers conducted two experiments for two cropping seasons (dry and wet season cropping) at the Bureau of Soils and Water Management - National Soil and Water Resources Research and Development Center in Bulacan and Tanay stations using the mutant variety PAEC-3 and recommended variety NSIC-Mg 14.

Results showed that application of 20 kg nitrogen per hectare (N ha^{-1}) produced a yield that is comparable to the application of 30 and 40 kg N ha^{-1}, respectively. The mutant variety obtained a higher grain yield than the recommended variety. The results of the two cropping seasons were presented during the IAEA-RAS5056 midterm program assessment meeting in Yogyakarta, Indonesia in October 2014.

IAEA-RAS/0/65 Supporting Climate-Proofing Rice Production Systems (CRiPS) based on Nuclear Application

The study aims to determine the nutrient-use efficiency and water-use efficiency of rice under varying irrigation technologies using nitrogen-15 (^{15}N) stable isotope technique, carbon-13 (^{13}C) isotope discrimination and related methods. The study also aims to determine the best fertilizer and water management technologies for rice production.

For this study, PNRI researchers conducted field experiments at the Philippine Rice Research Institute (PhilRice) central experimental station. They also obtained and analyzed the agro-meteorological data from the nearest PAGASA weather station in Muñoz, Nueva Ecija and from the installed onsite automatic weather station. This information was used to calculate the irrigation water evapotranspiration loss within the cropping period. Air moisture samplings were likewise done at various physiological stages to evaluate the water application efficiency in terms of evapotranspiration loss.

Fertilizer application and chlorophyll content measurement using Soil-Plant Analysis Development (SPAD) chlorophyll meter

Installation of automatic weather station for agrometeorological data aquisition

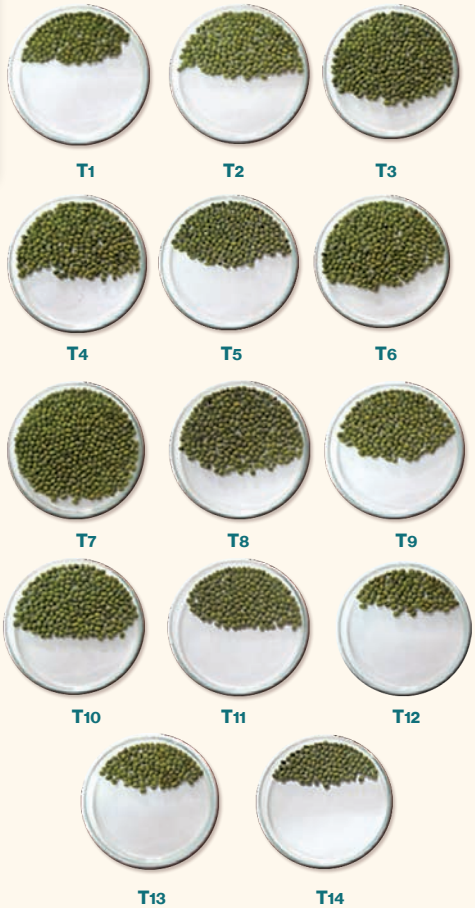
Preliminary results of the analyses showed the following: (1) higher grain yield per kilogram of nitrogen applied for soils with medium and high N; (2) achievement of optimum yield even at zero application rate for soil with medium to high phosphorus and potassium; (3) 35 percent savings on water with plots under alternate wetting and drying without yield penalty compared to continuous flooding; and (4) contribution of water loss in plants to more than 60 percent of the evapotranspiration losses in the current rice production systems during wet season cropping.

Evaluation of the Effects of Radiation-modified Carragenan on the Growth and Yield of Mungbean *(Vigna radiata [L.] R. Wilczek)* and Peanut *(Arachis hypogaea L.)*

The project aims to evaluate the effects of radiation-modified carrageenan on the growth and yield of mungbean and peanut and to determine their reaction to common pests under screenhouse and field conditions.

Soaking and spraying with carrageenan on mungbean and peanut improved their agronomic traits and increased their yield. The best plant growth promoter (PGP) of irradiated carrageenan was produced at a concentration of 60 parts per million (ppm), which increased the yield by 224 percent for peanut and 200 percent for mungbean. Current results confirmed the previous data from pot experiments which increased the yield up to 419 percent for mungbean of a different variety.

Radiation-modified carrageenan was fractionated into different molecular weight cut-offs of 5kDa, 3kDa, and 1kDa. Their PGP effect was tested on "pechay" plants by foliar spraying. Results indicate that the plants sprayed with the 1kDa fraction of oligo-carrageenan solution had the best attributes for plant height, leaf width, and fresh weight.



Preliminary trials on the effects of radiation-modified carrageenan on mungbean (variety Kulabo)

PEST MANAGEMENT

Enhancing Export Competitiveness in Philippine Super Mango: Establishing the Irradiation Dose for Quarantine Treatment of Mango Pulp Weevil

The PNRI and the Department of Agriculture (DA) Regional Field Unit 4B, submitted to the United States Department of Agriculture – Animal and Plant Health Inspection Service (USDA-APHIS), the request for approval of the established dose of 165 Gy for the quarantine treatment of Philippine Super Mangoes against *Sternochetus frigidus* (Fabr.), better known as the mango pulp weevil. The general treatment is the result of a joint five-year project between PNRI and DA which was completed in 2011.

In October 1, 2014, the USDA-APHIS approved the established dose and has accordingly amended the Plant Protection and Quarantine Treatment Manual allowing the 165-Gy treatment dose as an option to mitigate the risks posed by *S. frigidus.* Aside from the mango pulp weevil, the treatment is also applicable for disinfestations against *Bactrocera* fruit flies in the Philippines. While the conventional vapor heat treatment may be used to deal with *Bactrocera* flies, the method is inadequate against *S. frigidus*. In contrast, the new quarantine treatment is effective for disinfesting fruits against both insects.

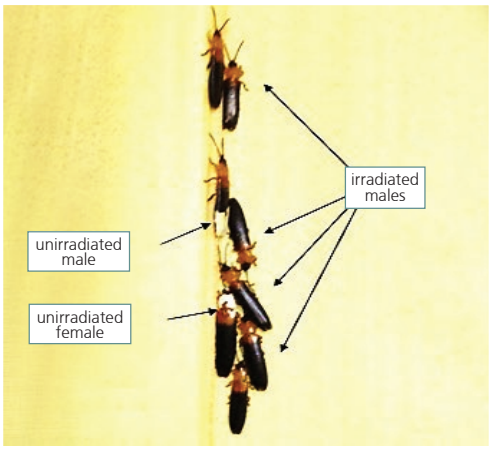
The quarantine treatment is more than capable of dealing with future cases of weevil outbreaks in mango-growing areas in the country, ensuring security and sustainability for the entire mango industry. Palawan mango growers may now export mangoes to the United States, provided that the fruits are subjected to the disinfestation treatment.

Shipment of infested mangoes from Brookespoint, Palawan to PNRI for irradiation at the Multipurpose Irradiation Facility. (Inset) Placement of dosimeter in infested mangoes prior to irradiation.

Development of Integrated Pest Management Strategies Against *Brontispa longissima* (Gestro)

In December 2014, PNRI completed the research study on determining the effects of irradiation on the mating competitiveness of adult males of *B. longissima (Gestro)*, an invasive insect pest for coconut and other palm species.

Results of the studies showed that in terms of duration and frequency of mating, no significant difference was observed between the unirradiated and irradiated male when crossed with unirradiated female. At 40 and 45 Gy doses, the longevity of irradiated males was significantly suppressed. Increasing the irradiation dose from 40 to 45 Gy resulted in an increased level of sterility. The parental crosses of irradiated males with unirradiated females showed no apparent loss of fecundity of females, but significantly reduced the egg hatch. At different ratios (unirradiated female: unirradiated male: irradiated male) of 1:1:1, 1:1:5, 1:1:10, and 1:1:15, the frequency of matings favored the cross between unirradiated pairs. Highest frequency of matings was observed specifically on unirradiated pairs at 1:1:1 and 1:1:5 ratios. Results also indicated that at 1:1:5 and 1:1:10 ratios, mean frequency of mating of both pairs (irradiated males x unirradiated female, and unirradiated male x unirradiated female) did not significantly differ.



Adult B. longissima on coconut leaf showing the unirradiated male marked with white paint on the elytra, irradiated males unmarked and the female marked on the head

HEALTH AND MEDICINE

Sterile Insect Technique for Dengue Mosquito Vector Using Gamma Irradiation

PNRI is currently developing an alternative method of control for the dengue mosquito vector, *Aedis aegypti,* using the sterile insect technique (SIT). SIT involves the use of gamma irradiation to make the mosquitoes sterile.

In support of the studies for this project, an adult colony of *Aedes aegypti* was reared in cubicle stainless steel cages at the PNRI laboratory as source of test insects. Quality control data obtained on pupal recovery was 79 percent with an adult emergence rate of 78 percent.

Results of studies on the mating competitiveness of *A. aegypti*, which were irradiated using the Gammacell irradiator, showed the highest percent mating in younger irradiated males (three-,four-, and

Mating competitiveness tests in Ae. aegypti conducted in a field cage

A PNRI researcher analyzes samples for the development of sterile insect technique against mosquitoes.

five-day old) as compared to older age groups. Four-day–old adults irradiated at the Multipurpose Irradiation facility were found to be more sexually competitive than the other ages tested. The data will be validated by conducting mating competitiveness in semi-field condition or in an outdoor environment.

For comparative studies on mosquito diets, PNRI researchers have observed that the shortest larval development and higher percentage of adult recovery occur in mosquitoes fed with the standard diet, although higher adult emergence was observed in using the diet developed by the International Atomic Energy Agency.

Establishment of Technetium-99m Generator Facility

License to Operate. In 2014, PNRI has successfully obtained a License to Operate (LTO) from the Food and Drug Administration as well as all other government permits for the operation of the Molybdenum-99/Technetium-99m (^{99}Mo- ^{99m}Tc) Generator Production Facility inside the PNRI Radioisotope Laboratory. The facility will pave the way for cheaper and more available supplies of ^{99m}Tc radiopharmaceuticals for nuclear medicine centers and hospitals across the country.

Production of ^{99m}Tc Ligands or Cold Kits. The local availability of the radioisotope ^{99m}Tc, is also projected to widen usage of radiopharmaceuticals using ^{99m}Tc. Hence, PNRI also embarked on the production of the most commonly used ^{99m}Tc ligands or cold kits. These are collectively called as ^{99m}Tc radiopharmaceutical products which are produced by reacting ^{99m}Tc obtained from a ^{99}Mo-^{99m}Tc generator with the non-radioactive components 'kit' formulation. All materials necessary for formulation are available in the non-radioactive kit with the exception of the radioactive isotope. When the radioactive isotope is added to the kit, the chemical reactions required for binding the isotope occur within the vial and the final product will be ready for quality control verification and unit dose dispensing.

Establishment of Radiopharmaceutical Kit Laboratory. Recognizing the country's need for locally produced kits, the International Atomic Energy Agency (IAEA) approved a project proposal which aims to develop the capacity of the Institute in the preparation of the ^{99m}Tc radiopharmaceuticals, through the establishment of the needed infrastructure and enhancement of human resources. The project is envisioned to provide the local availability of the radioisotope and the radiopharmaceutical kits which will enhance the application of nuclear medicine techniques in the diagnosis and treatment of diseases. Hence, PNRI established a Radiopharmaceutical Kit Laboratory for producing ^{99m}Tc- ligand kits. This included a functional clean room system and other vital equipment needed for the batch production and for compliance to good manufacturing practices.

Standard Operating Procedures for Synthesizing Cold Kits. This year, the Isotope Techniques Section (ITS) worked on establishing SOPs (Standard Operating Procedures) and protocols for synthesizing two cold kits: MDP (Methylene Diphosphonate) and DTPA (Diethylene Triamine Penta Acetic Acid). When combined, these cold kits with ^{99m}Tc are used for imaging of the bones and kidney, respectively. The ITS prepared and characterized several batches of the cold kits. Quality control tests were performed and the results showed that the kits prepared meet the standards of commercially available imported radiopharmaceuticals.

Preliminary documentary works are being conducted for the eventual registration of these cold pharmaceutical kits for ^{99m}Tc imaging.

Clean room facility of the Radiopharmaceutical Kit Laboratory

Development of Novel Biomedical Products Utilizing Gamma and Electron Beam Facilities

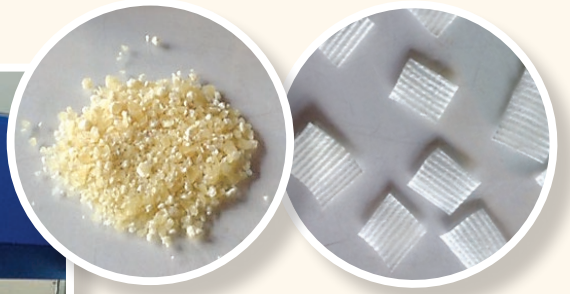
The project aims to develop new biomedical products which can contribute to health sectors by using gamma irradiation and electron beam technology.

Hemostatic Agents from Radiation-Modified Polysaccharides and their Derivatives

PNRI has developed hemostatic materials from radiation-modified polysaccharides which can be used to stop the bleeding from severe wounds in emergency civilian and military trauma.

In 2014, the hemostatic agent prototypes were further optimized in terms of physical form (granular and gauze-type), concentration, radiation dose and additives. The minimum effective concentration and dose were finalized for the granular hemostat made from carboxymethyl cellulose and gauze hemostat made from polyethylene oxide and kappa carrageenan (PEO-KC). Polyethylene glycol was also found to significantly increase the efficiency of the PEO-KC mixture.

Results from in vitro tests proved hemostatic effectivity against whole blood with either comparable or superior efficiency against the commercial product, Celox. The prototype has also been tested against blood with heparin (anticoagulant), which suggests that the blood clotting proceeds independent of the natural clotting function of the body and can therefore be used even on patients with low platelet count or some other clotting deficiency.



Hemostatic agent prototypes in granular and gauze forms

In-vitro assessment of hemostatic efficacy

There are still certain deviations in batch consistency testing owing to preparation inconsistency (e.g. variable particle size and non-uniform thickness of coating solution applied to the gauze). Production needs to be further optimized to maintain batch to batch product consistency as it relates to its efficiency.

Wound Dressing from Honey

The PNRI has developed an effective wound dressing from honey sources in the Philippines. The PNRI is taking advantage of the antimicrobial properties of these local products to produce a cheaper and comparable alternative to antibiotics for treating exudating wounds and burns.

Results from initial testing in rabbits showed that the dressing healed the wounds around the same time as the generic Neomycin; in some cases, the healing from the honey treatment was a day ahead of the antibiotic.

Pre-clinical testing conducted in a government hospital showed that with the honey dressing, full treatment of a burn patient was achieved earlier by a month than the usual healing time.

PNRI filed the patent application for the radiation-sterilized honey alginate dressing. The patent application was published in the electronic gazette of the Intellectual Property Office of the Philippines (IPOPHIL) in May 2014.

Sterility test of the honey alginate wound dressing developed by the PNRI

This year, the effects of two packaging materials on the physico-chemical properties of the radiation-sterilized honey alginate dressing for exudating wounds were tested and compared. Analysis showed that transparent polyethylene packaging causes an increase in moisture content and browning but no significant changes in pH level of honey alginate after a three and six month period. The opaque polyethylene terephthalate-foil-polyethylene (PET-foil-PE) on the other hand, has no significant change in pH level and moisture, has minimal browning after three to six months and remains stable within 16 months of storage at room temperature. Hence, it is more preferred as a packaging material. Further studies will be conducted for one year to confirm these results.

Development of Food Packaging Materials

This study aims to perform research and development on food packaging material made of synthetic or natural polymers. Through this project, PNRI has developed an alginate film crosslinked with calcium ions at a 10 kGy dose of gamma irradiation. Studies are being conducted to further enhance the antimicrobial property and tensile strength of the packaging material.

Food packaging material made of alginate film crosslinked with calcium ions by 10 kGy dose gamma radiation

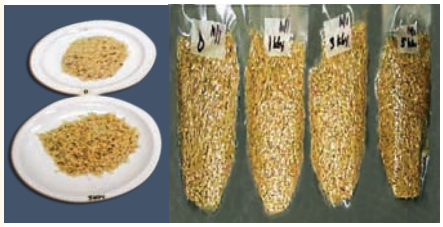
Application of Food Irradiation Technology for Enhancing Food Safety, Quality and Agricultural Trade

This project aims to undertake research and development studies on food irradiation and generate public awareness and interest on commercial applications of food irradiation.

Development of Safe, Quality and Shelf-Stable Filipino Ethnic Foods for Immunocompromised Patients

This project makes use of irradiation as a preservation method for safe and quality ethnic food products meant for immunocompromised patients.

This year, the PNRI completed the development of a one set meal for immunocompromised patients. The meal and the corresponding radiation dose used for the food products are as follows: pork adobo (25 kGy), brown rice (1.0 kGy), fresh fruits and vegetables (1.0 kGy).



Brown Rice (RC160 variety)

Pork Adobo

Fruits

Mixed Vegetables

Complete meal for immuno-compromised patients

Feasibility Study for the Establishment of a Commercial Irradiation Facility

Focused Group Discussion. In preparation for the feasibility study for putting-up a commercial irradiation facility to be funded by the Bureau of Agricultural Research- Department of Agriculture, PNRI conducted four focused group discussions (FGD) for various target groups such as food, medical and packaging industries. Three FGDs were conducted in the National Capital Region and one in Mindanao. Results of the discussions were very encouraging as indicated by the great interest of the stakeholders in using irradiation as a method for treatment of their products.

Information on the potential volumes of products to be irradiated in commercial scale was also obtained from survey questionnaires/forms administered to the participants. Products like spices, dehydrated vegetables, herbal and food packaging were identified as the highest volume of materials to be irradiated.

Philippine National Standard. A Technical Working Group (TWG), chaired by the PNRI, discussed the draft of the Philippine National Standard (PNS): Code of Practice for Radiation Processing of Food. The PNS, which was drafted and funded by the Bureau of Food Standards, Department of Agriculture, aims to provide guidance on best practices for irradiation of food for industry, irradiation facilities, regulators and the academe.

The PNS is currently being finalized after undergoing public consultations from three regions in Luzon, Visayas and Mindanao. The consultations generated positive feedback and full support from the different stakeholders and generated comments which will be incorporated in the final document of the PNS.

Enhancing Cytogenetic Biological Dosimetry Capabilities of the Philippines

The purpose of this project is to strengthen the capability of the Philippines in biological dosimetry as part of PNRI's radiological emergency preparedness and for routine monitoring of workers occupationally exposed to radiation.

In line with this objective, an *in-vitro* irradiation study of human peripheral lymphocytes is being conducted in order to establish a dose-response curve for radiation-specific dicentric chromosome aberrations. A dicentric chromosome is produced when one broken chromosome combines with another broken chromosome. Dicentric chromosomes are used in biological dosimetry as a tool to determine absorbed radiation dose in cases when physical dosimeters are not available at the time of exposure, in cases of over exposure and for radiological reassurance.

In this study, blood samples were collected from volunteer donors and together with OSL dosimeters, were irradiated at 0.1, 0.25, 0.5, 0.75, 1, 2, 4, & 6 Gy using a Cobalt-60 source. The result showed an increase in the frequency of dicentric chromosomes as the irradiation dose is increased. This observation is more pronounced in higher doses (1, 2 and 4 Gy). For 6 Gy dose, the number of dicentrics decreases. It was also observed that the number of metaphase cells decreases as the irradiation dose increases.

Focus group discussion conducted by PNRI for various target groups in preparation for the conduct of feasibility of putting up a commercial irradiation facility

Nuclear Analytical Techniques in Harmful Algal Bloom Studies

Transfer of Technology of Receptor Binding Assay (RBA)

In line with DOST's thrusts to hand over developed technologies to end-users, the PNRI is transferring the isotope-based receptor binding assay technology to the Bureau of Fisheries and Aquatic Resources (BFAR), which is the country's harmful algal bloom (HAB) regulatory and monitoring body.

Capacity Building on RBA of End-User

BFAR is mandated to monitor and perform analyses of HABs hotspots in the country. For decades, BFAR has been using the mouse bioassay (MBA) as detection method for paralytic shellfish poisoning (PSP) toxins. MBA has been the sole criterion for PSP monitoring, but due to some issues on sensitivity, specificity, variability, and limitations on the availability of mouse in order to perform the assay, a more efficient detection protocol is needed as a complementary method.

The RBA technology uses a radioactive isotope of hydrogen (tritium) attached to saxitoxin (STX). Since the method involves the handling of radioactive material, training in handling the reagents as well as in performing the assay is required. Moreover, to be competent for the requirements of the global market, a laboratory that will pass the international testing standards is necessary.

For effective transfer of technology to BFAR, PNRI assisted BFAR in preparing its laboratory for the new method. As a prerequisite in handling radioactive materials, three BFAR personnel successfully completed the Radiation Safety Course: Medical Use of Radioisotopes at PNRI. This equipped the monitoring agency with the basic principles of radiation, as well as the safety measures in performing radioassays. This is also in preparation for BFAR's application for license to use and to acquire radioactive materials.

Once BFAR has established its expertise to employ the RBA Technology, it can apply the technology in the analysis of other marine biotoxins such as ciguatoxins (responsible for the ciguatera fish poisoning). PNRI has started the development of RBA for ciguatera and aims to complete this in two years.

Receptor Binding Assay Facility at the Bureau of Fisheries and Aquatic Resources

PNRI researcher presents a paper on RBA at International Conference on Harmful Algae (ICHA) in Wellington, New Zealand on 27 – 31 October, 2014.

Developing Countries Towards RBA Technology

The project is linked to a collaborative work with the International Atomic Energy Agency (IAEA) entitled: "Supporting the Use of Receptor Binding Assay to Reduce the Adverse Impacts of Harmful Algal Toxins on Seafood Safety" (RAS7026). One of the components of RAS7026 is the adoption of RBA technology by the regulatory bodies of the IAEA Member States in the Asia Pacific. Aside from BFAR, other local agencies like the University of the Philippines-Marine Science Institute, also established the receptor binding assay technology.

Moving Forward with ISO 17025 Accreditation

PNRI is currently working on the draft of the Quality Manual for its RBA Laboratory. This will be under the PNRI ISO/IEC 17025:2005 Quality Management System, together with the other 17025 accredited laboratories of the Institute.

Promotional activities of the project were also undertaken this year. Three PNRI staff and one official from BFAR presented four papers on RBA technology transfer mechanisms and RBA-related research findings at the International Conference on Harmful Algae (ICHA) in Wellington, New Zealand on 27 – 31 October, 2014.

Nuclear and Isotope Technique Applications in Water Resources Management

IAEA Water Availability Enhancement (IWAVE) Project

Capitalizing on the unique advantage of nuclear technology, the Philippines joins the world in providing better access to clean and safe drinking water as it takes a pioneering role in the International Atomic Energy Agency (IAEA) Water Availability Enhancement Project, or IWAVE. The Philippines is the first Member State of the IAEA to participate in the project, followed by Oman and Costa Rica. The PNRI implements the IWAVE project in collaboration with the National Water Resources Board (NWRB), the Department of Environment and Natural Resources-Mines and Geosciences Bureau (DENR-MGB) and other agencies involved in the management of the country's water resources.

In 2014, PNRI conducted a three-week National Workshop on Isotope Hydrological Data which resulted in drawing meaningful conclusions from the isotopic data generated from the field investigations of water resources in Regions 2 and 10.

In most of the areas studied in Region 2, the mean residence time of groundwater ranged from five years to 40 years, indicating relatively "young" groundwater and a more rapidly replenished recharge. While this is considered to be favorable in terms of sustainable quantity of

groundwater, it also implies higher vulnerability of the groundwater to contamination. Closer monitoring of the groundwater quality and the delineation of recharge zones for protection are recommended. The Cagayan River may be an important source of recharge to the groundwater, thus, measures should be taken to protect the river from pollution.

Results of studies conducted in Region 10 provided the basis for inferring the sources of groundwater recharge in the two major basins in the region, the western (Cagayan River) basin and the eastern (Agusan River) basin. Data showed that the sources of groundwater in these two basins are distinct. In the Cagayan River basin, precipitation from altitude of around 400 meters contributes significantly to the groundwater recharge, while in the Agusan River basin, precipitation during the northeast monsoon (November – February) is a significant source of groundwater recharge.

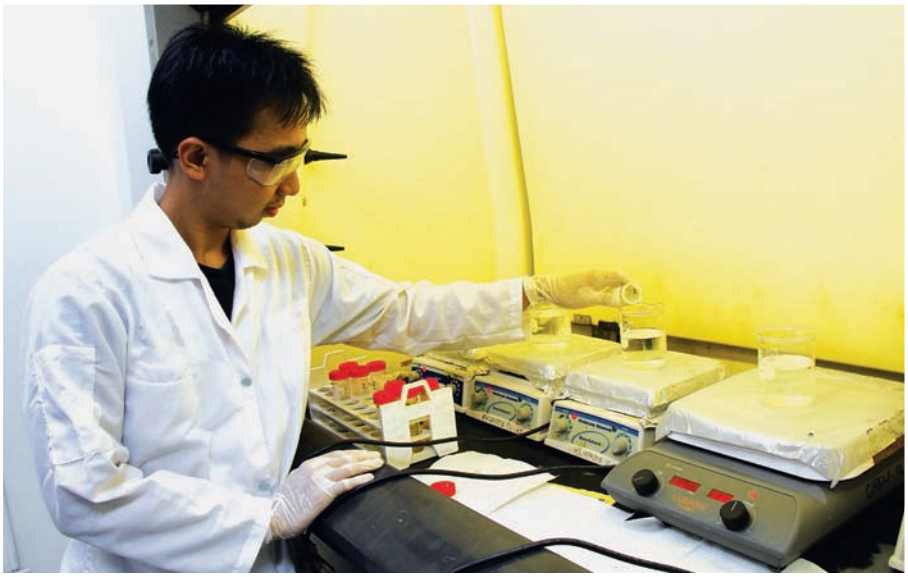
In Cagayan de Oro City (CDO), groundwater from the most exploited aquifer, an unconfined alluvial aquifer, has an estimated mean residence time of less than 100 years, an indication of relatively moderate period of replenishment. Groundwater in the western part of CDO may be influenced by water flowing from uplands where Cagayan River flows. On the other hand, groundwater in the eastern part of CDO appears to be influenced by water coming from Bukidnon.

Nuclear Analytical Techniques in Marine Environment

Supporting Pollution Assessment and Clean-Up Efforts of Selected Water Bodies in the Philippines

The study made use of the watershed approach for strategic sampling and analysis in order to identify critical areas contributing to pollution loading into the Manila Bay. It identified five critical locations for nitrate and three for phosphorous where major contributions to loading occur and where area-based strategic action plans can be pursued.

Determination of isotope ratios of carbon, nitrogen and oxygen in N-source materials such as particulate organic matter, plant tissues, and top soil proved useful in identifying various sources of pollution and in estimating the percentage contributions of these anthropogenic sources. Isotopic characterization of the different sources indicated that the major land use areas within the Pampanga River basin, such as cropland areas, domestic activities, and livestock contribute in some ways to the pollutant loading of the Pampanga River and eventually of the Manila Bay. The relative contribution of these activities to the total nutrient load from the basin was estimated using a three-source – two-tracer isotope mixing model. The model revealed that cropland sources generally contributed the most to pollutant loading during the wet season, from 22 percent to 98 percent, while domestic waste contributed higher in the dry season, from 55 percent to 65 percent.



PNRI researcher conducts test analysis of water samples

Carbon stable isotope ratios in surface sediments from the Manila Bay served as proxies of land use change in the Pampanga River Basin and, in combination with carbon and nitrogen concentrations, provided an insight on how much of the terrestrial anthropogenic sources contributed to the nutrient loading in Manila Bay. A two-source – one-isotope model showed that 17 to 30 percent of the organic matter deposited in the Bay comes from terrestrial activities in the Pampanga River Basin, mostly involving agriculture. The nutrient loading from the Pampanga River Basin mainly comes from terrestrial vegetation (rice and vegetables).

The differences in the distribution of nutrients and terrestrial input suggest that the main sources depend on the land use pattern of the catchments. Based on the estimated NO_3 and total phosphorus loading to the Pampanga River Basin, management efforts towards substantial reduction in the loading are vital to meet local and international standards. Periodic monitoring would be essential and area-based action plans must be developed, with strong local government unit participation and support from sectoral groups.

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

The study uses stable isotopes to determine the current state of the waters, corals, and white sands of Boracay Island, and the origin of nutrient contamination which have been held responsible for the algal bloom in the neritic zone. The sample collection and field data measurements have been completed in 12 sites in Boracay and nearby islands. Pre and post-monsoon samples of seawater, biota, sediment, sewage, surface water and groundwater were collected and analyzed for water chemistry, sediments and microbial load.

The study showed that critical areas in Boracay island were contaminated by coliform bacteria and blue green algae (cyanobacteria). The proliferation of blue green algae mats in the neritic zone points to high or unusual levels of nitrogen or phosphorus in seawater and sediments. The distribution of tritium, oxygen-18, nitrogen-15, and carbon-13 in the intertidal zone, helped to identify sites with septic sewage outflows and submarine groundwater discharge (SGD). In seawater, nitrates and nutrients were

discovered in the bathing zone while anomalies in tritium and oxygen-18 exposed the sources of infiltrating plumes. The isotope composition implied that algae acquire nutrients from septic contamination, while a number of corals assimilate inorganic fertilizer nutrients from land-based plumes and SGD.

The elements identified in sediments and corals were related to the natural mineral matrix of calcareous beach zone materials. However, sporadic spikes of lead, chromium and zinc were detected in particular sites at certain depths. These element spikes indicate proxy processes linked to anthropogenic pollution and/or organic matter decomposition in the sediment-water interfaces. Uranium is naturally abundant in neritic zone materials and since the corals and algae were obtained from the intertidal zone, the relatively higher uranium concentration in these samples cannot be avoided.

The similar trend in corals and sediments prove their similar composition; most likely, the weathering of corals provide the raw materials for sediment production. The rare earth and trace element composition of the algae was roughly 100 times lower than those of the corals and the sediments, indicating that algae has no participation in white sand production and refuting the long held local belief that the algae is beneficial to the white sand. The study demonstrates the practicality of applying isotope–based techniques in conjunction with other chemical methods for tracking down the sources of nutrient contamination in polluted systems.

Collection of sewage water samples from the Boracay Island sewage treatment plant

Air Pollution Studies Using Nuclear and Related Analytical Techniques

Air Pollution Source Apportionment

PNRI continued the collection of air particulate samples at two sites — at the Ateneo de Manila University (ADMU) and Valenzuela, to comply with the required activities under the RCA project on "Supporting sustainable air pollution monitoring using nuclear analytical technology." The maintenance of the ADMU sampling site is being maintained in collaboration with the Australian Nuclear Science and Technology Organization (ANSTO).

Results from ANSTO are expected to enable the Institute to perform source apportionment modeling for the said time period. Organic to elemental/carbon ratio (OC/EC) results will also be incorporated in this modeling and thus, it is expected that this will generate better results compared to those previously generated using only black carbon data. Multi-element data from Valenzuela are also now available.

Neutron Activation Analysis of Marine Sediment and Rice Samples

The PNRI is participating in the Neutron Activation Analysis (NAA) Project under the Forum for Nuclear Cooperation In Asia (FNCA) primarily on food safety and environmental monitoring of marine sediments. The project aims to determine the history of pollutant inputs in the Manila and Sorsogon bays, assess its impact in the ecosystem and to determine the source of nutrient contamination in Boracay Island.

On Marine Sediments. Increased levels of copper, iron, and zinc in core samples 1 and 2 from Manila Bay can be associated with increased siltations, but the high correlation of copper, zinc and lead in core 1 can be associated with increased industrial activities in the area. Association of patterns of elemental levels in marine sediment core samples to events can be done with available data on lead-210 (^{210}Pb) dating. Approximate beginning of increased levels of copper, iron and zinc in the core samples from the Manila Bay can be associated with the 1991 Mt. Pinatubo eruption (increase in siltation). The bulk density versus moisture content data in Sorsogon Bay indicate a disturbance starting at a depth of about 45 cm (Pb-dating not available yet) which can only be attributed to siltation but not to industrial activities since only copper, iron and zinc are well correlated.

Element composition and isotope abundance in Boracay Island samples disproved the local misconception that the algae turns into sand and is the eternal source of the white sand. The Bulabog area of Boracay is indicated to be the most polluted with reported elevated nitrate levels, microbial counts and chemical oxygen demand.

On Food Samples. Analyses of polished rice samples from the Philippines and Japan by NAA show reduction by as much as 72 to 91 percent for sodium, magnesium, manganese and potassium and as much as 27 percent for calcium and zinc as compared with unpolished rice. Likewise, one Philippine rice sample was found to have a very high bromine level and exhibited ^{13}C signature (analyzed by isotope-ratio mass spectrometry) outside the range of other Philippine rice samples. This may indicate that this particular imported rice sample may have been exposed to the pesticide methyl bromide during quarantine.

Comparison of elemental components in tilapia (Cichlid) and bangus (milkfish) fish samples showed higher potassium, iron and zinc in tilapia as compared to bangus. Bromine was found only in tilapia. Analysis of chocolate samples showed one sample with high titanium (Ti) levels, indicating either some contamination in the manufacturing process or the use of Ti for its white color. Ti is allowed in food up to one percent.

Environmental Radioactivity Monitoring

Radioactivity Monitoring and Updating of PNRI Radiation Map

PNRI's Health Physics Research Section (HPRS) monitors ambient gamma radiation levels and analyzes environmental samples for radioactivity. The regular monitoring activities constitute a vital part of PNRI's environmental monitoring program.

For 2014, PNRI was able to generate monthly radioactivity data in four monitoring areas in PNRI grounds. The ambient gamma radiation measurements at PNRI ranged from 47 to 59 nanosieverts per hour (nSv/hr). These values are within the normal background levels in PNRI which ranged from 42 to 60 ± 7 nSv/hr. Gamma dose rate levels were measured in four stations around the Institute using a SAM940 portable gamma meter with a NaI(Tl) detector.

15 monitoring sites around Metro Manila

The HPRS also updated the ambient gamma radiation map of the PNRI grounds. Under this activity, 21 sites were measured for radioactivity by setting up grids measuring 50 square meters each throughout the PNRI compound. The dose rates observed ranged from 36 to 71 nSv/hr, and the average rates are 50 ± 9 nSv/hr. These values are still within the normal background level,

SAM 940 portable gamma meter with Na (TI) detector

which would lead to an annual per caput effective dose equivalent to about 0.43 millisieverts per year (mSv/yr). Thus, the annual collective dose equivalent received by the PNRI employees from external radiation is 0.03 man-sievert. These dose rates can be attributed primarily to naturally-occurring radionuclides and do not pose any hazard to PNRI employees, as well as the public.

Radiation Monitoring In Metro Manila

PNRI also conducted monthly radiation monitoring in 15 monitoring sites around Metro Manila. Using the same monitoring procedure done at PNRI, 10 measurements were taken at ten-second intervals for each monitoring area. For 2014, the monitoring was conducted from June to November. The average radiation levels in these sites range from 34 to 44 nSv/hr, which are well within the normal background levels and are not hazardous to the general public.

Determination of Concentration Factors of Cs-137 in Philippine Green Mussels *(Perna viridis)*

The Health Physics Research Section has started setting up a radioecology laboratory for PNRI's experiments on determining the concentration factor (CF) of anthropogenic radionuclide cesium-137 (^{137} CS) in Philippine green mussels *(Perna viridis)*.

One of the critical steps for radioecology experiments is in maintaining stock population of mussels in the laboratory. The HPRS was able to set up three 80 liter aquaria that serve as acclimatization aquaria for the newly harvested mussels. The aquaria were filled with filtered sea water from the Manila Bay area. The mussels were collected in Binakayan, Cavite with the assistance of the Provincial Agriculturist of Cavite.

Laboratory conditions are currently being optimized to ensure the healthy state of the mussels and to lengthen their lifespan. Developing microalgal cultures which serve as food source (Chlorella) for the mussels, is also being done at the laboratory.

An expert mission was also conducted by Dr. Ronald Symzack in April 2014 to provide hands-on training, workshops on radioecology, and lectures on the rearing of mussels, proper maintenance of the aquaria and the acclimatization of the mussels in the aquaria under defined laboratory conditions.

Assessment of the Possible Radiological Impact Assessment of the Fukushima Nuclear Accident in the Philippine Marine Environment

This project aims to monitor the major bodies of water surrounding the Philippine archipelago through monitoring/sampling of seawater, sediment and marine biota for the determination of key anthropogenic radionuclides cesium-134 and cesium-137. The project also aims to submit all generated data to the Asia-Pacific Marine Radioactivity Database (ASPAMARD). The ASPAMARD is a compilation of available data on key anthropogenic and natural radionuclides in seawater, sediment and biota in the seas located in the Asia-Pacific Region. The Philippines is the focal point for ASPAMARD wherein there are 24 participating countries in the Asia-Pacific region.

PNRI researchers performed on-site analysis of cesium -134 (^{134}Cs) and cesium-137 (^{137}Cs) in seawater samples

Radiation monitoring at Rizal Park

Collection of sediment using a grab sampler

collected during the Koyo Maru cruise in November 2013 in San Fernando, La Union and at Lagonoy Gulf. Co-precipitation of ^{137}Cs was done with the use of AMP (ammonium phosphomolybdate). After pre-concentration, the samples were allowed to settle overnight and the precipitate was collected and brought to PNRI for further analysis using gamma spectrometry. Other samples collected for analyses were biota and sediment samples from Guimaras Strait, Negros Occidental, Lagonoy Gulf, Camarines Sur; and Atimonan, Quezon.

Average activity concentration of ^{137}Cs in fish samples analyzed was found to be 0.9 ± 0.3 Bq/kg wet weight. This value is within the range of values for ^{137}Cs reported in ASPAMARD Phase I (from 1975 to 2000) which is 0.02 to 2.76 Bq/kg wet weight. ^{134}Cs was not detected in any of the fish samples analyzed. ASPAMARD has been used as a reference for radioactivity in the marine environment as it also contains pre-Fukushima values of anthropogenic radionuclides contributed by countries in the Asia-Pacific region.

The average activity concentration of ^{137}Cs in seawater samples analyzed in the different marine areas in the country was found to be 0.6 ±0.2 Bq/m^3 (n=6). This value is less than the mean ^{137}Cs concentration in surface water reported in ASPAMARD Phase I. The average activity concentration of ^{137}Cs in surface seawater reported by ASPAMARD in 2000 was 4.34 ± 2.45 Bq/m^3. The ^{137}Cs activity concentrations in all seawater samples analyzed were found to be below the Lowest Limit of Detection (LLD=0.2). ^{137}Cs was not detected in any seawater and fish samples analyzed.

In support of this project, PNRI remains an active member of the Technical Working Group for Marine Scientific Research which is chaired by the Office of the Undersecretary for Special and Ocean Concerns, Department of Foreign Affairs.

Management of CTBTO Stations in the Philippines: PHP52 and NFC-PH

In line with the Philippines' commitment to the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO), PNRI continued to provide information and communications technology (ICT) technical support to the operation and maintenance of the PHP52 radionuclide monitoring station in Tanay, Rizal. The Institute also managed and maintained the National Data Center (NDC-PH)

Maintenance and repair of auxiliary generator at the RN52 Station in Tanay, Rizal as part of the management of CTBO stations in the Philippines

at PNRI, which receives International Monitoring System (IMS) data from the International Data Center in Vienna, Austria. The NDC-PH currently accesses relevant data particularly those generated from the PHP52 station through the secured International Data Corporation (IDC) website for environmental radioactivity monitoring and for other civil and scientific applications.

Together with its commitment to operate and maintain the CTBTO stations PHP52 and NDC-PH, PNRI, continued to develop strategies to optimize system performance through infrastructure improvements and system performance research. The first trial of the performance evaluation of the Canberra® Cryo-Cycle™ Hybrid Cryostat as cooling system for the HPGe Detector in RN52 Station, Tanay was completed in the 4th quarter of 2014, which aims to optimize resource management at the station. With the assistance of UltiSat, Inc., the Global Communications Infrastructure (GCI) service and maintenance provider for CTBTO stations, PNRI was also able to improve data communications with the installation of a new VSAT antenna reflector and replacement of the Uninterruptible Power Supply for the NDC-PH.

PNRI has also undertaken various scientific research utilizing IMS data and IDC products generated from the PHP52 radionuclide monitoring station. A preliminary study on the determination of natural radionuclide levels in air particulates derived from the CTBTO-PHP52 station was conducted and presented during the CTBTO East Asia Regional Data Centre Workshop in Mongolia from July 29 to August 1, 2014. This research is in line with the environmental radioactivity monitoring activities being conducted by the Health Physics Research Section.

Radiological Assessment of NORM/ TENORM in Cement Industries in the Philippines

PNRI, through the Health Physics Research Section (HPRS) undertakes this project to measure activity concentrations of naturally-occurring radioactive materials (NORM) and technologically enhanced NORM (TENORM) in cement and raw materials and its implications to human health and environment.

For 2014, the HPRS environmental monitoring team conducted a sampling trip to LaFarge-Republic Cement Manufacturing Plant in Barangay Dalumbayan, Teresa, Rizal. Ambient gamma dose rates in air at one meter above ground were measured around the

Collection of raw coal, shale, gypsum, limestone, silica and cement samples from HOLCIM Cement Manufacturing Plant in Davao City and Lafarge Republic Cement in Teresa, Rizal

vicinity of the plant site using SAM 940 portable dose rate meter. The average gamma dose rate measurements obtained range from 26.7 to 80.2 nanosieverts per hour (nSv/h).

Seven kinds of raw materials used in cement manufacturing and two cement samples were collected from the stockpiles located inside the plant site for gamma radioactivity analysis. The range of activity concentrations of radium-226, thorium-232 and potassium-40 in Becquerel per kilogram (Bq/kg) are 0.23 to 450.77, <2.85 to 71.66 and 1.15 to 618.63, respectively. Meanwhile, 11 raw materials used for cement manufacturing and three cement samples from the HOLCIM Cement Manufacturing plant site in Davao City were also collected.

These materials showed activity concentrations ranging from merely a fraction to a thousand times lower than the International Atomic Enegy Agency (IAEA) clearance levels for materials with radionuclides of natural origin, 10 becquerel per gram (Bq/g) for potassium-40 and 1 Bq/g for each radionuclide in the uranium and thorium decay chains. The NORM/TENORM concentrations measured at Holcim Cement and Lafarge Republic Cement were below clearance levels for natural radionuclides.

The first real-time radiation monitoring station in PNRI with EFRD 3300 Detector

Radon measurement in San Marcelino, Lahar Dike (Pampanga)

Establishment of Real-Time Environmental Radiation Monitoring System in the Philippines

The PNRI is establishing a countrywide network of detectors for the real-time monitoring and immediate detection of anomalous gamma radiation levels. This project aims to strengthen the emergency preparedness and response capabilities of the Philippines in an event of a wide-spread radiation emergency.

On 8 December 2014, the first radiation monitoring station located at the PNRI grounds was inaugurated. The equipment installed on this station, an EFRD 3300 Cube Spectroscopic Environmental Radiation Detector, was donated by Satrec Initiative of South Korea, through the sponsorship of the Korea Trade-Investment Promotion Agency, and commissioned by the Ministry of Trade, Industry, and Energy of South Korea.

The setting-up of the station was completed and its operation was started on 9 December 2014. The equipment consisted of a thallium-doped sodium iodide detector. The performance of the station will be evaluated, while data will be collected and analyzed to establish a baseline profile of radiation levels for one year. The baseline data will then be used to determine anomalous levels and detect radiation emergencies.

Radon Levels in Dwelling Places in the Philippines and Its Possible Implications to Human Health

The project aims to contribute to the promotion of the health and safety of the general population through the radiological assessment of radon concentration levels in household dwellings in the country. Radon is an odorless, tasteless and invisible radioactive gas that is found naturally in the soil, rocks and in volcanic ash or lahar.

The PNRI has started to conduct radiological assessment of radon in light of the Mt. Pinatubo eruption on June 15, 1992, which deposited 1.5 billion cubic meters of volcanic ash on the surrounding land. The ash is presently being used as a sustitute for sand in the manufacture of concrete blocks for building purposes and road construction. This project came about as a result of the IAEA meeting conducted in Bangkok, Thailand in 2013 wherein the IAEA requested the participating ASEAN Member States to submit project proposals on the measurement of radon in dwelling places. An intercomparison on radon measurement techniques is also part of the project program.

Field geochemical measurement using handheld OAKTON multi-parameter tester

Radon measurement in soil using alphaGUARD radon monitor

In 2014, PNRI conducted radon monitoring and assessment of selected sites in the vicinities of Mt. Pinatubo-lahar affected areas, namely: Pampanga towns (Angeles City, Bacolor, San Fernando, and Porac) and Zambales towns (San Marcelino and San Antonio) and in provinces of Region 4A. Short-term radon measurements in soil gas and water samples were performed using the Durridge RAD7. For assessment of indoor radon levels in dwellings, Passive Alpha Track Etch CR39 detectors provided by PNRI and the IAEA were deployed and will be retrieved for analysis after a six-month period. In principle, the measurement of ^{222}Rn concentration in soil gas, can be used as a method for evaluating the potential for elevated indoor radon concentrations. PNRI Health Physics specialists also collected and analyzed groundwater which is one of the sources of drinking water in some areas. The concentration of radon ranged from 0.79 to 54.00 kBq/m^3 in soil and 0.71 – 1.77 Bq/L for groundwater. The concentrations of ^{222}R in soil were found to be similar to the radon ranges in other countries such as Slovenia (0.9 – 32.9 kBq/m^3), Prague, Czech Republic (32-155 kBq/m^3), and Iraq ((x= 9.3 ± 4 kBq/m^3). The average radon activity concentration measured in groundwater (0.78 ± 0.33 Bq/L) is much lower than the 11 Bq/L Maximum Contamination Limit (MCL) set by the Philippine Drinking Water Standard in 2007.

Retrieval and replacement of LR115 alpha track detector

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

The PNRI, in joint cooperation with Philippine Institute of Volcanology and Seismology (PHIVOLCS) and Central Luzon State University, carried out radon measurements for earthquake monitoring along the north-central segment of the Philippine Fault (PF) in north-central Luzon and Valley Fault System (VFS), which traverses the eastern section of Metro Manila and the adjoining provinces of Rizal, Cavite and Laguna. This study utilizes radon gas, a naturally occurring radioactive tracer, as geochemical precursor of an impending large quake along these two seismically active faults. The study involved long-term radon measurements in soil employing LR115 alpha track detector and on-the-spot radon gas measurements in soil and groundwater using alphaGUARD monitoring system.

The results showed anomalous rise in radon concentrations either or both in soil and groundwater prior to some earthquakes. Although no quakes occurred along these two active faults during the period of measurements, several minor and major earthquakes with epicenters nearby and farther away (>100km) were identified. These quakes were correlated with the radon anomalies along the north-central segment of the PF and VFS based on their time of occurrences, strain radius and epicentral distances to the established monitoring sites.

These variations in radon levels could have been modulated by the state of stress that enhanced the radon concentrations in soil and groundwater that preceded the quakes. The radon signatures were more pronounced for larger magnitude (>ML4.0) particularly when the earthquake epicenter is closer to the monitoring sites while minor quakes (<ML4.0) exhibited small radon signals. Moreover, anomalous changes in radon concentrations were manifested in some monitoring sites quite sensitive to disturbances induced by approaching larger quakes (>ML4.0) even at great epicentral distances.

The results also showed that earthquakes occur about a few weeks to several months from the time that anomalous rise in radon concentrations were observed. This shows that radon can be utilized as a short-term practical approach for earthquake monitoring along these two active faults.

Moreover, geochemical measurements of groundwater indicated anomalous changes in electrical and total dissolved solids which could be attributed to induced stress, suggesting its potential as a possible indicator of an impending quake.

HARNESSING EMERGING TECHNOLOGIES TO BOOST INDUSTRY COMPETITIVENESS

Radiation-Induced Grafted Materials for Environmental Remediation

Radiation-induced grafting is one of the most effective and promising methods for modifying the surfaces of synthetic and natural polymers. The grafted polymers can be further functionalized to generate materials that can reduce the amount of certain pollutant metal ions and compounds in waste solutions. Moreover, gamma radiation is used for the initiation step of the grafting process, hence, no toxic chemical initiators remain in the final product.

In this study, pineapple fibers, polyethylene and polyethylene/polypropylene nonwoven fabrics were grafted with different polymers for removal of copper (II), lead (II) and phenol. The results demonstrated that grafting of polymers on surfaces of different trunk polymers significantly enhanced their capacity to remove molecular and ionic pollutants from solutions.

The newly inaugurated Electron Beam Facility at PNRI

Establishment of Electron Beam Facility

The second phase of the Construction of the Electron Beam (EB) Facility building was completed, culminating in the facility's inauguration on December 8 during the 42nd Atomic Energy Week celebration.

The following activities were also completed during the year: (1) installation and commissioning of the 2.5 MeV EB accelerator by personnel of EB-Tech Co. Ltd. (the supplier of the EB accelerator); (2) training of the Irradiation Services Section (ISS) staff on the operation and maintenance of the EB accelerator by EB-Tech personnel; (3) trial runs on several samples (such as non-woven fabric, hydrogel and surgical gloves, among others; and (4) hosting of an IAEA expert mission on process control and dosimetry of the EB irradiation faclity.

The EB irradiation facility is now fully operational and is currently being used by PNRI researchers for radiation grafting, crosslinking and sterilization. This is the first facility in the country intended for full-scale research and development and semi-commercial EB irradiation services.

DEVELOPMENT AND APPLICATIONS OF HIGH TECHNOLOGY MATERIALS

Characterization of Uranium/ Thorium Bearing Heavy Minerals using Nuclear and Other Related Techniques

The allanite mineral from Ombo, Palawan is a mineral containing thorium, uranium, iron and other heavy metal elements. These minerals contain radioactive materials that can damage the crystal structure, making them metamict over prolonged exposure to alpha dose.

The Applied Physics Research Section (APRS) conducted an initial characterization of metamict minerals such as allanite, using nuclear and other related analytical techniques such as x-ray fluorescence (XRF) spectroscopy, x-ray diffraction (XRD), gamma spectrometry and Mossbauer Effect spectrometry (MES). XRF spectroscopy, a non-destructive, elemental analysis, was used to quantify the elements of interest found in the mineral. Gamma spectrometry was applied for sample emitting gamma-rays, wherein the nuclide is known based on its gamma-ray energies emitted. The XRD and MES were used for mineral phase identification.

Allanite minerals from Ombo, Palawan containing rare earths, uranium and thorium elements

XRF and gamma spectrometry confirmed the presence of uranium and thorium in the mineral, with concentrations of 2.2% and 1.4-1.7%, respectively, as well as the other heavy minerals of interest. Preliminary results of the XRD and MES investigation of allanite showed a crystalline structure and a predominant Fe^{2+} iron site, respectively, which implies that the absorbed alpha-dose is relatively low and the geological age of the mineral is relatively young.

Survey of Nuclear and Other Industrial Minerals

The Nuclear Materials Research Section (NMRS) continued to implement the project entitled "Verification Survey for Radioactive Rare Earth Minerals in Northern Palawan" with financial support from the Nuclear Research Foundation, Inc.

This year, PNRI researchers surveyed further the area around the radioactive hot spring located within Barangay Barotuan in El Nido, Palawan through gamma ray spectrometric measurements as well as stream-heavy mineral survey technique. A total of 226 gamma ray spectrometric measurements in 42 data stations were conducted. Survey results showed that radioactivity levels in the area are 43 times higher compared with measurements taken inside PNRI premises. Analysis of heavy mineral panned concentrate, soil samples, stream sediment and water using atomic absorption spectrometry were undertaken. Fluorimetric analyses of the samples obtained are on-going.

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

Under this project, the analyses of soil samples by atomic absorption spectrophotometer (AAS) were continued. PNRI, through the NMRS, analyzed a total of 83 soil samples previously taken from the Kingking, Compostela Valley copper-gold mineralized area. The ranges of values (in parts per million) obtained from the elements analyzed using atomic absorption technique were as follows: silver (0.4 - 3.0 ppm); cadmium (< 4.6 ppm); chromium (2.9- 70.9 ppm); copper (44.56-10835.25 ppm); lead (18.29 -219.20 ppm); zinc (5.50-1223.95 ppm); nickel (5.03-39.07 ppm); cobalt (8.12-62.12 ppm); manganese (13.54 -3763.21 ppm); and iron (1.67%- 5.28%).

The measurements are useful tools in determining other valuable minerals that may be present in the ores, aside from copper and gold that may be economically viable for extraction.

Studies on Hydrogeochemical Process / Environmental Surveillance: Extraction of Uranium and Other Valuable Materials from Phosphoric Acid

IAEA Mission and National Workshop on Uranium Extraction from Phosphates.

With more opportunities to access the country's natural resources and minerals, the PNRI hosted an expert mission and a two-day national workshop of the International Atomic Energy Agency (IAEA) on "Situation Assessment for Uranium Extraction from Phosphate for Commercial Industries" in May. Uranium, which is commonly used as fuel for nuclear power plants, may also be extracted from alternative sources such as phosphate rocks and phosphoric acid.

Under the IAEA Technical Cooperation Project on "Enhancing National Capacity for Extraction of Uranium, Rare Earth Elements and Other Useful Commodities from Phosphoric Acid," the PNRI implements this project not only to improve its capacity in rendering services on the processing of uranium and other valuable commodities such as rare earth elements for potential economic gain but also to help lessen the impact on the agricultural soil of continuous use of phosphate fertilizer having radioactive materials. The NMRS has previously conducted preliminary studies on the potential of uranium extraction from phosphates obtained from the Philippine Phosphate Fertilizer Corporation (PHILPHOS) in Isabel, Leyte.

The two-day workshop was attended by representatives from Philippine Phosphate Fertilizer Corporation (PHILPHOS), the Department of Science and Technology – Philippine Council for Industry, Energy and Emerging Technology Research and Development, the Department of Environment and Natural Resources – Environmental Management Bureau and the Coal and Nuclear Minerals Division of the Department of Energy – Energy Resource Development Bureau as well as scientists and researchers from PNRI.

Panning for heavy minerals along Inagauan River

PROVISION OF QUALITY S AND T SERVICES

The benefits of nuclear science and technology are truly felt when applied to provide solutions to the needs and problems of clients as well as the general public. As an agency of the government, PNRI offers its services to industry, business, health, government and academic sectors with an unparalleled edge owing to the unique capabilities derived from nuclear and radiation applications.

GAMMA IRRADIATION SERVICES

PNRI's irradiation services using Cobalt-60 gamma radiation source have once again proven useful to the industrial, medical, government and academic sectors engaging in radiation processing and in advance research applications.

This year, 40,137 bags and boxes of various products were irradiated at the semi-commercial Multipurpose Irradiation Facility (MIF). More than 70 percent of these products were from clients involved in industrial and commercial ventures as well as in medical applications, while the rest were from academic and government institutions.

Among the products irradiated for commercial purposes were spices, herbal products, dehydrated vegetables, food seasonings, brewer's yeast, cosmetics, cosmetic raw materials and accessories, empty aluminum tubes, surgical gloves, plastic caps, antibiotic powder and frozen bone grafts.

For research and development studies, the samples irradiated included hydrogels, carrageenan, chitosan, polymers, non-woven fabric and cellulose, hemostat gels, water with plastic packaging, honey alginate

The Cobalt-60 Multipurpose Irradiation Facility (MIF)

dressings, alginate films, packaging materials, Manuka honey, Yacon plant, mixed fresh fruits and vegetables, corn and bitter gourd seedlings, male flowers of cucurbit and melon, banana shoot tips, nanocomposites and *Aedes aegypti* pupae.

The Gammacell 220 irradiator, which is utilized mainly for research purposes involving smaller volumes, was used to irradiate 656 samples from the academe and research institutes. Among these samples were orchids and other ornamental plants, native fruit trees, Anthurium plant, Wax plant, Carabao mangoes, Cavendish banana, okra, tomato, eggplant, Baguio beans, banana meristem, rice tissues, mosquito pupae, *Brontispa* adult coconut leaf beetle, sea urchin, mice, chitosan, carrageenan and OSL dosimeters. The samples also included seeds from several kinds of plants such as mustard, cashew, mangosteen, mungbean, rice and corn.

All in all, the Irradiation Services Section rendered a total of 830 gamma irradiation services – 705 with the MIF and 125 with the Gammacell 220.

The irradiation room of the Cobalt-60 Multipurpose Irradiation Facility

RADIATION PROTECTION SERVICES

Licensed users of radioactive materials and nuclear instruments as well as workers occupationally exposed to radiation regularly avail of PNRI's radiation protection services to monitor and control the radiation doses within the safe limits.

Personnel Monitoring Services

Compared to previous years, an even greater number of optically stimulated luminescence (OSL) dosimeters and thermoluminescent dosimeters (TLD) were issued for personnel monitoring of radiation exposure. In particular, the number of OSL dosimeters issued skyrocketed to more than double the amount recorded last year, which itself saw a tenfold increase in issuances compared to 2013.

Standardization and Calibration Services

Aside from the provision and rental of personal dosimeters, PNRI also performed calibration and standardization of radiation/nuclear instruments and equipment used in various institutions/ hospitals to ensure accurate and reliable measurements.

RADIATION PROTECTION SERVICES		
Personnel Radiation Monitoring	• 23,587 OSLs issued • 12,409 TLDs issued	• 20,011 individuals served • 3,576 institutions served • 11,425 individuals served • 965 institutions served
Calibration of radiation detection instruments	• 597 units of survey meters • 68 units of contamination meter • 519 units of pen dosimeters • 18 units of dose calibrators	• 516 institutions served • 59 institutions served • 202 institutions served • 18 institutions served
Leak testing of sealed radioactive sources	• 75 on-site leak testing	• 16 institutions served
Management of spent sealed sources	• 13 spent sealed sources	• 12 institutions served
Output calibration of brachytherapy sources	• 1 unit calibrated	• 1 institution served
Iodine-131 activity measurement	• 14 measured	• 1 client served
Iodine-125 Low Dose Measurement	• 6 measured	• 1 client served
Area/Air monitoring	• 6 services rendered	• 1 client served
Rental of survey meters and moisture density gauge	• 159 survey meters • 4 moisture density gauges	• 159 institutions served • 4 institutions served

Calibration of instruments at the PNRI Secondary Standards Dosimetry Laboratory

Radioactive Waste Management

Through its centralized Radioactive Waste Management Facility, PNRI carried out the collection and proper/safe management

IAEA experts inspect the PNRI Radioactive Waste Management Facility

of spent sealed sources and solid wastes generated by licensed users of radioactive materials. This facility serves as the only centralized waste processing and storage facility for low-level radioactive wastes in the country.

Radiation Control Services

Radiation control services such as area/air monitoring and leak testing of sealed radioactive sources were performed to make sure that work areas and operation conditions of radiation-emitting devices in authorized facilities are in accordance with national radiation safety standards.

Rental of Radiation Detection Instruments

PNRI also allowed the rental of radiation detection instruments (such as survey meters) by authorized users/facilities for area monitoring around radiation emitting devices in their workplace.

Leak testing of sealed radioactive materials being done by the Radiation Protection Services Section staff

ENGINEERING SERVICES

Keeping the Institute's facilities well-equipped and capable to stand the test of time as well as the rigors of experiments and services alike, the PNRI Engineering Services Section (ESS) continued to provide repair and maintenance services for both nuclear and non-nuclear equipment to clients from PNRI as well as clients from other sectors.

This year, the section fabricated several components and equipment which are essential to the Institute's radioactive waste management services such as lead shielding devices for conditioning Category 3 to 5 radioactive sources and shielding supports for drum prelining with concrete mix.

The ESS also provided vital technical support for the installation and maintenance of the liquid nitrogen plant of PNRI's newly established Central Analytical Laboratory, as well as minor modification of the cable trays for the Electron Beam Facility. A metal/lead shielding table for a High-Purity Germanium (HPGe) detector set-up was also fabricated by ESS.

In addition to this, the section fabricated several other components for research such as core samplers for conducting compound-specific stable isotope techniques, collimator holder for x-ray equipment, autoclave sterilization unit, and samplers for air and sediments.

Meanwhile, the ESS Electronics and Instrumentation Group continued to diagnose and repair radiation detection instruments such as survey meters brought by various clients. The section has also developed three prototype radiation detection devices that can be used for area monitoring or as low-cost survey meters designed for personal monitoring, rental services and educational purposes.

NUCLEAR-BASED ANALYTICAL SERVICES

A PNRI researcher conducts analysis of samples in the IRMS laboratory

The PNRI, through its Nuclear Analytical Techniques Applications Section (NATAS), uses the state-of-the-art precision and efficiency of nuclear-based analysis and related techniques for research and regulatory purposes, particularly for non-radioactivity certification of products prior to trading and exports.

Compared to other technologies, nuclear and isotopic analytical techniques offer the advantages of providing faster and more precise results on a wider range of compounds and elements without risking the sample to damage or irretrievability through its non-destructive capability.

For 2014, NATA analyzed 364 samples from 145 clients. Majority of the clients availed themselves of the procedures which were accredited and certified

under ISO/IEC 170 25:2005. In particular, more than half of the samples were for the analysis of foodstuffs and other related materials by gamma spectrometry, followed by samples for gross-alpha beta analysis of drinking water and well water by liquid scintillation counting, which formed almost a third of the total number of samples.

Four clients submitted five samples for detection of synthetic acetic acid adulteration in Philippine vinegar by liquid scintillation counting and isotope ratio mass spectrometry. Meanwhile, 20 clients submitted 34 samples for radon analysis.

Overall, the nuclear-based analytical services for this year showed an increase in income compared to last year.

X-Ray Diffraction Services

The Applied Physics Research Section conducted X-ray diffraction of mineral samples under the project "Characterization of Materials Using Nuclear and Other Related Techniques" to determine the crystallographic structure and identify phases present in the samples. The XRD service was also extended to clients from the industry, government and academe. This year, there were a total of 119 samples analyzed from 36 clients, the majority of which were from the academe.

NUCLEAR-BASED ANALYTICAL SERVICES		
Gross Alpha-Beta Analysis in Water	• 118 samples	• 58 customers served
Gammametric Analysis	• 207 samples	• 63 customers served
Vinegar Adulteration	• 5 samples	• 4 customers served
Radon Analysis	• 34 samples	• 20 customers served

GAMMA RAY COLUMN SCANNING SERVICES

Through its Isotope Techniques Section (ITS), PNRI offers its gamma column scanning technology to help improve the maintenance capabilities of the petroleum and chemical industries by showing the conditions inside process columns and vessels real-time without interrupting production for a more physical inspection, saving the operation valuable time and resources.

To improve its grasp of the technology and its industrial applications, PNRI engaged in a two-year technical cooperation project with the IAEA entitled PHI/1/018 "Enhancing National Capability in Applications of Industrial Radioisotope Techniques" which will include manpower development, procurement of new equipment and consultations through expert missions.

Aside from this, PNRI also continues to participate in the IAEA and RCA project RAS/1/012 "Characterizing and Optimizing Process Dynamics in Complex Industrial Systems using Emerging Radiotracer and Sealed Source Techniques" to improve its collaboration with other countries in the Asia-Pacific region on radiotracer technologies.

The Institute continues to engage petrochemical companies for PNRI's technical and promotional activities on gamma-ray column scanning and other industrial applications of radioisotopes.

During the five-day IAEA expert mission in July, the ITS staff composing the National Project Team for radiotracer techniques conducted a plant visit at the Petron Refinery in Limay, Bataan where they discussed the technology to the refinery's engineers and workers as well as the possibility of PNRI's engagement in technical and contract services with the company.

PNRI also conducted a technical visit at the JG Summit in Batangas. Here, the ITS team was requested to assess the problems regarding the company's process columns and evaluate the possibility of using nuclear techniques to visualize process vessels. JG Summit was notably receptive to the possibility of availing itself of PNRI's services using gamma column scanning and neutron scattering technologies.

IAEA expert discussing the Column Scanning Technique to PNRI clients

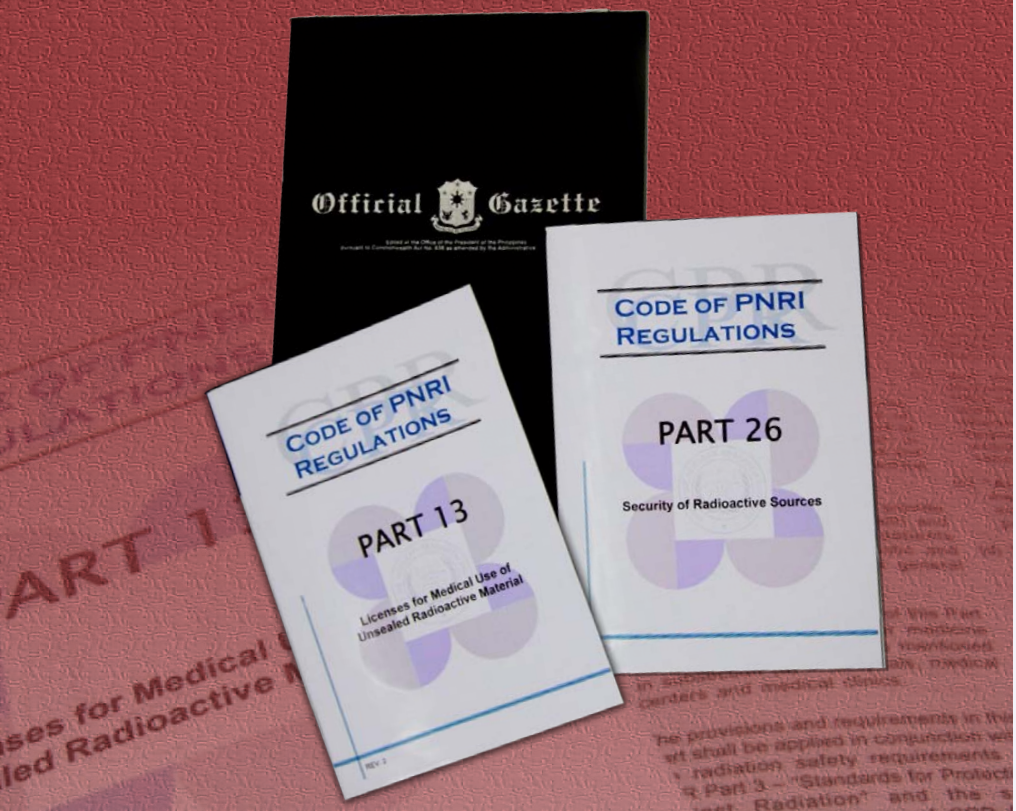
MICROBIOLOGICAL TESTS AND CYTOGENETIC COUNSELLING

For 2014, the Institute rendered 39 microbiological and 19 cytogenetic tests of various samples for 58 clients. The clients for cytogenetics analysis were non-destructive testing technicians who submitted samples for screening of any recent high-dose acute exposure to ionizing radiation.

In support of the accreditation of several procedures of the PNRI Microbiological Laboratory under ISO/TEC: 17025 and ISO 9001, the internal and external audits for both standards were also completed.

ENSURING THE SAFETY AND SECURITY OF RADIOACTIVE SOURCES

Nuclear regulation is the other half of PNRI's dual mandate, made vital and indispensable by the widespread use of nuclear and radiation technology across the country. PNRI continues to sustain the country's nuclear safety, safeguards and security regimes by ensuring that licensees adhere to the highest standards of handling radioactive materials and equipment, developing a radiological emergency preparedness and response program, and keeping our country's regulations updated and compliant with international standards.



Code of PNRI Regulations Part 13 and Part 26 published in the Official Gazette; Development of CPR Part 26 was undertaken by a technical working group with representatives from sections of the Nuclear Regulatory Division.

REGULATIONS AND STANDARDS

The PNRI's Regulations and Standards Development Section (RSDS) formulates nuclear safety policy and develops standards, licensing requirements, regulations, and criteria consistent with internationally acceptable guidelines and best practices to further enhance safety in the use of radioactive materials. It is also tasked to issue administrative orders and regulatory guides to assist licensees in complying with regulatory requirements.

Beyond developing regulations and providing technical inputs to stakeholders, the PNRI also hosts and conducts various meetings on the improvement of the nation's nuclear legal framework. Through RSDS, PNRI participates in several technical cooperation projects with the International Atomic Energy Agency (IAEA) and other partner groups in the field of nuclear regulations.

Code of PNRI Regulations (CPRs)

The PNRI has completed the revision of CPR Part 13 entitled *Licenses for Medical Use of Unsealed Radioactive Material,* which was already approved and published in the Official Gazette Vol. 110 No.12 on March 24. Meanwhile, the revision of CPR Part 26 on *Security of Radioactive Sources* was undertaken by the technical working group with representatives from other sections of the Nuclear Regulatory Division. The revised CPR Part 26 was approved and published in the Official Gazette Vol. 110 No. 21 on May 26.

Other Regulatory Documents

To provide its licensees with necessary information and technical support, PNRI also develops administrative orders and information notices aimed at improving compliance with regulatory requirements.

Administrative Order No. 01, Series of 2013 entitled *Adoption of the IAEA Safety Standards SSR-6, "Regulations for the Safe Transport of Radioactive Material"- 2012 Edition* was approved and published in the Official Gazette Vol. 110 No. 12 on March 24.

Four information notices were also disseminated to PNRI licensees, particularly regarding the revision of CPR Parts 13 and 26 as well as the issuance of the new CPR Part 27 entitled *Security Requirements in the Transport of Radioactive Material* published in 2013 and the issuance of A.O. No. 01, Series of 2013.

Legislative Support on Nuclear Law

In partnership with legislators and with the support of the International Atomic Energy Agency (IAEA), the PNRI continues to strongly push for the enactment of House Bill 147, which will provide for the creation of an independent nuclear regulatory body to meet international standards.

In line with this, the IAEA sponsored a bilateral meeting on the Comprehensive Nuclear Law hosted by PNRI on March 14, which was attended by representatives from various government agencies, stakeholders and other interested parties. Officials and regulators from the PNRI together with the staff of the DOST Legislative Liaison Office coordinated and met with the legislators from the Senate of the Philippines, House of Representatives, and the Presidential Liaison Officer to discuss the merits of the proposed bill and to justify the need for an independent regulatory body.

The PNRI participated in the meetings of the Technical Working Group organized by the joint committees on S & T and on government reorganization of the House of Representatives on the proposed Comprehensive Nuclear Law. The PNRI facilitated the participation of Congressman Francis Abaya, sponsor of the House Bill No. 147, in the Nuclear Law Institute of the IAEA in Baden, Australia in November 2014. The PNRI also facilitated the consultative meetings of Congressmen Victor Yu, and Mariano Piamonte, Jr. with the IAEA Office of Legal Affairs on the Comprehensive Nuclear Law in December 2014 in Vienna.

1st Training Workshop on Task 1 Training on Regulatory Framework and Regulatory Guidance in August 2014.

Technical working group meetings were conducted on October 17 and November 5 with representatives from the DOST and the House Committee on Government Reorganization regarding further revisions of the nuclear law drafts.

Technical Assistance for the National Regulatory Framework

The PNRI signed a project in cooperation with the European Union (EU) under PH/RA/01 to develop and implement nuclear safety cooperation in order to enhance and strengthen the regulatory regime. A series of workshops and meetings were conducted by the EU experts with the regulatory staff. The first workshop, which was held from August 18-22, dealt with the improvement of the current regulatory framework and guidance. This was followed by another workshop held from December 8-12, which focused on framework review for oversight of nuclear safety and radiation protection of nuclear power plants. These workshops were attended by representatives from the Department of Health – Center for Device Regulation, Radiation Health and Research, Department of Energy and the National Power Corporation, in addition to regulators from PNRI.

PNRI regulators also conducted a study visit to the regulatory organizations of Finland, Belgium and Germany from September 1-12 to observe and compare the regulatory frameworks of these various countries with each other as well as with PNRI's own framework.

Conduct of bilateral meeting on the Comprehensive Nuclear Law between the PNRI and the IAEA in March.

LICENSING, REVIEW AND EVALUATION

PNRI, through its Licensing, Review and Evaluation Section (LRES) issued 350 licenses for authorization to use, possess, produce, store, sell or import radioactive materials. From among the license applications granted, 19 were for new licenses, 52 were for amended licenses and the rest were for the renewal of licenses.

About 52 percent of the licensees were from the industrial sector, where radiation is mostly utilized for density, level and thickness gauging of products/materials. About 27 percent of the total number of licensees came from the medical sector, especially those engaged in the diagnosis and treatment of diseases. Around 14 percent of the total licensees were involved in commercial applications such as the sale and distribution of radioactive materials. The rest of the licenses were for research and education applications. Two licenses were issued for the operation of particle accelerators of medical cyclotrons. Seven licenses were terminated for 2014, while four license exemption certificates were granted because the items imported from other countries do not contain radioactive material or the activities of the radioactive material are in exempt quantities. PNRI also prepared 577 certificates of release for open and sealed sources for the Bureau of Customs to release imported materials to licensed users/suppliers. The LRES prepared 419 safety evaluation reports.

PNRI regulator conducting verification inspections on the facilities of prospective licensees

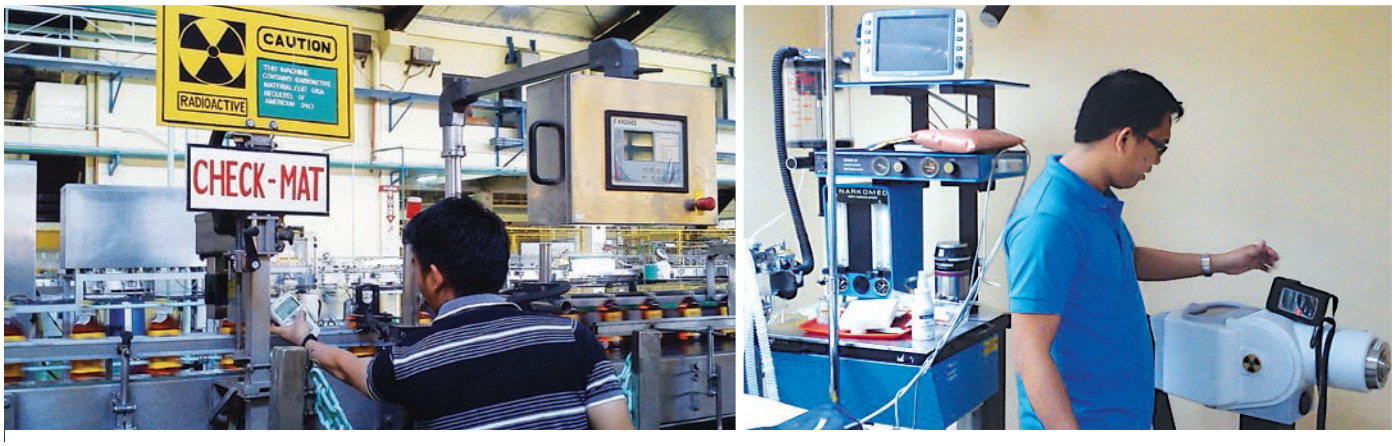
INSPECTION AND ENFORCEMENT

The PNRI enforces regulatory requirements through the conduct of inspection and audit of facilities and licensed radioactive materials to ensure compliance with PNRI safety and security regulations and standards, as well as the conditions of the license. With the aid of the Quality Management System, the PNRI through the Inspection and Enforcement Section (IES) developed a more systematic program to ensure effective enforcement of the regulations by requiring timely and adequate corrective actions on the part of licensees.

For 2014, the section conducted a total of 190 regulatory inspections, most of which were announced to the licensees concerned. Seven unannounced inspections were conducted to allow the inspectors a better opportunity to verify regulatory concerns and issues, while a follow-up inspection was conducted to check on the implementation of corrective actions that were previously recommended. As part of PNRI's Internal Regulatory Control Program, inspections were also conducted on nine of PNRI's facilities and laboratories which are using radioactive materials.

As part of its responsibilities, PNRI also issued and served Notices of Violation (NOV) and Cease and Desist Orders to PNRI licensees found violating regulatory provisions. Between 2012 and 2014, records show that the number of NOVs issued by PNRI was lessened in recent years, from five in 2012 to four in 2013, and down to one in 2014. This was despite the increasing number of licensees in recent years.

Two orders were served between 2013 and 2014 – one with respect to an abandoned device containing a radioactive source, and one with respect to willful violation of regulations.



Inspections conducted by PNRI in an industrial facility (left) and a medical facility (right).

SAFEGUARDS AND SECURITY

PNRI, through its Nuclear Safeguards and Security Section (NSSS), is responsible for ensuring that nuclear materials are not diverted to non-peaceful applications, as well as in sustaining the fulfillment of the Philippines' obligations to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and other various international agreements in the global effort to sustain nuclear security.

IAEA Nuclear Security Series Implementing Guide

Through the representation by the NSSS in the Nuclear Security Guidance Committee, during consultancy meetings held in Vienna, Austria, the PNRI contributed to the revision of the IAEA Nuclear Security Series Implementing Guide NSS No. 9, entitled "Security in the Transport of Radioactive Material". The PNRI was also able to contribute to the IAEA Safeguards Implementation Practices Guides on "Establishing and Maintaining State Safeguards Infrastructure" and "Facilitating IAEA Verification Activities which were published in December 2014.

IAEA Nuclear Safeguards Inspections and Nuclear Material Accounting

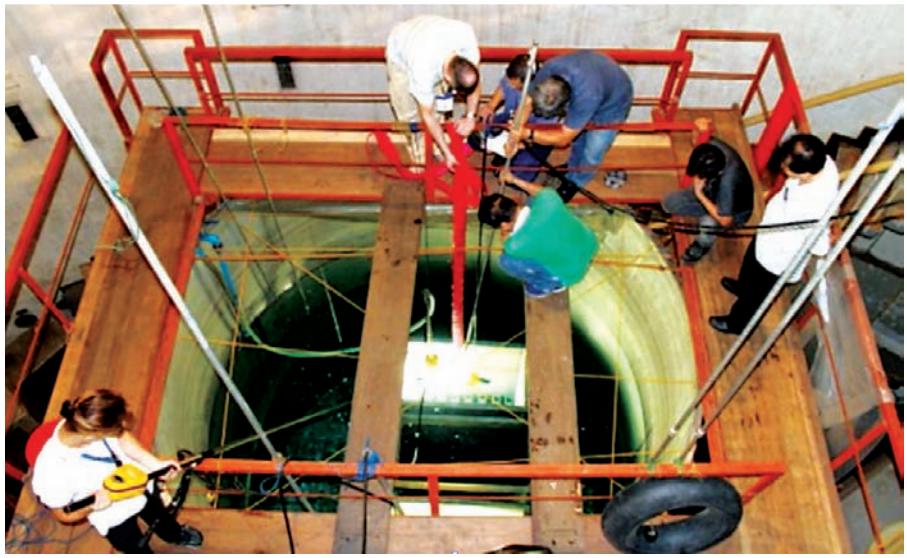
Inspectors from the IAEA Nuclear Safeguards Inspections and Nuclear Material Accounting conducted their annual physical inventory verification of the Philippine Research Reactor–1 (PRR-1) located at PNRI.

PNRI regulators provided assistance to the IAEA inspectors as they verified the research reactor's fuel identification and uranium content, as well as the depleted uranium in the Institute's centralized Radioactive Waste Management Facility. Moreover, NSSS assisted the IAEA inspectors as they carried out inspections at locations outside facilities, particularly those under private companies which are also licensees of PNRI . The inspection verified the depleted uranium used as shielding in radiographic cameras and heads of teletherapy machines, among others. The inspectors also carried out the Design Information Verification at the Bataan Nuclear Power Plant.

For this series of inspections, the PNRI was able to prepare five nuclear material accounting reports for PRR-1 and the BNPP and three reports on depleted uranium for the Location Outside Facilities, all of which were submitted to the IAEA in December.

The NSSS also submitted four quarterly reports of Export of Annex II items, and 4th annual updates of declarations for 2013 through the IAEA-NSSS secure communication. These submissions are part of the Philippines' reporting obligations under the IAEA Model Protocol Additional to the Agreements between States and the IAEA for the Application of Safeguards.

These activities were carried out in support of the international nuclear safeguards commitment with the International Atomic Energy Agency on Non-Proliferation of Nuclear Weapons Treaty and the physical protection of nuclear and other radioactive materials and facilities in the country.



Verification of fuel identification at the spent fuel pool storage of the Philippine Research Reactor-1

Depleted uranium verification at private facilities (left and center) and at the PNRI Radioactive Waste Management Facility (right)

IAEA safeguards inspectors at the Bataan Nuclear Power Plant.

Global Threat Reduction Initiative (GTRI)

The Philippines, through PNRI, participates in the Global Threat Reduction Initiative (GTRI), a comprehensive global initiative of the US Department of Energy (USDOE) that aims to address the issue of nuclear security around the world and reduce the threat of nuclear terrorism. Included under this initiative is the enhancement of security systems regulated in hospitals/ medical centers and PNRI facilities.

Physical security site assurance visits were conducted by PNRI along with the GTRI team at four upgraded facilities, while a site assessment at Western Visayas Medical Center in Iloilo City was conducted in May 2014. The PNRI also held a Site Security Plan Workshop for Category 1 facilities based on the revised Code of PNRI Regulation (CPR) Part 26 on "Security of Radioactive Sources".

In line with PNRI's commitments with the USDOE/Pacific Northwest National Laboratory (PNNL), medical facilities with Category 1 sources were subjected to security inspection regarding the status of installed security devices under Task Order No. 7 on Project Management. The NSSS also conducted the contract process for the upgrading of the PNRI perimeter fence along the University of the Philippines Arboretum.

Border Monitoring Activities in the Philippines under the European Commission

To help further the project between the Philippines and the European Commission on Border Monitoring Activities across the country, the PNRI received several brand-new radiation detection equipment in July and September this year, namely an ORTEC Hi-Purity Germanium Gamma Portable Detector, five Radioisotope IdentiFinders and 30 pieces of Personal Radiation Detectors.

Experts from the European Commission also conducted a Detectors Equipment Training for PNRI regulators and personnel.

Cooperative Arrangement with the Canadian Department of Foreign Affairs, Trade and Development Through the Global Partnership Program

The Philippines finds yet another strong link as it forges cooperation in nuclear security with the Canadian government. The PNRI, through the NSSS, has actively participated in the preparations for the proposed Partnership Program Against the Spread of Weapons of Mass Destruction. The NSSS has attended several preparatory and consultancy meetings with the Canadian Department of Foreign Affairs, Trade and Development (DFATD). The parties discussed about the Memorandum of Understanding and Implementing Arrangement at the Philippine Department of Foreign Affairs in August.

Megaports Initiative

PNRI participated in inter-agency meetings regarding the Joint Transition Plan with representatives of the USDOE and other agencies of the Philippine government involved in the implementation of the Megaports Initiative.

The transition plan will ensure the smooth turnover of the Radiation Portal Monitors and other equipment installed at the ports of Manila and the International Port of Cebu. A Memorandum of Agreement with the Philippine Ports Authority, Bureau of Customs and Cebu Port Authority was drafted by PNRI.

PNRI, through the NSSS, continued to monitor and respond to reports from the Bureau of Customs operators of the Central Alarm System. The Institute has also met with PNP and the USDOE Second Line of Defense regarding further assistance

The Philippines Integrated Nuclear Security Support Plan (INSSP)

The Philippines Integrated Nuclear Security Support Plan (INSSP) was updated to further contribute in enhancing nuclear and radiological security in the Philippines.

The update was based on the results of the review of the INSSP meeting held in November 2014 in Quezon City with representatives from the IAEA and from National Security Council, National Intelligence Coordinating Agency, PNP, BoC and Office for Transportation Security and the Anti-Terrorism Council. The future activities stipulated in the INSSP will provide a basis for cooperation with the IAEA. The Nuclear Security Information Management Systems workshop was conducted to integrate the INSSP.

In line with this, PNRI drafted the Joint Nuclear Security Action Plan, which describes the framework for cooperation between the Philippines through PNRI and the Division of Nuclear Security of the IAEA in the framework of the 27th APEC Economic Leaders Meeting to be held in Manila on 18-19 November 2015. The plan was submitted to IAEA in December 2014, and the APEC National Organizing Council has approved the IAEA's proposal.

Site assurance visits at the Cobalt-60 facilities of two hospitals

Development of National Radioactive Waste Repository

The PNRI, with the support of the International Atomic Energy Agency (IAEA), is in the process of further characterizing a preferred site for a repository for radioactive waste and disused radioactive sources, particularly in near surface and borehole disposal facilities. The proposed facilities are also being prepared to meet the standards of the IAEA's BOSS (borehole disposal of disused sealed sources) system.

In line with this, PNRI hosted several expert missions and technical visits to the proposed disposal sites, particularly the scientific visit of two IAEA fellows from Nuclear Malaysia aimed at sharing technical knowledge and experience on site characterization and performance evaluation for the proposed facilities.

Radiological Impact Assessment

In support of the activities of the Nuclear Regulatory Division, the Radiological Impact Assessment Section (RIAS) conducted a pre-assessment study of a fire accident scenario involving an existing inventory of thorium-based solid waste at a PNRI laboratory facility. An atmospheric modelling and consequence assessment web-based prediction tool was used to predict activity concentration from plume release and exposure dose at the ground level. Field monitoring measurements are necessary to confirm the level of radioactivity deposition.

The RIAS also continued a follow-up assessment of 'in vitro' application of iodine-125 (I-125) radioimmunoassay kits where new data from nuclear medicine facility were gathered by utilizing a survey questionnaire and conducting surveillance of the laboratory procedure and operation.

Development of Appropriate Strategies for Nuclear – Related Incidents

National Emergency Preparedness and Response

Revision of the National Radiological Emergency Preparedness and Response Plan (RADPLAN). The RIAS continued to review the national RADPLAN, focusing on the roles and responsibilities of participating agencies in view of emergency from the threat of using radioactive materials in malevolent actions. Referring to the country's disaster risk reduction management program, the RIAS considered the integrated concept of operation in its review, with emphasis on communication, notification and flow of assistance.

A draft of the revised RADPLAN is ready for review by other agencies, and its approval is expected to be in conjunction with future consultative meetings and exercises in 2015.

Revision of the PNRI Emergency Plan (PEP). In line with the revision of the RADPLAN and in cognizance of the National Disaster Risk Reduction and Management Program (NDRRMP) on natural disaster preparedness and response, the RIAS revised the PNRI Emergency Plan (PEP) to ensure that an organized all-hazard approach emergency action and response is established during an emergency situation at PNRI facilities and buildings. Twelve (12) review meetings including consultations with the PNRI emergency response team and a review by the PNRI Radiological

A set of Radioisotope IdentiFinders (inset) and ORTEC Hi-Purity Germanium Gamma Portable Detector received by PNRI through its partnership with the European Commission.

IAEA Expert Mission in support of the Technical Cooperation Project – Iteration of the Conceptual Design and Performance Assessment of the Proposed Deep Borehole and Near Surface Disposal Facilities in the Philippines held from May 10-16.

RIA staff analyzes plume predictions on air and ground contamination using web-based software.

Emergency Committee (RECOM) were rendered before the finalization of the PEP. Subsequently, the final PEP version was approved by the PNRI Director in October 2014.

Training and Maintenance of Emergency Preparedness and Response Capabilities. To maintain emergency preparedness and response capabilities throughout the RADPLAN member agencies and the PNRI emergency response organization, several trainings, seminars, lectures, workshops, drills and exercises were conducted in 2014.

In coordination with the Nuclear Training Center (NTC) and Japan Atomic Energy Agency (JAEA), the RIAS conducted the 2nd Follow-up Training Course (FTC) in a National Workshop on Nuclear and Radiological Emergency Preparedness and Response held in January 27-30, 2014.

Fourteen representatives from the following RADPLAN member agencies participated in the course, namely, the National Disaster Risk Reduction Management Council, Philippine Bomb Data Center (PBDC), Health Emergency Management Staff (HEMS), Bureau of Fire Protection (BFP), PATROL 117, Metro Manila Development Authority (MMDA), DOST-PAGASA and PNRI. The FTC was supported by two experts from Japan Atomic Energy Agency (JAEA) and 16 PNRI Radiological Emergency Monitoring and Control (REMCON) team members as consultants, lecturers, exercise controllers and evaluators in the drills and exercises. The highlights of the workshop include hands-on exercise on surface contamination monitoring and decontamination, and field exercise during a radiological emergency response.

The RIAS maintained the respective assignments of the 25 members of the PNRI REMCON team that are on-alert and on-duty 24/7 for a 15-day cycle. The REMCON teams participated in the IAEA Incident Emergency Centre (IEC) ConvEx-a exercise in April with a scenario involving a "dirty bomb" explosion. Using the same scenario, the PNRI emergency manager also prepared an exercise for the RADPLAN agencies focusing on notification, communication and response. Among the participants for this exercise were representatives from HEMS-DOH, PBDC-PNP, MMDA, DOST-PAGASA and BFP.

Members of the Philippine Army Explosive Ordinance Disposal Battalion of the Army Support Command received lectures from the RIAS on the Basic Nuclear and Radiological Emergency Preparedness and Response during their technical visits at PNRI in February and April 2014.

In coordination with the Nuclear Training Center the RIAS staff conducted a three-day Radiation Protection and Safety Training Course in November 24-26, 2014 to newly constituted 25 members of the Philippine Army platoon assigned to respond to Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) incidents. During the course of the training, the nuclear regulators had the opportunity to understand the concept of operations of the AFP, particularly their role in the search, rescue and recovery operations.

International Cooperation on Emergency Preparedness and Response. The PNRI participates in several cooperative initiatives by the IAEA, particularly the Convention on Early Notification of a Nuclear Accident (ENAC) and the Emergency Preparedness Review Mission (EPREV).

In line with these programs, the RIAS participated in several IAEA Incident Emergency Centre (IEC) ConvEx exercises in May, April, September and November, particularly the ENAC ConvEx exercises on notification, scenarios, requests for assistance, USIE access and information updates.

Participants of the 2nd FTC on Nuclear Emergency Preparedness and Response during the emergency field exercise that involved an explosion of a radiological dispersal device

Training course participants perform exercise on surface contamination monitoring and decontamination.

The PNRI, through the RIAS and Health Physics Research Section, hosted the four-day IAEA Emergency Preparedness Review (EPREV) mission on August 26-29 to assess the country's compliance with the emergency preparedness and response requirements under the IAEA Safety Standards GS-R Part 7.

The PNRI signed a Memorandum of Intent (MOI) with the United States Department of Energy (USDOE) -NNSA Radiation Emergency Management Program of Assistance, leading to the first radiation emergency management training conducted by the USDOE-NNSA from November 10-12, and was participated in by 25 PNRI staff. The workshop involved hands-on training on the IXP web-based tool as well as the Geographic Information System (GIS), and the expert review on the emergency operation center requirement and the RADPLAN and PEP drafts. Under the MOI, the USDOE will assist the Philippines in securing a major public event (MPE), the APEC Economic Leaders Meeting, to be held in Manila on 18-19 November 2015.

Vice President Binay and PNRI Director dela Rosa attend Nuclear Security Summit 2014

Philippine official to the Nuclear Security Summit host with Vice President of the Philippines Hon Jejomar Binay (third from right L-R) Employers Confederation of the Phillippines, Mr. Edgardo Lacson, Ms Gina Ledda, PNRI Nuclear Security Head, Ms Julieta Segis, Ms Nila Lacson, Ambassador to the Netherlands, Mr. Jaime Victor Neda and PNRI Director Alumanda Dela Rosa.

Representing Benigno Aquino III in the international stage, Vice President Jejomar Binay was joined by PNRI Director Alumanda M. dela Rosa and nuclear safeguards and Security Section head, Julietta Seguis at the 3rd Nuclear Security Summit at the Hague, Netherlands on March 24-25, 2014. In his address to the Summit, the Vice President emphasized the need for nuclear security in the Philippines' progress in improving our nuclear security infrastructure at all ports of entry and on-site facilities, legal framework and emergency response, as well as in developing a nuclear safety culture for all stakeholders responsible radioactive and nuclear materials. He thanked the IAEA for its continued support in maintaining the country's nuclear safety and security.

DIFFUSION OF KNOWLEDGE AND TECHNOLOGIES

PNRI's mandate to promote the peaceful uses and benefits of nuclear science and technology culminates in reaching out to the general public and cascading these developments. Through training courses, public communication, information management and technology commercialization, the Institute builds up and strengthens the capability of various sectors as well as the new generation of nuclear and radiation scientists for the Philippines.

An NTC staff guides participants in using a survey meter during the Follow-up Training Course on Reactor Engineering

NUCLEAR TRAINING

Through its Nuclear Training Center (NTC), PNRI offers training courses and seminars on nuclear science and technology, as well as radiation protection and nuclear safety and security. Every year, the NTC undertakes the training of hundreds of professionals from various sectors.

This year saw an increase in the number of training courses as well as the participants, as the NTC conducted 46 technical training courses for 803 professionals and technicians from different government and private institutions/agencies. Among these were three four-week courses on radioisotope techniques, two month-long nuclear science and technology courses for education and the academic sector, three follow-up training courses, 19 radiation safety courses, 16 non-destructive testing (NDT) courses and three welding technology courses for inspectors.

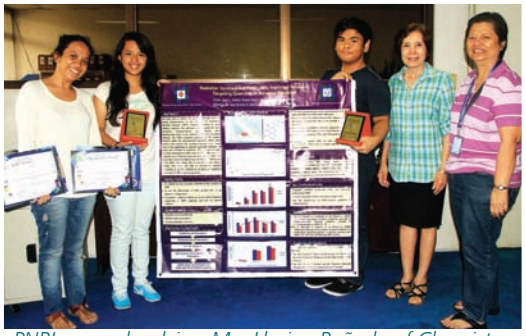
Follow-up Training Course. The follow-up training courses held early in 2014 were conducted in collaboration with the Japan Atomic Energy Agency (JAEA). PNRI and JAEA experts conducted courses on nuclear and radiological emergency preparedness and response, environmental radioactivity monitoring and level 1 reactor engineering. PNRI has been holding these follow up courses since 2013.

Nondestructive Training Course (NDT). Meanwhile, the PNRI continued to conduct NDT and welding technology courses in cooperation with the Philippine Society for Nondestructive Testing (PSNT). These courses include various levels of ultrasonic, radiographic, and infrared thermographic testing, surface methods and eddy current testing.

Updating of Training Courses. The NTC has also updated its roster of courses and syllabus on radioisotope techniques, nuclear science and technology, and radiation safety courses. In June, the NTC launched the Radiation Safety Course (RSC) – Commercial Sale Involving Radioactive Materials and Low Activity Sources (RSC-CL), which was previously the two-day RSC. This was followed in September by the first Course on Medical Use of Radioisotopes (CMR) and the Course on Radioisotope Technology (CRT), formerly the medical and general iterations of the Radioisotope Techniques

Korean exchange students from Dong-A University in South Korea during their on-the-job training at the PNRI Cytogenetics Laboratory

Participants of the 38th Seminar on Nuclear Science for High School Science Teachers and the 77th Course on Nuclear Technology for University/College Faculty perform a practical exercise.



PNRI research adviser Ma. Llorina Rañada of Chemistry Research Section PNRI Director Dr. Alumanda Dela Rosa and Chemistry Research Section Head Dr. Lucille Abad pose with Philippine Science High School students who won the Gold Award and Special Jury Award during the Malaysian International Young Inventors Olympiad.

Training Course (RTTC), as well as the Radiation Safety Course – Sealed Sources in Industrial Devices (RSC-ID), which was formerly the Safety in the Use of Nuclear Equipment and Devices (SUNED) training course. In October, the RSC for Medical Use of Radioisotopes (RSC-MR) was launched, replacing the former Radiation Safety Course for Medical and Radiopharmaceutical Facilities and Radiation Safety Officer Training Course.

Nuclear Training for Undergraduate Students. PNRI also provided services to high school and undergraduate students from various secondary schools, colleges and universities. A total of 107 college students and three secondary school students from Philippine Science High School undertook their on-the-job training at different facilities and laboratories of the Institute. For PNRI's thesis and research advisorship programs, 26 college students and a 3rd year high school student from Iloilo National High School availed themselves of the service.

CAPACITY BUILDING IN THE USE AND OPERATION OF SMALL NEUTRON SOURCES

Neutron Laboratory

The setting up of the laboratory for training, education, and research and development in basic neutron techniques is nearing completion. It houses a neutron source, californium-252 (Cf-252) that has an activity of 0.4 gigabecquerel (GBq) as of September 19, 1996. A number of neutron and gamma detectors and various nuclear instrumentation modules (NIM) were already acquired through the Technical Cooperation (TC) PHI0014 project. Preliminary testings were performed for these equipment. Three neutron survey meters from the Bataan Nuclear Power Plant (BNPP) were also acquired and tested.

IAEA Expert Mission/Proposal to Use the Philippine Research Reactor-1 Fuel Elements for Training and Education.

The Philippine Research Reactor-1 (PRR-1) is a type of TRIGA (Training, Research, Isotopes, General Atomics) reactor, which is a class of nuclear reactor designed and manufactured by General Atomics.

On March 2014, PNRI hosted an expert mission of TRIGA experts, Dr. Mario Palomba and Dr. Mario Villa, for consultation and technical recommendation regarding the preliminary assessment of the TRIGA fuel and advice on its use. A proposal to utilize the PRR-1 and its TRIGA fuel elements for training and education, which incorporated the recommendations from the expert mission, was submitted and approved by the management. This concept proposal has also been submitted to International Atomic Energy Agency (IAEA) under the Technical Cooperation (TC) Program for 2016-2018. This proposed concept is the top priority for the Philippines in the coming TC cycle, focusing on strengthening nuclear research and expertise in the country, and capacity building of research reactor technologies.

Annual Neutron School (ANS) 2014

The ANS 2014 was established to develop the knowledge and expertise in nuclear technology of the next generation of nuclear scientists, and to promote nuclear research and careers to the academe especially to undergraduate students. ANS 2014 was successfully conducted on April 24-30, 2014 and participated in by nine junior undergraduate students as part of their on-the-job training – three each from the University of Santo Tomas, Polytechnic University of the Philippines and the Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), as well as some PNRI personnel.

The modules used in the lectures included topics on: (a) Introduction to Radiation Dosimetry; (b) Interaction Cross Section; (c) Litany of Prerequisite Basic Physics Knowledge; (d) Basic Radiation Detection and Instrumentation; (e) Basic Neutron Physics I; (f) Gamma Spectrometry Using NaI and HPGe detectors; (g) Basic Neutron Physics II, and (h) Neutron Detection. The course was facilitated by the three junior lecturers and a senior lecturer. The participants used various radiation detectors for their experiments such as the Proton Recoil Scintillator, He^{-3} in remball, Dineutron, NaI scintillator and gamma and neutron survey meters. Other activities included fabrication of neutron shielding bricks made up of borated wax and the design and implementation of a mark-up language (XML) database and inputting records.

This year's follow-up research was able to provide and complete an undergraduate thesis for EARIST students entitled "Radiation Leak Measurement outside the Neutron Howitzer Tank", which involves measuring neutron and gamma radiation from a PuBe neutron source. Performance characterization and testing of a proton recoil scintillator detector was also accomplished, which will be used for next year's Annual Neutron School neutron techniques.

(Right) A junior lecturer discusses a topic to the ANS participants. (Left) A student performing radiation leak measurement in a simple nuclear device

NUCLEAR INFORMATION, EDUCATION AND COMMUNICATION

PNRI reaches out to various stakeholders and the public in general through information, education and communication activities aimed at promoting the beneficial uses of nuclear science and technology.

Development/Distribution of Information Materials

This year, PNRI stepped up its production of information materials as the Nuclear Information and Documentation Section (NIDS) made four new flyers and six technology brochures on nuclear technology applications as well as on PNRI's various services. The Institute also continued its regular publications such as the PNRI Annual Report and the online PNRI Newsletter Volumes 1 to 4, with the latter entering its first year of publication. Around 15,000 nuclear information materials were distributed to more than 4,000 clients, especially in the regions.

Brochures for the Philippine exhibits were distributed during the 58th IAEA General Conference in Vienna, Austria.

In addition, the NIDS developed 13 exhibit posters and six video presentations on PNRI technologies and nuclear services. These were exhibited during the 2014 National Science and Technology Week Expo Science and in four local science and technology fairs held across the country. Eight banners were also produced for the Philippine exhibit during the 58th IAEA General Conference in Vienna, Austria.

Educational Tours and Nuclear Awareness Seminars

Under the PNRI Visitors Program, NIDS conducted 29 educational guided tours of PNRI facilities and laboratories, lecture-demonstrations and video showings on nuclear science and technology. Of the 2,760 visitors, around 70 percent visited PNRI during the 42nd Atomic Energy Week celebration.

Around 900 of the visitors went on guided tours throughout the year, of which around 200 were professionals such as medical practitioners, army specialists, and teachers. The rest of the visitors were composed of students from high school and colleges/universities in Metro Manila and across the country.

In addition to the PNRI facility tours, PNRI also organized a tour to the Bataan Nuclear Power Plant in May with members of the media, high school and college faculty and new PNRI employees. The tour was sponsored by former Congressman Mark Cojuangco and was conducted in cooperation with the National Power Corporation, which is in charge of maintaining the BNPP.

Students from Ateneo High School operate microscopes during a guided tour of the PNRI Cytogenetics Laboratory

Information was likewise provided to more than a thousand walk-in visitors and individuals who inquired through phone or email/website. A total of 11 nuclear awareness seminars for 367 clients were conducted with the cooperation of the Nuclear Training Center (NTC) and the PNRI technical staff.

Participation in Special S & T Events

The Institute promoted the beneficial uses of nuclear science and technology to around 6,800 clients through exhibits

Participants listen to the presentation on Gamma Irradiation Services during the forum on "Radiation: May Benipisyo Ito!" at SMX Convention Center.

PNRI exhibits in DOST Outcome 3 (Industry Competitiveness) and 6 (Quality Healthcare) during the 2014 National Science and Technology Week at SMX Convention Center

in six local science and technology events in Metro Manila and in the regions in Luzon, Visayas and Mindanao during the celebration of the National Science and Technology Week (NSTW) and the DOST regional cluster Science and Technology Fair and Exhibits.

During the NSTW, PNRI, through NIDS, organized a technology forum entitled "Radiation: May Benepisyo Ito!" held at SMX Convention Center on July 25, 2014. The forum was attended by 150 participants, many of whom were from the academic, industrial and medical sectors.

The year 2014 also proved to be a special year for the Philippines in the global stage as the country participated in the 58th IAEA General Conference and Exhibition in Vienna, Austria, with the theme, "The Philippines: Moving Forward with Nuclear Science and Technology". Visitors in the Philippine booth from IAEA Member States were made aware of the country's nuclear applications in industry, agriculture, healthcare, and environmental protection as well as the country's efforts to ensure nuclear safety, safeguards and security.

The Philippine exhibit served as a proof of the sustained partnership between the Philippines and the IAEA and that this partnership has maximized the contribution of nuclear science and technology to the achievement of the country's development priorities.

Library Services

The PNRI Library acquired 347 volumes of publications composed of 110 volumes of books, 122 volumes of journals/technical publications, and 105 public information publications through gift donations and exchanges from local and foreign institutions/organizations. These publications, together with other library holdings, were made available to around 2,370 clients, composed mostly of students and researchers.

DATE	EVENT	VENUE	NO. OF VISITORS/ VIEWERS AT PNRI BOOTH*
A. National S & T Events			
24-28 July '14	National Science and Technology Week – Expo Science Exhibit	SMX Convention Center, Pasay City	2,500
18-20 Aug '14	Southern Luzon Cluster S&T Fair	Ibalong Centrum for Recreation, Legazpi City [with assistance from Isotope Techniques Section (ITS) staff]	500
1-5 Sept '14	Northern Luzon Cluster S&T Fair	Cagayan State University, Carig Campus, Tuguegarao City, Cagayan [with assistance from ITS staff]	1,000
2-4 Oct '14	Visayas Cluster S&T Fair	Convention Hall, J Center Mall, AS Fortuna, Mandaue City [with assistance from ITS staff]	300
13-15 Nov '14	Mindanao Cluster S &T Fair	SMX Convention Center, Lanang, Davao City [with assistance from ITS staff]	300
8-12 Dec '14	Atomic Energy Week	PNRI, Diliman, Quezon City	1,892
B. International S & T Event (2 NIDS staff participated)			
22-26 Sept. '14	58th International Atomic Energy Agency (IAEA) General Conference and Exhibition	Vienna International Centre, Vienna, Austria	500 +
			TOTAL: 6,792

Communication with the Public in a Nuclear or Radiological Emergency

Recognizing the importance of public communication in a well-coordinated preparation and response to emergencies, PNRI, in collaboration with the IAEA and the Asian Nuclear Safety Network (ANSN), hosted the National Training Course on Communication with the Public in a Nuclear or Radiological Emergency from October 20-24 at the PNRI compound.

Lectures on risk communication, radiation basics, and nuclear/radiological incidents were followed by practical exercises on building a public communication program, conducting press conferences, choosing and training agency spokespersons, handling interviews and writing information releases. The training course also aimed to facilitate collaboration and cooperation between the various government agencies tasked to respond in case a nuclear or radiological emergency happens in the country. Experts from the IAEA and the Greek Atomic Energy Commission handled the week-long training course, emphasizing the need to keep the public informed and the responding agencies credible and prepared well beforehand in case of a nuclear or radiological emergency.

Representatives from the Philippine National Police, National Disaster Risk Reduction and Management Council, Metropolitan Manila Development Authority, Bureau of Fire Protection, Department of the Interior and Local Government, Department of Health, DOST-Science and Technology Information Institute, Office of Civil Defense, Philippine Information Agency and the National Power Corporation participated in the training course. They were also joined by technical experts from the various divisions and sections of PNRI and some members of the media.

Nuclear S & T Promotion Through Media Linkages

PNRI arranged and coordinated 10 television and radio interviews of PNRI officials and technical staff about the Institute's programs and projects, nuclear power, and nuclear technology applications, among others.

Two press briefings were held this year. The first was in May which was attended by 12 media representatives, while the second was held during the 42nd Atomic Energy Week (AEW) celebration at PNRI in December 2014. Despite the onslaught of Typhoon Ruby, 22 representatives from the media were able to attend the media briefing during the opening of the Atomic Energy Week.

Print and broadcast journalists interview PNRI project leaders/technical staff on updates of nuclear technology applications.

NIDS prepared a total of 54 press releases, 24 of which were posted at the PNRI website. A total of 60 news articles on PNRI technologies, services and events were featured and published in daily broadsheets and websites of media networks and government agencies.

NUCLEAR S&T OUTREACH PROGRAM FOR SECONDARY SCHOOLS

The Philippines was chosen along with Indonesia, Malaysia and the United Arab Emirates as one of the pilot countries for the International Atomic Energy (IAEA) Project RAS/0/065 on Supporting Sustainability and Networking of National Nuclear Institutions in Asia and the Pacific Region. The project focuses on developing the youth's interest in nuclear science and technology.

The IAEA project intends to encourage more students to eventually engage in Science, Technology, Engineering and Mathematics (STEM) careers after graduating from college.

Two public secondary schools in Quezon City will participate in the pilot testing by January 2015: Quezon City Science High School (Regional Science High School for the National Capital Region) and San Francisco High School.

Four Philippine representatives from PNRI and the Department of Education, Division of City Schools, Quezon City, were among the participants to the IAEA TC Outreach Program on Nuclear Science and Technology.

MANAGEMENT INFORMATION SYSTEM

Helping to facilitate better information exchange and data management within the Institute's various sections and divisions, PNRI's Management Information System Section (MISS) continued to develop and manage the Institute's computerized systems and computer softwares.

Nuclear Training Center Web-based Management System. For 2014, MISS completed the development and rollout of Phase 2 of this system, which includes the management of each training course's schedules, duration, ratings and evaluation, participants, lecturers, grades, and the management of placement of on-the-job trainees and research advisees.

IAEA Regulatory Authority Information System (RAIS). MISS currently spearheads the Philippines' participation in implementing the IAEA RAIS among nuclear regulatory organizations across the globe. The RAIS software application serves as a management tool to support regulatory bodies such as PNRI in the discharge of their functions. This year, the section completed the requested customization of RAIS 3.2 for the Philippines. Meanwhile, PNRI also shared its technical expertise in implementing the IT infrastructure and installation of the more advanced RAIS 3.3, through the conduct of two IAEA expert missions with regulatory staff of nuclear agencies

A Management Information System Section staff trains nuclear regulators and inspectors on using the IAEA Regulatory Authority Information System (RAIS) 3.2.

in Myanmar and Laos PDR last June and October 2014, respectively. The section has also contributed to the development of the technical specifications for the upcoming RAIS 4.0.

Online Submission Mode for the Asia-Pacific Marine Radioactivity Database (ASPAMARD). The Philippines is the focal point for compiling ASPAMARD throughout the region. The online submission made for ASPAMARD, which was developed by MISS, will provide fellow Member States a better avenue to submit data on radionuclide concentrations in seawater, sediment and marine biota.

Other IT-related Activities. MISS also accomplished the following:
(1) customization of the IAEA Systematic Assessment of Regulatory Competence Needs (SARCoN) tool for the use of other divisions; (2) implementation of the Unified Laboratory Information Management System (ULIMS) for the DOST OneLab Project, including installation, configuration, testing and code modification to fix errors and bugs; (3) upgrading of the PNRI Public Website to the Joomla! Platform version 3.4; (4) the co-location of the PNRI website and mail system at the Advanced Science and Technology Institute Data Center; and (5) the continued management and enhancement of the PNRI Intranet, Local Area Network (LAN) and Internet services.

MISS also continued the maintenance and enhancements of several information and management systems, particularly the Personnel Information Management System, Nuclear Training Center Learning Management System, PNRI Payroll System and the Biometrics Attendance Monitoring System. Moreover, MISS provided IT Help Desk services to 322 PNRI personnel for software and network related problems and requirements in the Institute.

PNRI Information System Strategic Plan. The MISS developed the PNRI Information System Strategic Plan which served as the basis for the allocation of ICT requirements of the Institute. This plan was submitted to the Information and Communication Technology Office. The section is also the Institute's focal point to Medium-term Information and Communication Technology Harmonized Initiative (MITHI) program of the government. The MISS also controls and secures all documents relevant to the ISO9001:2008 Quality Management System of the PNRI.

Performance Management Information System (PMIS). To support the implementation of the PNRI Strategic Performance Monitoring System (PNRI-SPMS), the MISS developed the Performance Management Information System which will provide a mechanism to facilitate the monitoring and evaluation process of the SPMS. The PMIS, once operational will ensure the timely, accurate and reliable information for both performance monitoring/tracking, accomplishment reporting, program improvement and policy-decision making.

Enhancement of the PNRI's Local Area Network Infrastructure. The MISS also takes charge of the establishment, management and administration of the PNRI's local area network (LAN) and internet services. To enhance performance and security of the network and simplify its administration, the Virtual Local Area Network (VLAN) was implemented for each functional group in the Institute. Implementation of VLAN greatly reduces broadcast traffic, limiting the broadcast only to the members of the virtual network group. To beef-up the network security, MISS continued to subscribe to the Fortinet Security Firewall services.

BUSINESS DEVELOPMENT

To facilitate the commercialization of the Institute's nuclear technologies, the PNRI Business Development Section (BDS) coordinates with nuclear technology developers, end-users, adopters, and collaborators for business ventures, partnerships, intellectual property (IP) matters and other aspects of technology transfer. These activities help the Institute attain self-reliance as well as a higher degree of sustainability, and make PNRI's technologies more accessible to the public.

This year, the PNRI filed IP (Intellectual Property) applications at the Intellectual Property Office (IPO) for the following PNRI projects: (1) Control of Mango Pulp Weevil, (2) PVP-Chitosan Implant for Endoscopic Treatment of Vesicoureteral Reflux, and (3) A Method of Preparing Heavy Metal Ion Adsorbents from Plant Fibers.

Meanwhile, the patent application for detection systems for saxitoxin and other paralytic shellfish toxins was already published in the Official Gazette on October 20, 2014. The patent is co-owned by PNRI and the University of the Philippines.

For its efforts in obtaining patents for its nuclear applications, PNRI was awarded with the 2014 DOST Institutional Award for Highest Number of Registered Patents on December 10 at the Hotel Jen in Manila.

The PNRI also established stronger linkages for research collaboration and commercialization in Singapore, through a Memorandum of Understanding (MoU) with IP Intermediary and a Non-Disclosure Agreement with H.E.S. PTE Ltd.

In particular, the strategic alliance with IP Intermediary aims to cross-share on the promotion of technologies for commercialization, prospective investors' introduction, research and development contracting, and other forms of mutually relevant international collaborations.

Along with the University of the Philippines, Philippine Council for Industry, Energy and Emerging Technology Research and Development, and other research and development institutes, PNRI signed a Memorandum of Agreement for the long term engagement with a Balik Scientist Program awardee who will serve as one of the general consultants for technology transfer and R&D in medical devices/ biotechnology.

42nd ATOMIC ENERGY WEEK

December 8-12 2014

Theme:

The Philippines: Moving Forward with Nuclear Science & Technology

Spearheading the country's progress in nuclear science and technology, DOST-PNRI celebrated the 42nd Atomic Energy Week (AEW) from December 8-12, 2014 with the theme, "The Philippines: Moving Forward with Nuclear Science and Technology", at the PNRI compound. 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, industry, medicine and the environment.

Opening Ceremonies. The AEW opening ceremonies was graced with the presence of DOST Secretary Mario Montejo and Congressman Francis Gerald Abaya of the 1st District of Cavite, along with other officials of the DOST, technical experts from the International Atomic Energy Agency, members of the diplomatic corps, former officials and employees of the PNRI, and the media. Secretary Montejo gave an inspirational message. Congressman Abaya delivered the keynote address.

The BMG of the University of the Philippines College of Music rendered a special number.

Opening of AEW Exhibits. Congressman Francis Gerald A. Abaya and DOST Undersecretary Amelia Guevarra, assisted by PNRI Director Alumanda M. dela Rosa, cut the ceremonial ribbon to formally open the 2014 AEW exhibits.

Inauguration of the Electron Beam Facility. During the celebration, the PNRI inaugurated its brand new Electron Beam Facility established with funds from the International Atomic Energy Agency, DOST- Grants-in-Aid, the United States and Japanese Governments.

Turnover of Environmental Radiation Monitor. The PNRI accepted a donation of an online environmental radiation monitor from the South Korean government. The ceremonies were attended by representatives from the EB Tech Co., Korea Atomic Energy Research Institute, the Korea Trade Promotion Corporation, EB Tech, Co., and Satrec Initiative.

Media Briefing. Around 22 media representatives attended the press briefing on December 9. The topics presented included the PNRI activities in 2014 and new projects in 2015.

Technical Sessions. On Dec 9 -10, experts from PNRI, the IAEA and South Korea delivered lectures on:

Applications of Nuclear Technology: Electron Beam Technology; Electron Accelerator and their Environmental Applications; Radiation Processing of Polymers by Electron Beam; Environment Radiation Monitoring in Korea (focusing on activities in KAERI Research Reactor).

Nuclear Analytical Techniques and Technology: Nutrient and Water Management in Rice and Corn Production Through Nuclear Analytical Techniques; Management of Environmental Radiation Monitoring Stations in the Philippines – CTBTO RN-52 Radionuclide Monitoring Station and PNRI Online Monitoring Station; Nuclear Analytical Techniques for Food Safety and Traceability; and Nuclear Techniques and Technology for Environmental Applications-for Harmful Algal Bloom.

Guided Tours at PNRI Facilities and Laboratories. PNRI opened its facilities to hundreds of visitors daily during the week, featuring the latest advances in nuclear science and technology in the country in the fields of agriculture, industry, health & medicine, and the environment.

Closing Ceremonies. On December 12, PNRI scientists who recently won in the DOST International Publication Awards, those who were able to patent their works, exemplary civil servants and the PNSQ winners were awarded and recognized. PNRI Director Dr. Alumanda M. Dela Rosa proudly announced that PNRI won the DOST International Awards for the highest number of ISI Publications and approved Patents. The Director also announced that the Institute was finally awarded with the ISO 9001:2008 certification as of December 2014.

PHILIPPINE NUCLEAR SCIENCE QUIZ

For High School Students

December 11, 2014

One of the highlights of the Atomic Energy Week celebration in December was the Philippine Nuclear Science Quiz (PNSQ) which aims to sustain awareness and understanding of high school students on nuclear science and technology and its beneficial applications. This year's quiz was participated in by 50 public and private secondary schools in the country. The competition covered various topics on nuclear science and technology such as radiation and radioactivity, atomic/nuclear structure, radiation protection, nuclear regulations and other related topics.

PNSQ judges were Dr. Christina A. Petrache, Dr. Soledad S. Castañeda, and Dr. Lucille V. Abad. The winners received cash prizes, plaques and certificates of recognition.

WINNERS OF THE PNSQ

1st Place:
Parañaque Science High School
Lawrence Glen Sabaria and Justine Mateus Medina
Coach: Jane Andrea Nitro

2nd Place:
Caloocan City Science High School
Patrick Canacana and Ma. Steffi Lucum
Coach: Angelo Cabic

3rd Place:
Manila Science High School
Benedict Anuta and Christopher John Limos
Coach: Ferdinand Bautista

Philippine Exhibits at the 58th IAEA General Conference

Vienna, Austria
September 22 to 26, 2014

Giving the world a glimpse of "Atoms for Peace" the Filipino way, the Philippine Nuclear Research Institute – Department of Science and Technology (PNRI-DOST) showcased the country's various accomplishments in nuclear science and technology, nuclear safety, safeguards and security during the 58th General Conference Exhibition of the International Atomic Energy Agency (IAEA) held in Vienna, Austria from September 22 to 26, 2014.

Attended by thousands of delegates from more than 160 IAEA Member States and various United Nations agencies and other international organizations, the annual IAEA General Conference provides a forum for its Member States to further its general programs and projects as well as to deliberate on key issues in nuclear power, nuclear science and technology and nuclear safety, safeguards and security.

With the theme **"The Philippines: Moving Forward With Nuclear Science and Technology"**, the Philippine exhibits highlighted the nation's fruitful partnership with IAEA for more than half a century through PNRI. IAEA Director General Yukiya Amano himself graced the Philippine exhibits and was welcomed by DOST Undersecretary Dr. Amelia Guevara, PNRI Director Dr. Alumanda Dela Rosa and Philippine Ambassador and Permanent Representative to the IAEA Lourdes Yparraguirre.

S&T LINKING AND NETWORKING

Through PNRI's partnerships with national and international organizations, its productivity and potential is amplified as it conducts its research and development projects, nuclear regulatory mandate and specialized nuclear services. These networks demonstrate that the Philippines is an active member of the greater nuclear community.

FOREIGN S&T NETWORKING

The Philippines, through the PNRI, continued to strengthen its collaborations with the following institutions:

- International Atomic Energy Agency (IAEA), Vienna, Austria
- Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA), Vienna, Austria
- Ministry of Science, Technology, Education, Culture and Sports (MEXT) of Japan
- Forum for Nuclear Cooperation in Asia (FNCA), Japan
- Nuclear Safety Research Association (NSRA), Japan
- Japan Atomic Energy Agency (JAEA)
- United States Department of Energy (US-DOE)
- United States Department of Agriculture (USDA)
- Australian Nuclear Science and Technology Organization (ANSTO)
- Asian Nuclear Safety Network (ANSN)
- Asian Network for Education in Nuclear Technology
- Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Vienna, Austria
- European Commission (EC)
- Canadian Department of Foreign Affairs , Trade and Development

Capacity Building Towards a Self-Sustaining RDI

With the invaluable support of the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD), PNRI scientists and officials were able to conduct study missions in collaboration with its counterpart nuclear research agencies under the joint project by DOST and the Bases Conversion and Development Authority (BCDA) entitled "Capacity Building for Science, Technology and Innovation Towards Self-Sustaining Research and Development Institute (RDIs) of the DOST."

The missions were conducted in May, June and September 2014 in Japan and Korea, as well as in the laboratories of IAEA and the Vienna University of Technology (TU Wien) in Austria. Aside from initiating new cooperative research and development activities, PNRI aims to foster an exchange of scientific and technical information as well as scientists, engineers and other experts between the PNRI and the cooperating agencies.

Memorandum of Understanding (MoU)

The Institute was also able to secure several Memorandums of Understanding (MoU) with both private and government entities across the globe.

MOU between PNRI and South African Consultancy Firm ISO-Q, signed on August 14 at PNRI for collaboration in conducting Non-Destructive Testing (NDT), nuclear and radiation safety training programs in South Africa. The PNRI will be in charge of providing lecturers and experts to facilitate the training program, and

Through these collaborative efforts , PNRI was able to avail of the following:

- **7** • IAEA research contracts
- **6** • IAEA technical cooperation projects
- **78** • IAEA experts/mission delegates
- **13** • PNRI hostings of regional meetings, seminars/workshops and regional training.
- **222** • Fellowship/travel grants for PNRI and non-PNRI personnel

develop the necessary training materials. ISO-Q also committed to help develop the NDT program in the Philippines through donations for facility upgrades, additional equipment and human resources development.

MOU between PNRI and the Korea Atomic Energy Research Institute (KAERI), signed on September 24, coinciding with the 58th IAEA General Conference, for collaborative activities in nuclear science and technology. The technical cooperation between the agencies will consist of complementary research and development undertakings and a healthy exchange of technical information as well as scientists, engineers and other experts, which will entail short or long–term visits and working assignments.

Statement of Intent (SOI)

Officials from the United States Department of Energy – National Nuclear Safety Administration (US-DOE-NNSA) met with the officials of the Philippine Nuclear Research Institute – Department of Science and Technology (PNRI-DOST) for further cooperation between the two agencies in the field of emergency preparedness and response to nuclear and radiological emergencies.

The PNRI and the US DOE NNSA signed a Statement of Intent (SOI) on May 6, which includes collaboration on the development of emergency operation centers and community networks, atmospheric plume modeling, risk reduction, incident assessment, joint training and exercises. Both agencies also cooperate with and support each other under the Global Initiative to Combat Nuclear Terrorism, particularly in activities on dealing with radiological dispersal devices (RDD's), radioactive source recovery, nuclear/ radiological search and consequence management.

LOCAL S&T NETWORKING

This year, the Institute once again partnered with private companies, DOST agencies and other government institutions in the implementation of its various activities.

- Bureau of Soils and Water Management-Department of Agriculture
- Department of Science and Technology
- Department of Environment and Natural Resources-Mines and Geosciences Bureau
- Environmental Management Bureau
- National Institute of Molecular Biology and Biotechnology, University of the Philippines
- National Research Council of the Philippines
- National Soil Water Resources Research and Development Center (NSWRRDC)
- National Water Resources Board
- Nuclear Research Foundation
- Nutri-Asia
- Philippine Council for Agriculture and Aquatic Research and Development
- Philippine Council for Industry, Energy and Emerging Technology Research and Development
- Philippine Center for Postharvest Development and Mechanization
- Philippine Rice Research Institute
- Quezon City Science Community
- University of the Philippines-Manila
- University of the Philippines-Marine Science Institute
- Philippine Institute of Volcanology and Seismology

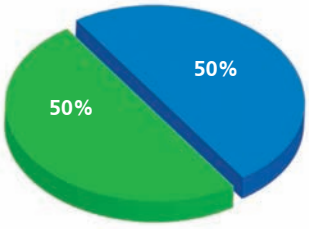
Former University of the Philippines-Diliman Chancellor Dr. Caesar Saloma administers the oathtaking of newly elected agencies for the Board of Trustees and Sector Representatives of the Quezon City Science Community.

HUMAN RESOURCE DEVELOPMENT

In pursuit of the Institute's vision of a dynamic and competent workforce in the mainstream of national development, PNRI continues to prioritize human resource development in order to meet the standards of civil service and to facilitiate better productivity in research, delivery of nuclear services, promotion of nuclear technology and the enforcement of nuclear regulations, among others.

DISTRIBUTION OF PERSONNEL

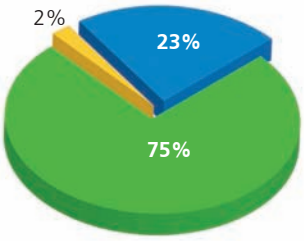
BY GENDER



MALE
FEMALE

TOTAL 212

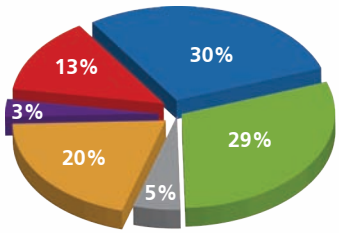
BY STAFF CATEGORY



ADMINISTRATIVE
MANAGERIAL
TECHNICAL

TOTAL 212

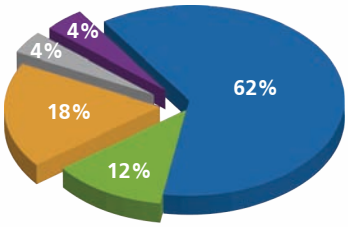
BY STAFF ACTIVITY



R&D
TECHNOLOGY DELIVERY
S&T SERVICE
S&T EDUCATION
REGULATORY
ADMINISTRATIVE

TOTAL 212

BY EDUCATION



PH.D.
MS/MA
BS/BA
POST HIGH SCHOOL DIPLOMA
HIGH SCHOOL & BELOW

TOTAL 212

2

PNRI staff obtained their doctorate and masteral degrees in 2014:

PhD on Environmental Science
Technological University of the Philippines
DR. THELMA P. ARTIFICIO
Nuclear Regulatory Division

MS in Technology Management
University of the Philippines, Diliman
GREGORY R. CIOCSON
Technology Diffusion Division

22

PNRI staff pursued post graduate degrees on local/foreign scholarships

46

Nuclear training courses conducted by PNRI with 803 participants

107

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

27

Students from six schools were accepted for thesis advisorship at PNRI

110

Students from 31 schools were accommodated for on-the-job training at PNRI.

222

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

PNRI RECOGNITION AWARDS

PNRI gave the following recognition awards to its employees during the 42nd AEW Closing Ceremonies at PNRI:

- The PRAISE (Program on Awards and Incentives for Service Excellence) Special Award for expertise shared to the Institute on matters relating to nuclear technology;
- Director's Choice Award based on the employee's contributions to the Institute and commitment to service
- Division Award for contributing greatly to the accomplishment of the division's functions and goals

2014 Praiseworthy Award

Giuseppe Filam O. Dean
Senior Science Research Specialist
Irradiation Services Section
Nuclear Services Division

Director's Choice Award 2014

Technology Diffusion Division
Nuclear Information & Documentation Team
(L to R)
Rhodora R. Leonin - *Supervising Science Research Specialist*
Justina S. Cerbolles - *Information Officer III*
Joan L. Tugo - *Information Officer I*
Hans Joshua V. Dantes - *Project Assistant I (Contractual)*
Jayson V. Godoy - *Information Officer I (Contractual)*

Division Awardees

Atomic Research Division
Paolo Tristan F. Cruz
Science Research Specialist I
Health Physics Research Section

Nuclear Services Division
Andrew C. Barrida
Science Research Specialist I
Engineering Services Section

Nuclear Regulatory Division
Lynette B. Cayabo
Senior Science Research Specialist
Licensing, Review and Evaluation Section

Technology Diffusion Division
Nuclear Information & Documentation Section

Rhodora R. Leonin (5)
Supervising Science Research Specialist
Justina S. Cerbolles (6)
Information Officer III
Elizabeth C. Vidal (4)
Librarian II
Joan L. Tugo (2)
Information Officer I
Hans Joshua V. Dantes (1)
Project Assistant I (Contractual)
Jayson V. Godoy (3)
Information Officer I (Contractual)

Finance and Administrative Division

Camille Grace B. Beredo *(center)*
Administrative Assistant II
Aileen B. Cezar *(left)*
Administrative Aide VI
Joanrose N. Villanueva *(right)*
Administrative Assistant II

OTHER PNRI AWARDS

2014 DOST International Publication Award

PNRI Director Dr. Alumanda M. Dela Rosa (7th from left) along with the PNRI scientists and researchers as they received the 2014 DOST Institutional Awards for Highest Number of Registered Patents and the 2014 International Publication Awards and Incentives of P60,000 per publication at Traders Hotel in December 2014 . (See Appendices, page 65 for list of publications)

2014 AEW Special Awardees

GILAS Award

Wilfredo A. Gultiano (3)
Agricultural Research Section

Recognition given to a new recruit whose initiatives have contributed to the overall work performance of his/her section.

MY BFF Award

Enrico Bondoc (2)
Isotope Techniques Section

Appreciation given to an employee who is very friendly and courteous, always accommodating, very pleasant to deal with in the course of the performance of his/her job and able to complete assignments and perform job responsibilities very satisfactorily.

Best AEW Tour Guide Award

John Faustus Vidal (1)
Agricultural Research Section
(Contractual)

People's Choice (AEW Exhibit)

Chemistry Research Section
Atomic Research Division

BEST GROUFIE Award

Quality Management Systems Committee

Recognition given to a team who is committed to excellence and has shown initiative, flexibility, dedication, innovation, reliability, and camaraderie.

Best Section Exhibit

Agricultural Research Section, Atomic Research Division

This is a group exhibit competition among PNRI Sections to showcase their 'best' technical and scientific activities, outputs and achievements.

2014 Service Awards

40 years

Teofilo Y. Garcia
Dolores M. Lazo

30 years

Ma. Lucia C. Cobar
Aurelio L. Maningas
John M. Marquez

20 years

Charito T. Aranilla, Lynette B. Cayabo, Allan D. Flores, Socorro P. Intoy, Oliver V. Luz, Gonzalo G. Madera, Jr., Mary Rose Q. Mundo, Luzviminda B. Muyco, Rizalina G. Osorio, Haydee M. Solomon, Efren J. Sta. Maria, Ernesto I. Ventura, Jr.

Best Poster Paper

Best Poster Paper
Third Place - Best Poster Paper Competition

Mr. Raymond Sucgang - Researcher/ Project Leader. Awarded as one of the ten outstanding young Aklanon achievers given by the "Benhur Z. Mobo Move Aklan Forward Foundation" for the successful application of *Nuclear Analytical Techniques (NATs)* in Boracay and Aklan River

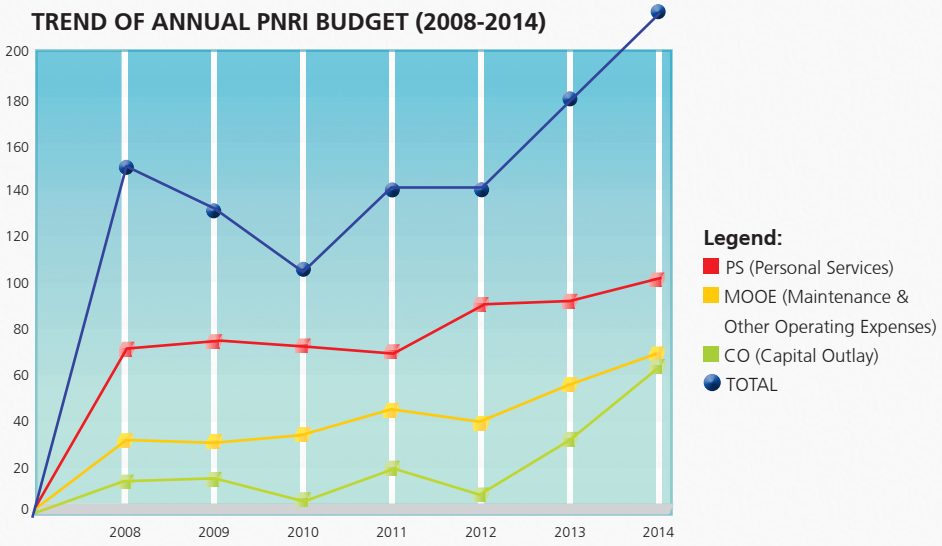
Plaque of Recognition

The Plaque of Recognition was given by University of the Philippines National Institute for Science and Mathematics Education Development (UPNISMED) to DOST-PNRI for unselfishly sharing its laboratories, facilities, and expertise to UPNISMED's teacher trainees, thus enabling them to appreciate the positive impact of nuclear science and technology on human lives.

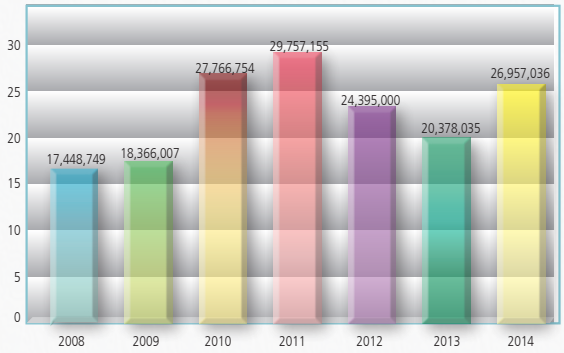
FINANCIAL RESOURCES

This year, PNRI had a budget allotment of ₱229,929,000.00 by class and ₱146,161,000.00 by major final output. The Institute generated an annual income of ₱26,957,036.00 from licensing fees and from the Institute's nuclear and allied services, among others. Additional resources were also generated through local and foreign –funded projects on nuclear science and technology applications.

TREND OF ANNUAL PNRI BUDGET (2008-2014)

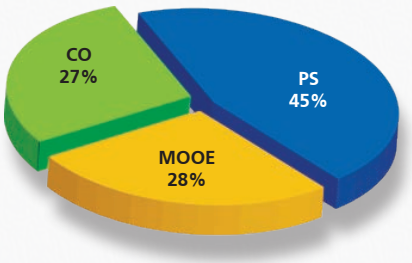


ANNUAL INCOME (2008-2014)



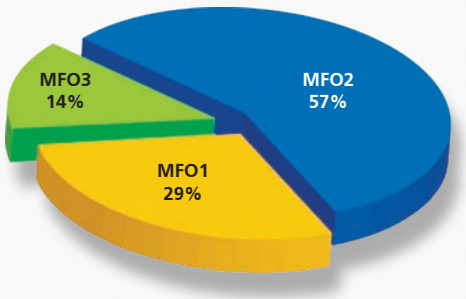
Additional Resources Generated from External Sources 2014

Grant	Amount
Local Grants-in-Aid	Php 19,092,161.00
Foreign Grants	Php 4,046,188.00
TOTAL	**Php 23,138,349.00**



2014 ALLOTMENT BY EXPENSE CLASS

PS	₱101, 931,000.00
MOOE	₱ 65,065,000.00
CO	₱ 62,933,000.00
Total	₱ 229,929,000.00



2014 EXPENDITURES BY MAJOR FINAL OUTPUT (MFO)

MFO1	₱ 41,804,000.00	• Scientific Research & Development
MFO2	₱ 83,404,000.00	• Technical Advisory Services
MFO3	₱ 20,953,000.00	• Nuclear Regulatory Services
Total	₱146,161,000.00	

APPENDICES

TABLE 1. PNRI TECHNICAL TRAINING COURSES CONDUCTED IN 2014

TITLE OF TRAINING	TRAINING VENUE/ LOCATION	NO. OF PARTICIPANTS	INCLUSIVE DATES CONDUCTED	FUNDING SCHEME
RADIOISOTOPE TECHNIQUES				
Radioisotope Techniques Training Course (RTTC-Medical) 104th Session	PNRI, Diliman, Quezon City	39	2 – 27 June	Company- sponsored
Course on Medical Use of Radioisotopes (CMR) (formerly RTTC-Medical)	PNRI	35	1 – 26 Sept	Company- sponsored
Course on Radioisotope Technology (CRT) (formerly RTTC-General)	PNRI	(10*)	1 – 26 Sept.	Waived
NUCLEAR SCIENCE AND TECHNOLOGY				
Seminar on Nuclear Science for High School Science Teachers (SNSHSST- 38th Session)	PNRI	26	14 April – 16 May	PNRI-sponsored
Nuclear Technology for University/College Faculty (NTUCF-47th Session)	PNRI	1	14 April – 16 May	PNRI-sponsored
RADIATION SAFETY				
Radiation Safety Course	Daguma Agrominerals, Inc.	11	12 – 14 Feb	Company- sponsored
Safety in the Use of Nuclear Equipment and Devices (SUNED) -69th Session	Coral Bay Nickel Corp, Palawan	13	17 – 21 Feb	Company- sponsored
Safety in the Use of Nuclear Equipment and Devices -70th Session	THPAL, Surigao del Norte	18	21 – 25 Feb	Company- sponsored
Safety in the Use of Nuclear Equipment and Devices – 71st Session	PNRI	37 (4*)	10 – 14 March	Company- sponsored
Radiation Safety Refresher Course	PNRI	20	25 – 27 March	Company- sponsored
Radiation Safety Course for Medical and Radiopharmaceutical Facilities	The Medical City Hospital, Mandaluyong City	13	7 – 12 April	Company- sponsored
Safety in the Use of Nuclear Equipment and Devices -72nd Session	PNRI	30 (1*)	26 – 30 May	Company- sponsored
Radiation Safety Course for Medical and Radiopharmaceutical Facilities	PNRI	17	27 June – 29 Aug	Company- sponsored
Radiation Safety Course-Commercial Sale Involving Radioactive Materials and Low Activity Sources	ICI Systems Inc., Pasig City	10	5 – 6 June	Company- sponsored
Radiation Safety Refresher Course	Makati Medical Center	10	20, 27 June and 4 July	Company- sponsored
Radiation Safety Course-Commercial Sale Involving Radioactive Materials and Low Activity Sources	PNRI	13	15 – 17 July	Company- sponsored
Radiation Safety Course – Refresher Course	PNRI	25	5 – 7 Aug	Company- sponsored
Radiation Safety Course– Well Logging	GXD, Makati City	10	4 – 7 Aug	Company- sponsored
Radiation Safety Course-Sealed Sources in Industrial Devices (formerly SUNED)	PNRI	35	1 – 12 Sept	Company- sponsored
Radiation Safety Course – Medical Use of Radioisotopes	PNRI	4(2*)	13 – 24 Oct	Company- sponsored
Radiation Safety Course	National Pesticide Analytical Laboratory, BPI	15	2 – 3 Oct	Company- sponsored
Radiation Safety Course-Sealed Sources in Industrial Devices (formerly SUNED)	PNRI	7 (1*)	17 – 21 Nov	Company- sponsored
Radiation Safety Course-Sealed Sources in Industrial Devices (formerly SUNED)	Apo Cement Corp, Cebu	12	26 – 28 Nov	Company- sponsored
Radiation Safety Officer Refresher Course	Apo Cement Corp, Cebu	2	26 – 28 Nov	Company- sponsored
NUCLEAR POWER				
JAEA Follow-Up Training Course on Reactor Engineering – Level 1	PNRI	10 (6*)	10 – 21 Feb	PNRI- sponsored
EMERGENCY PREPAREDNESS				
JAEA Follow-Up Training Course on Nuclear and Radiological Emergency Preparedness and Response	PNRI	15 (6*)	27 – 31 Jan	Waived
ENVIRONMENTAL RADIOACTIVITY				
JAEA Follow-Up Training Course on Environmental Radioactivity Monitoring	PNRI	12 (6*)	3 – 7 Feb	PNRI- sponsored
NON-DESTRUCTIVE TESTING AND WELDING TECHNOLOGY (conducted in cooperation with the Phil. Society for Nondestructive Testing, Inc. (PSNT)				
Ultrasonic Testing – Level 2	PNRI	15	13 – 24 Jan	Individual fee- paying
Surface Methods – Level 2	PNRI	12	3 – 14 Feb	Individual fee- paying
Radiographic Testing – Level 2	PNRI	30	24 Feb – 7 Mar	Individual fee- paying
Eddy Current Testing –Level 2	PNRI	10	17 – 28 March	Individual fee- paying
Infrared Thermographic Testing	PNRI	10	21 – 25 April	Individual fee- paying
Radiographic Testing – Level 2	PNRI	29 (1*)	5 – 16 May	Individual fee- paying
Surface Methods – Level 2	PNRI	24	16 – 30 May	Individual fee- paying
Ultrasonic Testing	Tsuneishi Industrial Services, Balamban, Cebu City	10	21 July – 1 Aug	Company Sponsored
Radiographic Testing – Level 2	PNRI	31	16 – 27 June	Individual fee- paying
Ultrasonic Testing – Level 2	PNRI	31	4 – 5 Aug	Individual fee- paying
Eddy Current Testing –Level 2	PNRI	12	15 – 29 Sept	Individual fee- paying
Surface Methods – Level 2	PNRI	20	1 – 15 Sept	Individual fee- paying
Radiographic Testing – Level 2	PNRI	40	13 – 24 Oct	Individual fee- paying

APPENDICES

TABLE 1. PNRI TECHNICAL TRAINING COURSES CONDUCTED IN 2014 (continuation)

TITLE OF TRAINING	TRAINING VENUE/ LOCATION	NO. OF PARTICIPANTS	INCLUSIVE DATES CONDUCTED	FUNDING SCHEME
Infrared Thermographic Testing-1	PNRI	10	21 – 25 April	Individual fee- paying
Infrared Thermographic Testing-1	PNRI	7	13 – 17 Oct	Individual fee- paying
Ultrasonic Testing – Level 2	PNRI	32	10 – 21 Nov	Individual fee- paying
WELDING TECHNOLOGY				
Welding Inspectors	PNRI	20	13 – 17 Jan	Individual fee- paying
Welding Inspectors	PNRI	9	2 – 6 June	Individual fee- paying
Welding Inspectors	PNRI	11	15 – 19 Sept	Individual fee- paying
TOTAL NO. OF COURSES: 46	**TOTAL**	**803 (37*)**		

* No. of PNRI participants

TABLE 2. IAEA RESEARCH CONTRACTS IMPLEMENTED IN 2014

TITLE/DESCRIPTION OF RESEARCH	PROJECT DURATION		NAME OF RESPONSIBLE AGENCY STAFF
	START	END	
Resource Sparing Curative Radiotherapy for Locally Advanced Squamous Cell Cancer of the Head and Neck	15 Nov 2010	15 Non 2016	Jonas Santiago St. Luke's Medical Center
Enhancing Capacity for Early Detection and Diagnosis of Breast Cancer Through Imaging	18 Nov 2011	18 Nov 2016	Orestes Monzon Philippine Heart Center
Strengthening of "Biological Dosimetry" in IAEA Member States: Improvement of Current Techniques and Intensification of Collaboration and Networking Among the Different Institutes	10 Feb 2013	9 Feb 2016	Celia Asaad PNRI
Ocean Acidification and the Economic Impact on Fisheries and Coastal Society	17 Sept 2012	17 Sept 2016	Rodelio Subade University of the Philippines , Visayas Foundation, Inc.
Application of Radiation Technology in the Development of Advanced Packaging Materials for Food Products	8 Feb 2013	7 Feb 2017	Zenaida De Guzman PNRI
Evaluation of QA/Qc Procedures in Radiotherapy in the Philippines	4 June 2013	3 June 2017	Lilian Rodriguez St. Luke's Medical Center
A Study on Radiotherapy Utilization Rate in the Philippines	13 Feb 2014	13 Feb 2017	Anthony Albert Abad Jose Reyes Memorial Medical 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 5,000.00 per year.

TABLE 3. IAEA TECHNICAL COOPERATION PROJECTS* IMPLEMENTED IN 2014

NAME OF PNRI CONTACT PERSON	TITLE/DESCRIPTION OF RESEARCH	PROJECT DURATION	
		START	END
Denis DC. Aquino	Enhancing National Capability in Applications of Industrial Radioisotope Techniques	2014	2015
Luvimina G. Lanuza	Enhancing the Safety and Throughput of the Gamma Irradiation Facility Through Full Automation	2014	2015
Rolando Y. Reyes	Enhancing National Capacity for Extraction of Uranium, Rare Earth Elements and other Useful Commodities from Phosphoric Acid	2014	2015
Soledad S. Castañeda	Integrating Isotope Techniques for Increasing Effectiveness in Water Assessment and Management	2014	2015
Teofilo Y. Garcia	Strengthening National Capability to Respond to Radiation Emergencies	2014	2015
Ma. Visitacion B. Palattao	Iterating Design and Safety Assessment of the Proposed Deep Borehole and Near Surface Disposal Facilities	2014	2015

TABLE 4. PNRI HOSTINGS IN 2014

FIELD	PHILIPPINE PARTICIPANT	AGENCY / INSTITUTE	ORGANIZER/S	VENUE	DATE
IAEA Regional Training Course on the Organization, Staffing and Competencies of the Regulatory Body	Sylvia Busine, Lynette Cayabo, Teresita de Jesus, Cecelia De Vera, and Luzviminda Venida	PNRI	IAEA	Crowne Plaza Galleria Manila	27 – 31 Jan
Regional Training Course on Application of Stable Isotope and Trace Element Analysis for Food Traceability	Menandro Ortego	PTTC	IAEA	Imperial Suites, Quezon City	3 – 14 Feb
	Cezar Dela Cruz	Tigre de Oro Mining			
	Arvin Hagonoy, Norman Mendoza, and Joseph Michael Racho	PNRI			
Follow-Up Training Course (FTC) on Reactor Engineering Course	Cheri Anne Dingle, Marriana Grande, Eugene Gregorio, Richard Fernandez, and Lorna Jean Palad	PNRI	JAEA	PNRI	10 – 21 Feb
National Workshop on Isotope Data Interpretation Under the Water Availability Enhancement Project (IWAVE)	Wendy Lim, Norman Mendoza, Charles Racadio, Edmundo Vargas, and Jennyvi Ramirez	PNRI	IAEA	PNRI	17 Feb – 7 Mar
	Azeneth Baguhun	Cagayan de Oro Water District			
IAEA Practical Training Course on Decommissioning to Enhance the Technical Capabilities for Member States to Manage the Radioactive Waste Generated by Decommissioning of Researchers Reactors and Other Facilities	Jan Aldrich Agustin, Alan Borras, Jose Calaycay, Roberto Fontanilla, Abelardo Inovero, Ronald Piquero, and Alfonso Singayan	PNRI	IAEA	Crowne Plaza Galleria Manila	16 – 20 June

APPENDICES

TABLE 4. PNRI HOSTINGS IN 2014 (continuation)

FIELD	PHILIPPINE PARTICIPANT	AGENCY / INSTITUTE	ORGANIZER/S	VENUE	DATE
Supporting the Use of Receptor Binding Assay (RBA) to Reduce the Adverse Impacts of Harmful Algal Toxins on Seafood Safety	Lourdes Cruz and Rhodora Azanza	UP-Marine Science Institute	IAEA	Richmonde Hotel, Eastwood City	22 – 27 June
	Edcel Mae Llemos, Guzdale Lo	Bureau of Food and Aquatic Resources			
	Sandra Victoria Arcamo	Department of Agriculture-Bureau of Food and Aquatic			
	Rhett Simon Tabbada	PNRI			
IAEA/RCA Mid-term Progress Review Meeting of the RCA Project Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resources Management	Bienvenido Batar	Cagayan de Oro Water District	IAEA	Richmond Hotel, Eastwood , Quezon City	30 June – 4 July
	Soledad Castañeda and Norman Mendoza	PNRI			
National Workshop on the Logical Framework Approach for Technical Cooperation Project Design	PNRI			PNRI	8 – 11 July
National Workshop on Security Culture in Practice	Thelma Artificio, Nelson Badinas, Estrella Caseria Grace De Leon Cuevas, Eugene Gregorio, Editha Marcelo, John Marquez, Carl Nohay, and Haydee Solomon	PNRI	IAEA	PNRI	26 – 29 Aug
IAEA National Training Course on Communication with the Public in a Nuclear or Radiological Emergency	Framelia V. Anonas and Joy Lazcano	Science and Technology Information Institute	IAEA	PNRI	20 – 24 Oct
	Enrique Navarette and Diana Christine Gabito	Department of Energy			
	Jose Manalo, Jocylin Alpay	National Power Corporation			
	Deniece Krizza Ballesteros	National Disaster Risk Reduction Management Center			
	Sherry Ivy Valenzuela	Metro Manila Development Authority			
	Susana Juangco	Department of Health			
	Densi Godda	Bureau of Fire Protection			
	Jonathan Del Rosario and Carmelo Olavario Siapno	Philippine National Police			
	Dino Lagas	Department of the Interior and Local Government			
	Jerome Carlo Paunan	Philippine Information Agency			
	Rhodora R. Leonin, Justina S. Cerbolles, Estrella S. Caseria, Hans Joshua V. Dantes, Eliza B. Enriquez, Teofilo Y. Garcia, Ma. Celerina M. Ramiro, Rolando Y. Reyes, Carl M. Nohay, Alfonso A. Singayan, Joseph R. Tugo, Joan L. Tugo, Grace Carlos	PNRI			
Regional Workshop on Field Data Processing for the Safety Case of Waste Disposal Facilities and Annual Meeting of the Topical Group on Radioactive Waste Management	Editha Marcelo	PNRI	IAEA	Crowne Plaza, Quezon City	3 – 7 Nov
Workshop of FNCA Neutron Activation Analysis Project	Preciosa Corazon Pabroa and Raymond Sucgang	PNRI	FNCA	Imperial Suites, Quezon City	4 – 6 Nov
IAEA/RCA Regional Training Course on Best Practices for the Use of Irradiation as a Phytosanitary Treatment	Leslie Manalo and Merle Palacpac	Bureau of Plant Industry	IAEA/RCA	Crowne Plaza Galleria	1 – 5 Dec

TABLE 5. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
TRAINING COURSE					
Training Course on Providing Decision Support for Nuclear Power Planning and Development	Manuel Luis Plofino	National Power Corporation	Tokyo, Japan	2 – 13 June	IAEA
CTBTO Technical Training for Station Operators of Manual Radionuclide Stations	Alejandro Jesuitas	PAGASA	Vienna, Austria	14 – 18 July	IAEA
Regional Training Course on Assessment of Body Composition and Total Energy Expenditure by Stable Isotope Techniques	Aida Malilin	Food and Nutrition Research Institute	Kuala Lumpur, Malaysia	1 – 5 Sept	IAEA
Regional Training Course on Advance Hybrid Nuclear Medicine Reporting in Oncology	Raymund Augustus Conlu	St. Luke's Global	Victoria, Australia	8 – 12 Sept	IAEA
Training Course on 3D Image-Guided Brachytheraphy for Cervical Cancer	Anthony Albert Abad	Jose Reyes Memorial Medical Center	Japan	22 – 26 Sept	IAEA
Regional Training Course on CT Cancer Staging: Abdomen and Urogenital System	Irene Bandong and Eric Cruz	St. Luke's Medical Center	Seoul, Korea	6 – 10 Oct	IAEA
Regional Training Course on Clinical Applications of Stereotactic Body Radiotherapy (SBRT) in Head and Neck Spinal and Liver Cancers	Czarina Devilleres	Philippine Radiation Oncology Society	Tokyo, Japan	20-24 Oct	IAEA
Regional Training Course on Essentials of Hybrid Nuclear Medicine Imaging	Cynthia Liao	AFP Medical Center	Chiang Mai, Thailand	8 – 12 Dec	IAEA
	Enrique Leonardo Ote	St. Paul Hospital, Tugegarao			
WORKSHOP/SEMINAR					
Workshop on Decision Making Process for Countries Embarking on Nuclear Power following the IAEA Milestones Approach	Mylene Capongcol and Carmencita Bariso	Department of Energy	Fukui, Japan	17 – 21 Feb	IAEA
Regional Workshop on Resource and Training Materials for Computed Tomography Cancer Staging	Eric Cruz	St. Luke's Medical Center	Denpasar, Indonesia	28 Apr – 2 May	IAEA

TABLE 5. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014 (continuation)

FIELD	NAME	AGENCY	TRAINING VENUE	DATE	SPONSOR
WORKSHOP/SEMINAR					
ANSN Regional Workshop on Probabilistic Seismic Hazard Assessment and Surface Faulting Analysis for Nuclear Power Plant Sites and the Fifth Annual Meeting of the Topical Group on Siting	Teresito Bacolcol	Philippine Institute of Volcanology and Seismology	Vienna, Austria	10 – 13 June	IAEA
Regional Workshop on the Application of Single Photon Emission Computed Tomography (SPECT)/ Computed Tomography(CT) and Positron Emission Tomography (PET)/ Computed Tomography(CT) Technology in Pediatric Oncology and Other Non-communicable Diseases for Nuclear Medicine Physicians	Teofilo San Luis, Jr.	St. Luke's Medical Center	Seoul, Republic of Korea	4 – 8 Aug	IAEA
	Maria Lourdes Taylan	UST Hospital			
Training Workshop for Teacher Training on the IAEA's Analytical Tools for Elaborating Sustainable Energy Strategies	Marietta M. Quejada	Department of Energy	Sweden	11 – 12 Aug	IAEA
Workshop to Support Pilot Countries Launch an Outreach Program on Nuclear S & T for Secondary Schools	Helen Go and Maria Violeta Tupas	Department of Education	Vienna, Austria	14 – 17 Oct	IAEA
Regional Workshop for TAD Vaccine Selection Criteria and Technologies	Christina F. Legaspi	Bureau of Animal Industry	Vienna, Austria	28 – 31 Oct	IAEA
Regional Workshop on the Improvement of Compliance Assurance Regime for Transport Safety	Marivic J. Apao	Civil Aviation Authority of the Philippines	Vienna, Austria	3 – 7 Nov	IAEA
MEETING					
Technical Meeting on Strengthening Research Cooperation in Radiation Disaster Medicine (Research Cooperation 3)	Teofilo San Luis, Jr.	St. Luke's Medical Center	Vienna, Austria	27 – 31 Jan	IAEA
Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure	Raul Aguilos and Jesus Tamang	Department of Energy	Vienna, Austria	4 – 7 Feb	IAEA
Technical Meeting on Issues of Harmonization, Communications, and Denials of Shipment, Taking into Account the Results for the 2011 International Conference on the Safe and Secure Transport of Radioactive Material	Dante Lantin	Department of Transportation	Vienna, Austria	1 – 3 Apr	IAEA
Technical Meeting on the Future of Nuclear Medicine and Diagnostic Imaging	Juvy Obaldo	Philippine Heart Center	Vienna, Austria	5 – 16 May	IAEA
Meeting on E-Learning in the Education and Clinical Training of Medical Physicist	Agnette Peralta	Food and Drug Administration-Department of Health	Vienna, Austria	14 – 16 May	IAEA
Technical Meeting on Milestones in the Development of a National Infrastructure for Nuclear Power	Gladys C. Sta. Rita	National Power Corp.	Vienna, Austria	28 – 30 May	IAEA
Technical Meeting on Building a National Position on a New Nuclear Power Programme	Jesus Tamang	Department of Energy	Vienna, Austria	24 – 26 June	IAEA
ANSN Fifth Annual Meeting of the Topical Group on Siting (STG) and Regional Workshop on Probabilistic Seismic Hazard Analysis (PSHA) and Surface Faulting Analysis for Nuclear Power Plant Sites	Roy Anthony Luna	Univ.ersity of the Philippines	Vienna, Austria	15 – 18 July	IAEA
	Ramon D. Quebral	AMH (Philippines) Inc.			
Second Technical Meeting of the Application of the Practical Illustration and Use of the Safety Case Concept in the Management of Near-Surface Disposal Project (PRISMA)	Augustus Ressureccion	University of the Philippines	Vienna, Austria	6 – 10 Oct	IAEA
First Regional Coordination Meeting on the Development of Project Strategy and Implementation Plan on Therapeutic Nuclear Medicine Techniques	Emerita A. Barrenchea	Veterans Memorial Medical Center	Yangon, Myanmar	13 – 17 Oct	IAEA
Technical Meeting on the Patient Safety and Radiotherapy	Mary Ann Reyna	Jose Reyes Memorial Medical Center	Vienna, Austria	29 – 31 Oct	IAEA
Final Coordination Meeting on Strengthening the Application of Nuclear Medicine in the Management of Cardiovascular Diseases	Orestes Monzon	Philippine Heart Center	Chiang Mai, Thailand	3 – 7 Nov	IAEA
IAEA/RCA Final Project Meeting	Miriam Joy Calaguas	Jose Reyes Memorial Medical Center	Japan	6 – 19 Dec	IAEA
CONFERENCE/SYMPOSIUM					
International Conference on Human Resource Development for Nuclear Power Programmes: Building and Sustaining Capacity	Ermie Bacarra	PCIEERRD-DOST	Vienna, Austria	12 – 16 May	IAEA
	Angelina Manga	Department of Energy			
International Symposium on Understanding Moderate Malnutrition in Children for Effective Interventions	Mario Capanzana	Food and Nutrition Research Institute-DOST	Vienna, Austria	26 – 30 May	IAEA
OTHERS					
Improving Nuclear Cardiology Services in Evaluation of IHD and Left Ventricular Failure	Jasmin de Jesus	Univ.ersity of Santo Tomas	Colombo, Sri Lanka	7 – 11 July	IAEA
	Dominic Velasco	Cardinal Santos Medical Center			
2014 Nuclear Law Institute	Hon. Francis Gerald A. Abaya and Bernard R. Odron	Congress of the Philippines	Vienna, Austria	6 – 17 Oct	IAEA
2nd Nuclear Youth Summit	Ian Mark V. Allas	Quezon City Science High School	Jakarta, Indonesia	22 – 24 Nov	BATAN
	Ana Jamille A. Restubog	San Francisco High School			
Proposed Legislation of the Comprehensive Nuclear Law and Visit at IAEA Headquarters	Hon. Victor J. Yu and Mariano U. Piamonte, Jr.	Congress of the Philippines	Vienna, Austria	8 – 10 Dec	IAEA
Enhancing Effectiveness of Assistance to Countries Embarking on Nuclear Power	Jesus Tamang	Department of Energy	Vienna, Austria	8 – 10 Dec	IAEA
Strengthening Hybrid Imaging in Nuclear Medicine in Asia and the Pacific Region	Gerald Fabian	St. Luke's Medical Center	Ho Chi Minh City, Vietnam	15 – 19 Dec	IAEA

APPENDICES

TABLE 6. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014

FIELD	NAME	COUNTRY	TRAINING DATE	SPONSOR
ON-THE-JOB TRAINING				
Fellowship Training in the Field of Radiation Processing Facilities and Applications	Davison T. Baldos	Jeongeup, Korea	4 Aug – 4 Nov	IAEA
Two (2) Months IAEA Fellowship Training in the Field of Radiopharmaceuticals at the Korea Institute of Radiological and Medical Sciences (KIRAMS); Korea Cancer Center Hospital; Cyclotron Application Laboratory	Rommel DC. Mascariñas	Seoul, Korea	Starting 17 Nov	IAEA
TRAINING COURSE				
International Training Course on Nuclear Security	Maria Teresa A. Salabit and Haydee M. Solomon	Daejeon, Korea	10 – 14 Mar	
Training Course on Water Balance Modelling for Pilot IWAVE Countries	Norman DS. Mendoza	Vienna, Austria	10 – 21 Mar	IAEA
EUSECTRA Training on Radiation Detection Techniques for Southeast Asia	Alvie J. Asuncion, Raymund P. Beredo, Maria Teresa A. Salabit, and Ramoncito F. Sulit	Ispra, Italy	24 – 28 Mar	EU Joint Research Center/ Institute for Transuranium Elements
Regional Training Course on Basic Elements of Nuclear and Radiological Emergency Preparedness and Response	Cecilia M. De Vera	Vienna, Austria	7 – 11 Apr	IAEA
Regional Training Course on Advanced Radiation Grafting of Polymeric Matrices for Environmental and Industrial Applications	Jordan F. Madrid	Ho Chi Minh City, Vietnam	14 – 18 Apr	IAEA/RCA
Regional Training Course on Industrial Radioactive Particle Tracking (RPT) and SPECT for Multi-phase Process Investigation	Adelina DM. Bulos and Janice P. Mallillin	Kajang, Malaysia	14 – 18 Apr	IAEA
RCARO Regional Training Course in Basic and Advanced Knowledge and Hands-on Experiment on Electron Beam Applications for Advanced Material in Asia Pacific Region	Luvimina G. Lanuza and Veriza Rita C. Cruz	Jeongeup, Korea	14 – 25 Apr	RCA
Practical Training Course on Planning and Implementation of Nuclear Facility Decommissioning and Remediation of Radioactively Contaminated Sites	Estrella S. Caseria	Argonne, United States of America	5 – 16 May	IAEA
Regional Training Course on Assessment of Occupational Exposures Due to External Sources of Radiation	Abelardo A. Inovero	Jakarta, Indonesisa	2 – 6 June	IAEA
2nd KINA/INSAInternational Training Course on Nuclear Safeguards	Maria Teresa A. Salabit and John Marquez	Daejeon, Korea	9 – 13 June	KINAC/INSA
RCARO Regional Training Course in Basic and Advanced Knowledge and Hands-on Experiment on Electron Beam Applications for Value Addition to Food Products in Asia Pacific Region	Gina B. Abrera	Jeongeup, Korea	16 – 20 June	RCARO
Training on Public Communication	Grace M. Carlos and Joan L. Tugo	Rome, Italy	23 – 27 June	EU
Course on Environmental Radioactivity Monitoring	Charles Darwin Racadio	Japan	23 June– 1 Aug	JAEA
Course on Nuclear and Radiological Emergency Preparedness	Franklin Pares	Japan	23 June – 1 Aug	JAEA
Regional Training Course on Management of DSRS Using the IAEA Borehole Disposal Concept	Carl M. Nohay and Edmundo P. Vargas	Wellampitiya, Sri Lanka	30 June – 4 July	IAEA
Technical Training for PKI Operators on Public Key Infrastructure and Data Surety	Paolo Tristan F. Cruz	Vienna, Austria	2 – 4 July	IAEA/RCA
Guest Lecturer on Instructor Training Course on Environmental Radioactive Monitoring	Rosario R. Encabo	Japan	6 – 10 July	JAEA
Production of an On-Line Training Course for the Dissemination of Good Food Irradiation Practices	Zenaida M. De Guzman	Vienna, Austria	7 – 11 July	IAEA
Regional Training Course on Radiation Detection Techniques for Front Line Officers from South East Asia	Joseph R. Tugo	Siem Reap, Cambodia	21 – 25 July	IAEA
Interregional Advanced Training Course on Marine Radioactivity: Analytical Techniques and Quality Management	Christopher Mendoza and Jennyvi D. Ramirez	Karlsruhe, Germany	21 July – 1 Aug	IAEA
Regional Group Training on the Effective Utilization of XRF Spectrometers for an Optimized and Accurate Air Particulate Matter (APM) Analysis	Joseph Michael D. Racho	Lower Hutt, New Zealand	28 July – 1 Aug	IAEA
Regional Training Course on Establishment of Transfer Factors and Dose Assessment for Marine Organisms from Contaminants released from Nuclear Activities	Christopher Mendoza	Bangi, Malaysia	11 – 22 Aug	IAEA/RCA
Advanced Training Course on the Application of RAIS 3.3 Web for Management of Regulatory Programme	Alan M. Borras and Nelson P. Badinas	Ulaanbaatar, Mongolia	18 – 22 Aug	IAEA
Inter-Regional Training Course on Nuclear Material Accounting and Control at Facilities	Florante C. Valderrama, Jr.	Yogyakarta, Indonesia	19 – 28 Aug	IAEA
Course on Reactor Engineering II	Adrian Cruz	Tokai, Japan	25 Aug – 17 Oct	JAEA
Regional Training Course on Security of Radioactive Sources	Raymund P. Beredo	Tokai-mura, Ibaraki Prefecture, Japan	22 – 26 Sept	IAEA/ISCN, JAEA
Regional Training Course on Quality Assurance of Fingerprint and Source Apportionment of Air Particulate Matter (APM)	Preciosa Corazon B. Pabroa	Vienna, Austria	22 – 26 Sept	IAEA
Regional Training Course on Security of Radioactive Sources	Maria Teresa A. Salabit	Tokai-mura, Japan	22 – 26 Sept	IAEA
Regional Training Course on Mass Rearing and SIT-related Activities for the Control of *Aedes* Mosquitoes, the Major Vectors of Dengue and Chikungunya	Glenda B. Obra and Sotero Resilva	Juazeiro, Brazil	22 – 26 Sept	IAEA
Training Course on NDC Capacity Building: Access and Analysis of Radionuclide IMS Data and IDC Products	Fe M. Dela Cruz	Vienna, Austria	29 Sept – 10 Oct	IAEA
Regional Training Course on the Security of Radioactive Sources for Regulatory Authorities in Southeast Asian Countries	Teresita G. De Jesus, Carl M. Nohay, and Luzviminda L. Venida	Jakarta, Indonesia	30 Sept – 3 Oct	IAEA

TABLE 6. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014 (continuation)

FIELD	NAME	COUNTRY	TRAINING DATE	SPONSOR
TRAINING COURSE				
2nd Basic Integrated Regulatory Review Service (IRRS) Training Course	Alan M. Borras	Vienna, Austria	6 – 9 Oct	IAEA
Regional Training Course on Regulatory Enforcements	Albert M. Llagas Johnylen V. Melendez	Doha, Qatar	12 – 16 Oct	IAEA
Regional Training Course on Application of Stable Isotope and Trace Element Analyses for Food Traceability: Multivariate Statistics and Use of On-line Toolbox	Raymond J. Sucgang	Drugodawatta, Wellampitiya, Sri Lanka	13– 24 Oct	IAEA
Training Meeting on Best Practices in the Uranium Production Cycle – From Exploration to Mining	Rolando Y. Reyes	Jakarta, Indonesia	14 – 17 Oct	IAEA
Regional Training Course on Radiation Protection in the Oil and Gas Industry	Mary Rose Q. Mundo	Abu Dhabi, United Arab Emirates	19 – 23 Oct	IAEA
INT/9174 Interregional Training Course for CONNECT Users – for Asia/Pacific, Latin America, Africa, and Europe	Nydia C. Medina and Alfonso A. Singayan	Vienna, Austria	28 – 31 Oct	IAEA
Regional Training Course on the Use of C-13 in Soil Organic Matter Studies and in Assessment of Plant Toleranc to Abiotic Stress (Drought and Salinity)	Roland V. Rallos Faye G. Rivera	Kuala Lumpur, Malaysia	3 – 7 Nov	IAEA
Regional Training Course on Nuclear Security Detection Architecture for South-East Asia and the Pacific	Soledad S. Castañeda	Kuala Lumpur, Malaysia	3 – 07 Nov	IAEA
International Training Course on Security in the Transport of Nuclear Material	Maria Teresa A. Salabit	Karisruhe, Germany	3 – 7 Nov	IAEA
Regional Group Training on the Utilization of Synchrotron Radiation Techniques for Advanced Analytical Studies on Air Pollution	Joseph Michael D. Racho	Basovizza, Italy	4 – 7 Nov	IAEA
3rd Korea Institute of Nuclear Nonproliferation and Control/International Nuclear Nonproliferation and Security Academy (KINAC/INSA) International Training Course on Strategic Trade Control	Sylvia S. Busine	Daejeon, Korea	10 – 14 Nov	KINAC/INSA
Regional Training Course on Information and Computer Security Advanced Practices for Nuclear Security	Christopher G. Halnin	Mumbai, India	10 – 14 Nov	IAEA
Interregional Training Course on Integrated Management Systems and Developing of the Safety Culture	Graceta DL. Cuevas and Ana Elena L. Conjares	Lemont, Illinois, USA	10 – 21 Nov	IAEA
Course on Nuclear Plant Safety (NPS)	Mariana Lourdes Marie L. Grande	Tsuruga, Japan	17 Nov – 12 Dec	WERC
IAEA's Training Workshop on the Implementation of a Management System for Research Reactor Operating Organizations	Thelma T. Artificio	Vienna, Austria	24 – 28 Nov	IAEA
Regional Training Course on Protective & Preventive Measures Against Sabotage	Nelson P. Badinas	Beijing, China	24 – 28 Nov	IAEA
Regional Training Course on Developing a Safety Case for Predisposal Waste Management Facilities in Line with the IAEA Safety Standards	Romelda P. Azores	Vienna, Austria	15 – 19 Dec	IAEA
WORKSHOP				
Technical Workshop on Application of Isotopes for Assessing Improved Crop Genotype Response to Water and Nutrient Use	Adelaida C. Barrida Faye G. Rivera	Denpasar, Bali, Indonesia	3 – 7 Feb	IAEA
CRDF Global "Tiger Reef Workshop and Tabletop Exercise"	Joseph R. Tugo	Kuala Lumpur, Malaysia	4 – 7 Feb	
Interregional Workshop on Social Licensing and Stakeholder Communications in Uranium Exploration and Mining Industry	Rolando Y. Reyes	Istanbul, Turkey	10 – 14 Feb	IAEA
FY2013 FNCA Workshop on Nuclear Security and Safeguards Project	Sylvia S. Busine	China	26 – 28 Feb	FNCA
FNCA JFY2013 Workshop on Mutation Breeding Project	Adelaida C. Barrida	Indonesia	4 – 7 Mar	FNCA
Regional Workshop on Clearance of Decommissioning Waste – Part 2	Editha A. Marcelo John M. Marquez Alfonso A. Singayan	Hanoi, Vietnam	24 – 28 Mar	IAEA
Regional Workshop on the Time-Limited Ageing Analysis Methodology for Life Extension, with a Focus on Equipment Qualification and Concrete in Nuclear Facility Buildings	Andrew C. Barrida	Haiyan City, China	24 – 28 Mar	IAEA
Regional Workshop on Systematic Approach to Training (SAT) and on Developing a Training Action Plan to Fill the Gaps Identified Using the Guidelines for Systematic Assessment of Regulatory Competence Needs (SARCoN)	Sylvia S. Busine Lynette B. Cayabo	Jakarta, Indonesia	24– 28 Mar	IAEA
Regional Workshop to Provide Basic Professional Training in Nuclear Safety	Eugene S. Gregorio Raymund P. Beredo Mariana Lourdes Marie L. Grande	Daejeon, Korea	7 – 18 Apr	IAEA/ANSN
Regional Workshop on Application of Ion Beam Radiation Technology in Plant Mutation Breeding	Adelaida C. Barrida	Jeongeup, Korea	14 – 18 Apr	
Regional Workshop to Conduct a Review Exercise for the Preparation of Safety Analysis Reports for Nuclear Power Plants: Transient and Accident Analysis	Teofilo V. Leonin, Jr.	Hanoi, Vietnam	5 – 9 May	IAEA
Regional Workshop on the Transition of Management Systems Already in Place for Nuclear Facilities from ISO 9000 to GS-R-3	Ma. Celerina M. Ramiro	Daejeon, Korea	12 – 16 May	IAEA
National Data Center Workshop 2014	Paolo Tristan F. Cruz	Vienna, Austria	12 – 16 May	CTBTO
Peer Review/Workshop for the FNCA Safety Management Systems (SMS) Project	Allan M. Borras	Dhaka, Bangladesh	19 – 23 May	FNCA
Regional Workshop on Regulatory Approaches Needed for the Deployment of a Country's First Nuclear Power Plant Project	Thelma P. Artificio and Teresita de Jesus	Kuala Lumpur, Malaysia	19 – 23 May	IAEA
First KINS-KAIST Master Program Review Meeting Workshop	Ronald E. Piquero	Putrajava, Malaysia	26 – 28 May	KINS
Regional Workshop on Leadership and Management for Safety and Safety Culture for the Regulatory Bodies	Teofilo V. Leonin, Jr.	Hanoi, Vietnam	26 – 30 May	IAEA
Regional Workshop on Special On-the-Job Training (OJT) for Nuclear Power Plant (NPP) Newcomers	Jeana Lee P. Sablay	Daejeon, Korea	9 – 13 June	IAEA

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TABLE 6. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014

FIELD	NAME	COUNTRY	TRAINING DATE	SPONSOR
WORKSHOP				
Regional Workshop on Long Term Issues Following a Nuclear or Radiological Emergency and Annual Meeting of the Topical Group on Emergency Preparedness and Response (EPRTG)	Teofilo V. Leonin, Jr.	Dengkil, Malaysia	9 – 13 June	IAEA
RCARO Annual Workshop: Working Group Meeting for the RCARO's Future Role	Alumanda M. Dela Rosa	Jeju, Republic of Korea	10 – 12 June	RCARO
First Coordination Meeting and Workshop	Nydia C. Medina Raymund J. Sucgang Roland V. Rallos	Vienna, Austria	10 – 13 June	IAEA
Interregional Workshop on Best Practices in Media and Public Communication for Nuclear Power Programmes	Justina S. Cerbolles	Abu Dhabi, UAE	17 – 19 June	IAEA
Regional Workshop on Predisposal – Waste Acceptance Criteria, Processing and Interim Storage	Teresita G. De Jesus	Hanoi, Vietnam	30 June – 4 Jul	IAEA
Regional Workshop on Safety Analysis Using RELAP5 and Annual Meeting of the Topical Group on Safety Analysis (SATG)	Alfonso A. Singayan	Daejeon, Republic of Korea	30 June – 4 Jul	IAEA
FY2014 FNCA Workshop on Human Resources Development	Christina A. Petrache	Ulaanbaatar, Mongolia	2 – 4 Jul	FNCA
Regional Workshop on Impact of APM Concentrations and Sources on Cultural Heritage Objects	Preciosa Corazon B. Pabroa	Columbo, Sri Lanka	7 – 11 Jul	IAEA
Regional Workshop on Using the Education and Training Review Service (ETRES) for Self-assessment and Filling the Gaps	Roel A. Loteriña and Lynette B. Cayabo	Vienna, Austria	7 – 11 Jul	IAEA
Regional Workshop on Occupational Radiation Protection and ALARA in Waste Management	Estrella S. Caseria	Dejeon, Republic of Korea	14 – 18 Jul	IAEA
Fifth Annual Meeting of the Topical Group on Siting (STG) and Regional Workshop on Probabilistic Seismic Hazard Analysis (PSHA) and Surface Faulting Analysis for Nuclear Power Plant Sites	Rolando Y. Reyes	Vienna, Austria	15 – 18 Jul	IAEA/ANSN
East Asia Regional National Data Center Workshop	Lorna Jean H. Palad Fe M. Dela Cruz	Ulaanbaatar, Mongolia	29 Jul – 1 Aug	CTBTO
Regional Workshop on the Instructor Training Programme	Giuseppe Filam O. Dean Eileen Beth A. Hernandez	Fukia, Japan	4 – 8 Aug	IAEA
Regional Workshop on Communication During Emergencies (Phase II)	Rhodora R. Leonin Justina S. Cerbolles Mary Rose Q. Mundo	Chiang Mai, Thailand	18 – 22 Aug	IAEA
Regional Workshop on Familiarizing Member States in Asia with Integrated Nuclear Security Support Plans (INSSP)	Teofilo V. Leonin, Jr.	Yogyakarta, Indonesia	19 – 21 Aug	IAEA
Workshop on Safety and Regulation of Nuclear Power Plants – a new set of YVL-gides for design and construction of a new build in Finland	Teofilo V. Leonin, Jr. Maria Visitacion B. Palattao Alan M. Borras	Helsinki, Finland	1 – 3 Sept	IAEA
Joint IAEA/JRC Workshop on Environmental Impact Assessment for Decommissioning of Nuclear Installations	Mary Rose Q. Mundo Romelda P. Azores	Ispra, Italy	1 – 5 Sept	IAEA
Workshop on Safety and Regulation of Nuclear Power Plants – a new set of YVL-gides for design and construction of a new build in Finland	Maria Visitacion B. Palattao Alfonso A. Singayan Alan M. Borras	Brussels, Belgium	4 – 9 Sept	IAEA
International Workshop on the Fundamentals of Domestic Safeguards Inspections	Julietta E. Seguis	Jakarta, Indonesia	8 – 12 Sept	USDOE-NNSA
Workshop on SARCON Methodology for Developing a Training Programme and Knowledge Management System	Cecilia M. De Vera Luzviminda L. Venida	Vienna, Austria	9 – 12 Sept	IAEA
Workshop on Safety and Regulation of Nuclear Power Plants – a new set of YVL-gides for design and construction of a new build in Finland	Maria Visitacion B. Palattao, Alfonso A. Singayan, and Alan M. Borras	Berlin, Germany	10 – 11 Sept	IAEA
Regional Workshop on Safety Review and Assessment by the Regulatory Body	Jeana Lee P. Sablay and Joseph R. Tugo	Daejeon, Korea	15 – 19 Sept	IAEA
Regional Workshop on Outlining a National Strategy for Education and Training	Cecilia M. De Vera and Lynette B. Cayabo	Bali, Indonesia	13 – 17 Oct	IAEA/ANSN
2014 RCARO/KAERI Regional Workshop on Radiation Technology and its Applications	Celia O. Asaad and Arnold R. Valenzuela	Daejeon, Korea	13 – 24 Oct	RCARO
Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Research Reactor Network	Adelina DM. Bulos	Bangkok, Thailand	14 – 16 Oct	Japanese Government
The Workshop on the Implementation of UN Security Council Resolution 1540 (2004)	Christina A. Petrache and Teofilo V. Leonin, Jr.	Phnom Penh, Cambodia	15 – 17 Oct	United Nations Office for Disarmament Affairs
Sixth Annual Meeting of the Topical Group on Governmental and Regulatory Infrastructure (GRITG)	Alan M. Borras	Rockville, Maryland, United States of America	27 – 31 Oct	IAEA/ANSN
Workshop on Notification, Reporting and Requesting Assistance	Mary Rose Q. Mundo	Fukushima, Japan	4 – 6 Nov	IAEA
Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Nuclear Security and Safeguards	Sylvia S. Busine	Daejeon, Korea	5 – 7 Nov	FNCA
Workshop on Application of Quality Assurance and Control in Analytical Laboratories to Address Food Safety and Quality	Preciosa Corazon B. Pabroa and Haydee M. Solomon	Vienna, Austria	10 – 14 Nov	IAEA
Third Annual Meeting of the Topical Group on Leadership and Management for Safety of the Regulatory Bodies (LMSTG) and Regional Workshop on Development of an Integrated Management System Model Based on GS-R-3 and GSR Part 2	Luvimina G. Lanuza Ma. Celerina M. Ramiro Alan M. Borras Cecilia M. De Vera	Dengkil, Malaysia	17– 21 Nov	IAEA

TABLE 6. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014 (continuation)

FIELD	NAME	COUNTRY	TRAINING DATE	SPONSOR
WORKSHOP				
Regional Workshop on Computer Security of Nuclear Facilities	Ronald E. Piquero	Daejeon, Republic of Korea	24 – 28 Nov	IAEA
Regional Workshop on Nuclear Safety Tailored for Regulators	Eugene S. Gregorio	Dengkil, Selangor, Malaysia	1 – 5 Dec	
Regional Workshop on Fire Safety for Research Reactors	Arturo F. Salih	Lemont, Illinois, United States of America	8 – 12 Dec	IAEA
Workshop on Integration of Nuclear and Isotopic Data on Climate Change and Marine Ecosystem Regional Impacts	Adelina DM. Bulos	Monaco	8 – 12 Dec	IAEA
Workshop for National Coordinators of the IAEA's Radiation Safety Information Management System	Teofilo V. Leonin, Jr.	Vienna, Austria	9 – 12 Dec	IAEA
MEETING				
Consultancy Meeting to Revise the IAEA Nuclear Security Series Implementing Guide on Security in the Transport of Radioactive Material (NSS No. 9)	Julietta E. Seguis	Vienna, Austria	20 – 24 Jan	IAEA
Meeting Between ASEANTOM, IAEA and the EC JRC in the Frame of the EU CBRN Centre of Excellence (CoE) Initiative of the Project P28	Teofilo V. Leonin, Jr. and Maria Visitacion B. Palattao	Bangkok, Thailand	28 – 30 Jan	IAEA
Fourth Regional Review Meeting on Radioactive Source Security	Teofilo V. Leonin, Jr. Julietta E. Seguis	Phuket, Thailand	11 – 14 Feb	IAEA
RCA Working Groups Meeting	Alumanda M. Dela Rosa	Vienna, Austria	19 – 21 Feb	IAEA/RCA
Annual Meeting of the International Network for Nuclear Security Training and Support Centres (NSSC)	Julietta E. Seguis	Vienna, Austria	19 – 21 Feb	IAEA
Technical Meeting on Safeguards Implementation Practices Guide on Provision of Information to the IAEA	Julietta E. Seguis	Vienna, Austria	25 – 28 Feb	IAEA
Technical Meeting to Review 2 Draft SIP Guides From 2013	Julietta E. Seguis	Vienna, Austria	3 – 4 Mar	IAEA
15th FNCA Coordinator Meeting	Soledad S. Castañeda	Tokyo, Japan	11 –12 Mar	NSRA
Meeting of the RCA Chairs and the Meeting of the Standing Advisory Committee of the RCA Regional Office (SAC)	Alumanda M. Dela Rosa	Wellington, New Zealand	31 Mar	IAEA/RCA
36th Regional Meeting of the National RCA Representatives	Alumanda M. Dela Rosa	Wellington, New Zealand	1 – 4 Apr	IAEA/RCA
Subregional Meeting to Familiarize Southeast Asian States with the Nuclear Security Information Management System	Julietta E. Seguis and Nelson P. Badinas	Dengkil, Selangor, Malaysia	1 – 4 Apr	IAEA
Regional Meeting on Safety Review and Assessment	Teofilo V. Leonin, Jr.	Vienna, Austria	7 – 11 Apr	IAEA
6th Meeting of the Working Groups of the IAEA Fukushima Report	Alumanda M. Dela Rosa	Vienna, Austria	14 – 16 Apr	IAEA
19th Asian Nuclear Safety Network (ANSN) Steering Committee (SC) Meeting	Christina A. Petrache	Da Lat, Vietnam	23 – 25 Apr	ANSN
Asia and the Pacific National Liaison Officers (NLO) Meeting	Nydia C. Medina and Mylene M. Espinal	Vienna, Austria	5 – 8 May	IAEA
First Coordination and Consultative Meeting - Mass Rearing and SIT-Related Activities for the Control of *Aedes* Mosquitoes	Glenda B. Obra and Sotero S. Resilva	Colombo, Sri Lanka	5 – 9 May	IAEA
First KINS-KAIST Master Program Review Meeting Workshop	Ronald E. Piquero	Putrajava, Malaysia	26 – 28 May	KINS
Regional Meeting on Measures to Enhance the Safe Transport of Radioactive Material and Sources	Lynette B. Cayabo	Dengkil, Malaysia	26 – 30 May	IAEA
Mid-term Coordination Meeting of RAS1012 Project	Denis D. Aquino	Denpasar, Bali, Indonesia	26 – 30 May	IAEA
Regional Workshop on Long Term Issues Following a Nuclear or Radiological Emergency and Annual Meeting of the Topical Group on Emergency Preparedness and Response (EPRTG)	Teofilo V. Leonin, Jr. and Ceciia M. De Vera	Dengkil, Malaysia	9 – 13 June	IAEA/ANSN
RCARO Annual Workshop: Working Group Meeting for the RCARO's Future Role	Alumanda M. Dela Rosa	Jeju, Republic of Korea	10 – 12 June	RACARO
First Coordination Meeting and Workshop- Complementing Conventional Approaches with Nuclear Teachniques Towards Flood Risk Mitigation and Post Flood Rehab Efforts in Asia	Nydia C. Medina, Raymund J. Sucgang, and Roland V. Rallos	Vienna, Austria	10 – 13 June	IAEA/RCA
Technical Meeting on the Practical Application of IAEA Nuclear and Other Radioactive Material	Julietta E. Seguis	Vienna, Austria	10 – 13 June	IAEA
Second Research Coordination Meeting on Strengthening of 'Biological Dosimetry' in IAEA Member States: Improvement of Current Techniques and Intensification of Collaboration and Networking among the Different Institutions	Celia O. Asaad	Vienna, Austria	10– 13 June	IAEA
International Meeting on Application of Code of Conduct on the Safety of Research Reactors	Thelma P. Artificio	Vienna, Austria	16 – 20 June	IAEA
5th Meeting of the Nuclear Security Guidance Committee (NSGC) and the 1st Joint Meeting of NSGC with the Radiation Safety Standards Committee (RASSC)",	Julietta E. Seguis	Vienna, Austria	16 – 20 June	IAEA
Regional Workshop on Safety Analysis Using RELAP5 and Annual Meeting of the Topical Group on Safety Analysis (SATG)	Alfonso A. Singayan	Daejeon, Republic of Korea	30 June – 4 July	IAEA
Technical Meeting on Networking Educational Networks	Roel A. Loteriña	Vienna, Austria	30 June – 4 July	IAEA
IAEA/RCA 3rd Annual Project Review Meeting	Eliza B. Enriquez	Busan, Republic of Korea	7 – 11 July	IAEA
Fifth Annual Meeting of the Topical Group on Siting (STG) and Regional Workshop on Probabilistic Seismic Hazard Analysis (PSHA) and Surface Faulting Analysis for Nuclear Power Plant Sites	Rolando Y. Reyes and Edmundo P. Vargas	Vienna, Austria	15 – 18 July	IAEA/ANSN
Consultancy Meeting to Prepare a Draft Revised Implementing Guide on Security in the Transport of Radioactive Material (IAEA Nuclear Security Series No. 9)	Julietta E. Seguis	Vienna, Austria	21 – 25 July	IAEA
Kick-off Meeting and Information Days	Alumanda M. Dela Rosa and Teofilo Y. Garcia	Brussels, Belgium	4 – 8 Aug	European Commission

APPENDICES

TABLE 6. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014

FIELD	NAME	COUNTRY	TRAINING DATE	SPONSOR
MEETING				
Annual Working Group Meeting of the International Network for Nuclear Security Training and Support Centres (NSSC)	Julietta E. Seguis	Vienna, Austria	18 – 20 Aug	IAEA
Final Project Review Meeting	Renato T. Bañaga	Hanoi, Vietnam	18 – 22 Aug	IAEA
2nd Annual Meeting of ASEANTOM and Technical Meeting on Environmental Radiation Monitoring in ASEAN	Teofilo V. Leonin, Jr.	Chiang Mai, Thailand	25 – 27 Aug	IAEA
6th Meeting of Study Panel on the Approaches Toward Infrastructure Development for Nuclear Power	Alumanda M. Dela Rosa	Hanoi, Vietnam	26 – 27 Aug	NSRA
Technical Meeting on Advances in Exploration Techniques for Uranium Deposits and Other Radioactive Element Deposits	Rolando Y. Reyes	Vienna, Austria	1 – 4 Sept	IAEA
5th Annual Meeting of the Asia-Pacific Safeguards Network (APSN)	Julietta E. Seguis and Sylvia S. Busine	Nay Pyi Taw and Yangon, Myanmar	1 – 5 Sept	USDOE-NNSA
Consultancy Meeting to Develop Technical Specification for a New Version of Regulatory Authority Information System(RAIS)	Ana Elena L. Conjares	Vienna, Austria	1 – 5 Sept	IAEA
Second Annual Meeting of the Regional Advisory Safety Committee for Research Reactors in Asia and the Pacific (RASCAP)	John M. Marquez and Romelda P. Azores	Selangor, Malaysia	8 – 12 Sept	IAEA/ANSN
RCA Meeting to Agree on the Establishment and Maintenance of the Databases of CSSI and FRN Data of the Region	Adelina DM. Bulos	Kathmandu, Nepal	8 – 12 Sept	IAEA/RCA
43rd RCA General Conference Meeting (19 September 2014), 58th Regular Session of the General Conference (22-26 September 2014), Senior Regulator's Meeting (25 September 2014) and Plenary of the Regulatory Cooperation Forum (26 September 2014)	Alumanda M. Dela Rosa	Vienna, Austria	19 – 24 Sept	Philippine Government
Regulatory Cooperation Forum	Alumanda M. Dela Rosa	Vienna, Austria	25 – Sept	Philippine Govt.
Technical Meeting on Research Reactor Coalitions: Enhanced Networking in the Asia-Pacific Region	John M. Marquez	Da Lat, Vietnam	29 Sept – 2 Oct	IAEA/ANSN
Midterm Project Assessment Meeting in Supporting Mutation Breeding Approaches to Develop New Crop Varities Adaptable to Climate Change	Adelaida C. Barrida and Roland V. Rallos	Yogyakarta, Indonesia	6 – 10 Oct	IAEA/RCA
Annual Meeting of the Communication Topical Group(CTG) and Consultation with Interested Parties (CTG) and Regional Workshop on Legal and Regulatory Requirements Concerning Communication	Rhodora R. Leonin	Dengkil, Malaysia	7 – 10 Oct	IAEA/ANSN
Regional Meeting on Status of Occupational Radiation Protection in Asia and the Pacific Region	Estrella S. Caseria	Kathmandu, Nepal	13 – 17 Oct	IAEA/RCA
Meeting to Support Pilot Countries Launch an Outreach Programme on Nuclear Science and Technology for Secondary Schools	Rhodora R. Leonin and Roel A. Loteriña	Vienna, Austria	14 – 17 Oct	IAEA/RCA
Training Meeting on Best Practices in the Uranium Production Cycle – From Exploration to Mining	Rolando Y. Reyes	Jakarta, Indonesia	14 – 17 Oct	IAEA
Annual Meeting of the Topical Group on Education and Training (ETTG) and Seminar on the Strategic Approach to Education and Training in Nuclear Safety 2013-2014	Roel A. Loteriña and Nydia C. Medina	Vienna, Austria	20 – 24 Oct	IAEA/ANSN
Sixth Annual Meeting of the Topical Group on Governmental and Regulatory Infrastructure (GRITG) and Regional Workshop on the Legal and Regulatory Framework for Nuclear Safety	Maria Visitacion B. Palattao	Rockville, Maryland, United States of America	27 – 31 Oct	IAEA
Meeting of the Nuclear Energy Experts Group (NEEG)	Teofilo V. Leonin, Jr.	Bangkok, Thailand	29 – 30 Oct	CSIS
Technical Meeting on Uranium from Unconventional Resources	Rolando Y. Reyes	Vienna, Austria	4 – 7 Nov	IAEA
Technical Meeting on Effective Techniques and Messages to Engage with Decision Makers and the Public	Justina S. Cerbolles	Bristol, United Kingdom	4 – 7 Nov	IAEA
Technical Meeting on the Safeguards Implementation Practices Guide on Provision of Information to the IAEA	Julietta E. Seguis	Vienna, Austria	4 – 7 Nov	USDOE
6th Meeting of the Nuclear Security Guidance Committee (NSGC)	Julietta E. Seguis	Vienna, Austria	10 – 14 Nov	IAEA
Third Annual Meeting of the Topical Group on Leadership and Management for Safety of the Regulatory Bodies (LMSTG) and Regional Workshop on Development of an Integrated Management System Model Based on GS-R-3 & GSR Part 2	Luvimina G. Lanuza and Cecilia M. De Vera	Dengkil, Malaysia	17 – 21 Nov	IAEA/ANSN
20th Asian Nuclear Safety Network (ANSN) Steering Committee (SC) Meeting	Teofilo V. Leonin, Jr.	Vienna, Austria	19 – 21 Nov	ANSN/IAEA
Technical Meeting on Uranium as a By-product and Co-product with an Emphasis on Base and Precious Metal and Related Deposits	Rolando Y. Reyes	Vienna, Austria	24 – 26 Nov	IAEA
First Coordination Meeting of Project RAS/5/061[-1]	Zenaida M. De Guzman	Bali, Indonesia	24 – 28 Nov	IAEA
Third Annual Meeting of the DACCORD Project	John M. Marquez	Vienna, Austria	24 – 28 Nov	IAEA
Project Design Meeting (PDM)	Preciosa Corazon B. Pabroa	Vienna, Austria	24 – 28 Nov	IAEA
CONFERENCE/SYMPOSIUM/SUMMIT				
CTBTO Regional Conference for States in Southeast Asia, the Pacific and the Far East	Soledad S. Castañeda Teofilo Y. Garcia	Jakarta, Indonesia	19 – 21 May	CTBTO
International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle: Exploration, Mining, Production, Supply and Demand, Economics and Environmental Issues	Rolando Y. Reyes	Vienna, Austria	23 – 27 June	IAEA
International Conference on Advances in Nuclear Forensics: Countering the Evolving Threat of Nuclear and Other Radioactive Material Out of Regulatory Control	Rolando Y. Reyes	Vienna, Austria	7 – 10 July	IAEA
8th International Symposium on BioPIXE	Preciosa Corazon B. Pabroa	Bled, Slovenia	14 – 19 Sept	IAEA

TABLE 6. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2014 (continuation)

FIELD	NAME	COUNTRY	TRAINING DATE	SPONSOR
CONFERENCE/SYMPOSIUM/SUMMIT				
58th Regular Session of the General Conference of the International Atomic Energy Agency	Nydia C. Medina, Rhodora R. Leonin and Rhett Simon Tabbada	Vienna Austria	22 – 26 Sept	DOST-GIA
16th International Conference on Harmful Algae	Ma. Llorina O. Rañada	Wellington, New Zealand	27 – 31 Oct	IAEA
International Conference on Challenges Faced by Technical and Scientific Support Organizations (TSOs) in Enhancing Nuclear Safety and Security: Strengthening Cooperation and Improving Capabilities	Alumanda M. Dela Rosa	Beijing, China	27 – 31 Oct	IAEA
2014 Nuclear Youth Summit	Joan L. Tugo and Cheri Anne Dingle	Jakarta, Indonesia	22 – 24 Nov	BATAN
International Conference on Occupational Radiation Protection: Enhancing the Protection of Workers – Gaps, Challenges and Developments	Estrella S. Caseria	Vienna, Austria	1 – 5 Dec	IAEA
SCIENTIFIC VISIT				
Study Visit as Part of the Capacity Building for Science, Technology and Innovation Towards a Self-Sustaining Research and Development Institutes (RDIs) of DOST	Ma. Celerina M. Ramiro	Tokyo, Japan	3 – 7 June	BCDA/DOST
Study Visit Under the European Commission Project - "Technical Assistance for Improving the Legal Framework for Nuclear Safety and Strengthening the Capabilities of the Regulatory Authority of the Philippines and its TSO-PNRI and Includes the Workshop on Safety and Nuclear Power Plants	Maria Visitacion B. Palattao, Teofilo V. Leonin, Jr., Alan M. Borras and Alfonso A. Singayan	Finland, Belguim and Germany	1 – 11 Sept	European Commission
Scientific Visit at National Nuclear Energy Agency of Indonesia (BATAN); Centre for Radioisotopes and Radiopharmaceuticals Technology	Ma. Teresa L. Borras	Jakarta, Indonesia	15 – 26 Sept	IAEA and BATAN
Study Visit of Laboratories and Benchmarking Activities as Part of the Capacity Building for Science ,Technology and Innovation Towards a Self-Sustaining Research and Development Institutes (RDIs) of DOST	Ma. Celerina M. Ramiro and Soledad S. Castañeda	Vienna, Austria	22 – 26 Sept	BCDA/DOST
Scientific Visit at the IAEA Isotope Hydrology Laboratory	Charles Darwin T. Racadio and Jennyvi D. Ramirez	Vienna, Austria	13 – 17 Oct '14	IAEA
Scientific Visit in Different Irradiation Facilities	Luvimina G. Lanuza	Budapest, Hungary	27 – 31 Oct '14	IAEA
Scientific Visit – Isomass Isotope Ratio Mass Spectrometry (IRMS) Training Center	Norman DS. Mendoza	Ottawa, Canada	1 – 10 Dec '14	IAEA
ACADEMIC				
Master of Science Program in Agricultural Biotechnology	Jorge R. Sahagun	Naresuan University, Thailand	9 Aug '14– 31 May '16	
SPECIAL SERVICE ASSIGNMENT				
To Assist in the Implementation of the Regulatory Authority Information System (RAIS 3.3)	Ana Elena L. Conjares	Vientiane, Lao P.D.R.	13– 17 Oct	IAEA

TABLE 7. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2014

FIELD	NAME	DATE	VENUE
NATIONAL TRAINING COURSE			
IAEA Follow-up Training Course (FTC) on Environmental Monitoring	Alvie J. Asuncion, Percedita T. Cansino, Veriza Rita C. Cruz, Fe M. Dela Cruz; Tristan F. Cruz Cheri Anne Dingle, Rosario R. Encabo, Mylene M. Espinal, Wendy G. Lim; Roel A. Loteriña, Nydia C. Medina, Paolo Christopher O. Mendoza, Jennylyn C. Minglana, Vanessa J. Omandam, and Ramoncito F. Sulit	3 – 7 Jan	PNRI
IAEA Follow-up Training Course on Nuclear and Radiological Emergency Preparedness	Jan Aldrich Agustin, Romelda P. Azores, Jose N. Calaycay, Eugene S. Gregorio, Rollie B. Ilao, Abelardo A. Inovero, Franklin A. Pares, and Gerardo Jose M. Robles	27 – 30 Jan	PNRI
IAEA 2nd Follow-up Training Course (FTC) on Nuclear and Radiological Emergency Preparedness	Ruth B. Alicer, Alvie J. Asuncion, Percedita T. Cansino, Paulo Tristan F. Cruz, Cecilia M. De Vera, Mylene M. Espinal, Mariana Lourdes Marie L. Grande, Eileen Beth A. Hernandez, Johnylen V. Melendez, Jennylyn C. Minglana, Mary Rose Q. Mundo, Carl M. Nohay, Nydia C. Medina, Ma. Teresa A. Salabit, Haydee M. Solomon; Ramoncito F. Sulit, and Joseph R. Tugo	27 – 30 Jan	PNRI
IAEA Regional Training Course on Organization and Competence of Regulatory Body	Alan M. Borras; Sylvia S. Busine; Lynette B. Cayabo; Teresita G. De Jesus; Cecilia M. De Vera; Teofilo V. Leonin, Jr.; and Luzviminda L. Venida	27 – 31 Jan	Crowne Plaza Hotel
Follow-up Training Course on Reactor Engineering Level 1	Cheri Anne M. Dingle; John Richard A. Lourdes; Marie L. Grande, Eugene S. Gregorio; Fernandez Mariana; and Lorna Jean H. Palad	1 – 21 Feb	PNRI
Training-workshop on Implementing QA/QC in Analytical Chemistry Laboratories in Preparation for ASEAN 2015	Arvin M. Jagonoy	17 – 18 Feb	Camp Crame
Training on Philippine Public Sector Accounting Standards and Revised Chart of Accounts	Hidie S. Gocuyo; Gerald DG. Conise; and Marife R. Roa	17 – 21 Feb	Commission on Audit
Training-workshop in the International School on Atmospheric Aerosol Physics, Measurement and Sampling	Preciosa Corazon B. Pabroa	31 Mar – 3 Apr	University of the Philippines - Diliman
Training on ISO/IEC:17025:2005	Aileen D. Mendoza; Ma. Llorina A. Rañada; and Rhett Simon DC. Tabbada	21 – 23 Apr	Philippine Trade Training Center/ Department of Trade and Industry (PTTC/DTI)
2014 Philippine Statistical Research & Institute Training Course	Gina B. Abrera, Socorro P. Intoy, Abigale Mia V. Javier, and Jenifer A. Sagum	12 – 16 May	Philippine Statistical Research and Institute Training Course
20th Executive Course on National Security (ECNS)	Lucille V. Abad	19 – 23 May	Camp Crame

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TABLE 7. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2014 (continuation)

FIELD	NAME	DATE	VENUE
NATIONAL TRAINING COURSE			
4th INTERPOL Radiological and Nuclear Investigations Training Course	Carl M. Nohay	26 – 30 May	Marriot Hotel
Training Course on CESB Accredited Leadership Training Programs 2014 on Strategic and Critical Thinking	Soledad S. Castañeda	29 – 30 May	Makati City
COA Course on Laws and Rules on Government Expenditures	Joanrose N. Villanueva	9 – 12 Sept	Commission on Audit
Course on Supplier Selection and Evaluation	Dante Q. Bajet	9 July	Philippine Trade Training Center
ISO/IEC 17025:2005 Training (Laboratory Internal Audit)	Rhett Simon DC. Tabbada	23 – 24 July	Pasay City
Training on Weapons of Mass Destruction (WMD) Detection Equipment for Bureau of Customs	Mary Rose Q. Mundo	4 – 6 Aug	Bureau of Customs
	Maria Teresa A. Salabit	11 – 13 Aug	
	Joseph R. Tugo	18 – 20 Aug	
Export Control and Related Border Security Training, Counter Proliferation Investment Course	Alan M. Borras, Cecilia M. De Vera Teofilo V. Leonin, Jr., Carl M. Nohay, Julietta E. Seguis, and Luzviminda L. Venida	12 – 15 Aug	Hyatt Hotel
4th Pilot Course on the WMD-Commodity Identification Training	Teresita G. De Jesus	16 – 18 Sept	Bay Leaf Hotel
Technicom and Technology Investment Forum and Training Program	Anie Day DC. Asa	17 – 18 Sept	Heritage Hotel
	Charito T. Aranilla	30 Sept – 1 Oct	
	Gregory R. Ciocson and Lorna S. Relleve	15 – 17 Oct	
COA Course on Laws and Rules on Government Expenditures	Bryan B. Villoria	4 – 7 Oct	Commission on Audit
Training Course on Managing High Performance Teams	Ana Elena L. Conjares	9 – 10 Oct	Civil Service Commission
Second Hands-on-Training on Thomson Database Usage	Anie Day DC. Asa, Roland V. Rallos, Ma. Llorina O. Rañada	17 Oct	University of the Philippines -Diliman
Training Course for IT Personnel for the One-Lab Project	Jeza A. Buctot	28 – 30 Oct	Industrial Technology Development Institute
	Grace P. Gonzales	3 – 7 Nov	
iGovPhil Project Users Training on Online Forms Generator	Christine P. Singayan	30 Oct	UP-Diliman
Weapons of Mass Destruction (WMD) Detection Equipment Training for the Philippine Coast Guards, Philippine National Police Group and Bureau of Customs Personnel	Romelda P. Azores	3 – 10 Nov	Bureau of Customs
	Raymund P. Beredo	11 – 18 Nov	
Training on Patent/Prior Art Search	Bin Jeremiah D. Barba and Veriza Rita C. Cruz	5 – 7 Nov	UP -Diliman
Orientation-Training on Gender Mainstreaming Monitoring System	Emma L. Cancino and Bernard M. De Lara	3 Dec	DOST
SEMINAR/WORKSHOP			
Anti-Terrorism Council Program Management Center (ATC-PMC) Preparatory Workshop on Developing a Chemical, Bio-logical, Radiological and Nuclear (CBRN) National Action Plan	Cecilia M. De Vera and Julietta E. Seguis	8 Jan	Manila
Seminar and Exhibits on the Integrated Services Digital Broadcasting-Terrestrial	Justina S. Cerbolles, Arminda V. Espineda, and Joan L. Tugo	13 – 14 Jan	EDSA Shangri-la Hotel
IWAVE National Worksop on Isotope Hydrology	Soledad S. Castañeda, Rollie B. Ilao, Wendy G. Lim, Norman DC. Mendoza, Charles Darwin T. Racadio, Jennyvi D. Ramirez, and Edmundo P. Vargas	17 Feb – 7 Mar	PNRI
2014 National Workshop Coast Watch System (NCWS) Workshop	Cecilia M. De Vera, and Ma. Teresa A. Salabit	18 – 20 Feb	Hyatt Hotel
MITHI Workshop on the ICT Plan and Budget for FY 2015	Ana Elena L. Conjares	20 Feb	Information & Communications Technology Office
Seminar-Workshop on Strategic Trade Management	Teofilo V. Leonin, Jr. and Ma. Teresa A. Salabit	24 Feb	Peninsula Manila
On-Scene CBRN Incident Commanders Seminar at the Non-Commissioned Officers (NCO)	Joseph R. Tugo	24 – 28 Feb	Philippine Army, Taguig
Workshop on Accelerator Mass Spectroscopy and its Application	Anie Day DC. Asa, Angel T. Bautista , VII, Danilo A. Cuyco, Arvin M. Jagonoy, Gloria R. Jimenez, Norman DS. Mendoza, Preciosa Corazon B. Pabroa, and Joseph Michael D. Racho	3 – 5 Mar	PNRI
First ISDB-T Datacasting Seminar	Justina S. Cerbolles, Arminda V. Espineda, and Christopher G. Halnin	5 Mar	EDSA Shangri-la Hotel
ISO Seminar on How to Become an Effective Controller	Andrew C. Barrida, Ana Aileen B. Cezar, Jeza A. Buctot, Ana Maria S. Veluz, Luzviminda L. Venida, and Christine P. Singayan	14 May	Philippine Trade Training Center
Anti-Terrorism Council Program Management Center Seminar-Workshop on the Strategic Trade Management	Carl M. Nohay	19 May	Malacañang, Manila
Quality Management System Training Seminar	Alan M. Borras, Cecilia M. De Vera, and Teofilo V. Leonin, Jr.	24 – 25 Mar	Philippine Trade Training Center
National Coast Watch Operational Planning Workshop (CONOP Serial #6)	Teresita G. De Jesus	26 – 30 May	Hyatt Hotel, Manila
DST-NCR Comprehensive Information, Education and Communication Workshop "Iba na ang Panahon: Science for Safer Communities"	Cecilia M. De Vera	29 – 30 May	Philippine International Convention Center, Roxas Blvd, Pasay City
Consultative Workshop with IWAVE Expert	Norman DS. Mendoza, Charles Darwin T. Racadio, and Edmundo P. Vargas	2 – 6 June	National Water Resources Board
Workshop on Disaster Preparedness Standards	Mary Rose Q. Mundo, Joseph R. Tugo	23 June	Goldland Millenia
COA Course Seminar at the Commission	Mark Anthony E. Baal, Denia A. Dato-on, Ricky C. Gabinete, Luzviminda B. Muyco, Susan S. Pascual, Cecilia T. Perez, Hershy Lou C. Santos, and Israel D. Vinoya	24 – 25 June	Commission on Audit
Web-based Hydrological Information Sharing: Workshop Using Open Source Software	Jeza A. Buctot, Christopher G. Halnin, Norman DS. Mendoza	25 June	Department of Environment & Natural Resources

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TABLE 7. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2014 (continuation)

FIELD	NAME	DATE	VENUE
SEMINAR/WORKSHOP			
Seminar-Workshop on Strategic Communication for the Eight DOST Outcomes	Justina S. Cerbolles and Joan L. Tugo	2 – 4 July	Development Academy of the Phils. (DAP), Tagaytay City
Anti-Terrorism Council – Program Management Center Write-Shop to Finalize the Drafting of the National Chemical, Biological, Radiological Nuclear (CBRN) Action Plan	Cecilia M. De Vera	3 – 4 July	Bayleaf Hotel
Seminar on ISO/IEC 17025: 2005 Laboratory Management System Documentation	Aileen DL. Mendoza, Ma. Llorina A. Rañada and Rhett Simon DC. Tabbada	21 – 22 July	Philippine Trade Training Center
Seminar-Workshop on QA/QC in the Laboratory	Riva G. Panganiban and Ma. Llorina A. Rañada	24 – 25 July	Ateneo De Manila University
Stakeholders Workshop on Critical Aspects of Nanotechnology R & D Management	Gregory R. Ciocson	24 – 25 July	Midas Hotel
Web-based Seminar on Reactivity Insertion Accident (RIA) for Nuclear Power Plants (R29)	Giuseppe Filam O. Dean, Teofilo V. Leonin, Jr., Carl M. Nohay, Christina A. Petrache, Alfonso A. Singayan, Joseph R. Tugo	30 – 31 July	PNRI
Seminar on Increasing Personal Effectiveness	Carolina M. Andres, Gerald DG. Conise, Bernard M. De Lara, Hidie S. Gocuyo, Ana N. VIllanueva	5 – 6 Aug	Civil Service Commission
Back-to-Back Writeshop for the NUWAM Projects	Wilfredo A. Gultiano, Roland V. Rallos, Faye G. Rivera	11 – 15 Aug	Bureau of Soil and Water Management (BSWM)
Seminar on Competency Modelling and Profiling	Aileen B. Cezar	24 – 26 Aug	Civil Service Commission
National Workshop on Security Culture in Practice	Nelson P. Badinas, Thelma P. Artificio, Sylvia S. Busine, Estrella S. Caseria, Graceta DL. Cuevas, Eugene S. Gregorio, Luvimina G. Lanuza, Editha A. Marcelo, John M. Marquez, Carl M. Nohay, Maria Teresa A. Salabit, Julietta E. Seguis, and Haydee M. Solomon	26 – 29 Aug	PNRI
AGIA Seminar on Government Procurement Reform Act (RA-9184) and its Revised IRR and Updates	Gerard D. Conise, Bernard M. De Lara	27 – 29 Aug	Kimberly Hotel
One Lab Orientation and Planning Workshop	Jeza A. Buctot, Ana Elena L. Conjares, and Gregory R. Ciocson	28 – 29 Aug	DOST-ITDI
Seminar on Competency Modelling and Profiling	Aileen B. Cezar	2 – 4 Sept	Civil Service Commission
Seminar on Development of Competency Based QS and Job Descriptions	Emma L. Cancino	10 – 12 Sept	Civil Service Commission
Training-Workshop on Irradiation as a Phytosanitary Treatment	Zenaida M. De Guzman, Luvimina G. Lanuza, Aurelio A. Maningas Glenda B. Obra, and Haydee M. Solomon	16 – 18 Sept	Intercontinental Hotel
Humanitarian Assistance and Disaster Response Subject Matter Expert Exchange (HADR-SMEE) 14-3 Emergency Operation Center (EOC) Interagency Coordination Workshop	Emma L. Cancino	17 Sept	Marco Polo Hotel
Two-Day National Workshop on ASEAN Trade Repository (ATR) National Trade Repository (NTR)	Thelma P. Artificio	18 – 19 Sept	Crowne Plaza Hotel
Seminar-Workshop for the Development of the Implementing Rules and Regulations of the Strategic Trade Management Act	Teresita G. De Jesus	23 – 24 Sept	Malacañang, Manila
Seminar on Competency Assessment	Camille Grace B. Beredo	24 – 26 Sept	Civil Service Commission
Seminar on the Technology Transfer and Licensing of Intellectual Property Rights in a Knowledge Based Economy	Gregory R. Ciocson	24 – 25 Sept	Heritage Hotel Manila
COA Course/Seminar at the Commission on Audit, Professional and Institutional Development Sector	Mark Anthony E. Baal	21 – 25 July	Commission on Audit
	Denia A. Dato-on	11 – 15 Aug	
	Ricky C. Gabinete	15 – 19 Sept	
	Luzviminda B. Muyco	24 – 27 June	
	Susan S. Pascual	9 – 12 Sept	
	Cecilia T. Perez	22 – 25 July	
	Hershylou C. Santos	9 – 11 July	
	Israel D. Vinoya	27 – 29 Aug	
In-House Training Workshop on Protocol and Social Services	Mylene M. Espinal, Miriam F. Rejas	1 – 2 Oct	DOST
Seminar-Workshop on Technical Introduction to Strategic Trade Control Licensing	Teofilo V. Leonin, Jr., Cecilia M. De Vera, and Teresita G. De Jesus	7 – 9 Oct	New World Hotel, Makati
Workshop on Needs Assessment Questionnaire	Cecilia M. De Vera	3 – 4 Nov	Malacañang, Manila
Training-Workshop on Process Benchmarking for the DOST Regional and RDI's Technology Transfer Staff	Gregory R. Ciocson	5 – 7 Nov	DOST-FNRI
National Workshop on Nuclear Security Information Management System and Review of the Integrated Nuclear Security Support Plan	Sylvia S. Busine, Julietta E. Seguis, and Ma. Teresa A. Salabit	23 – 29 Nov	PNRI
Seminar-Workshop on the National Inventory of Records	Emma L. Cancino	4 Dec	DOST
MEETING			
NRCP Division Meeting	Glenda B. Obra and Sotero S. Resilva	20 Jan	DOST-NRCP
Inception Meeting on the Technical Assistance for Improving the Legal Framework for Nuclear Safety and Strengthening the Capabilities of the Regulatory Authority of the Philippines and its TSO	Thelma P. Artificio, Nelson P. Badinas, Alan M. Borras, Sylvia S. Busine, Soledad S. Castañeda, Lynette B. Cayabo, Ana Elena L. Conjares, Graceta DL. Cuevas, Teresita G. De Jesus, Cecilia M. De Vera, Michael P. Hernandez, Teofilo V. Leonin, Jr., Roel A. Loteriña, Nydia C. Medina, Carl M. Nohay, Vangeline K. Parami, Christina A. Petrache, Edgar G. Racho, Jeana Lee P. Sablay, Julietta E. Seguis, Alfonso A. Singayan, and Luzviminda L. Venida	4 – 5 Mar	PNRI

APPENDICES

TABLE 7. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2014 (continuation)

FIELD	NAME	DATE	VENUE
MEETING			
Governing Meeting on Plant Bio-stimulants and Elicitor from Radiation-Modified Natural Polymers	Lucille V. Abad, Charito T. Aranilla, and Fernando B. Aurigue	28 Apr	DOST
NAST 36th Annual Scientific Meeting (ASM) at the Summit	Luvimina G. Lanuza	9 – 10 July	PICC
Technical Working Group (TWG) Meeting that will Finalize the Draft Department of Health Administrative Order entitled Regulations on the Operation of Diagnostic X-ray Facilities	Jeana Lee P. Sablay	25 – 26 Sept	Department of Health
17th Meeting of the Technical Committee I	Roland V. Rallos, and Faye G. Rivera	30 Oct	Bureau of Soils and Water Management
Inception Meeting for the PCAARD-Funded Program Titled: Boosting the Sugarcane Industry Through Smart Farming Techniques	Gerald DG. Conise, Roland V. Rallos, Ma. Celerina M. Ramiro, and Faye G. Rivera	10 Nov	DOST- MIRDC
Third Expert Meeting in the CBRN CoE Project 8 Prerequisite to Strengthening CBRN National Legal Framewrok	Teresita G. De Jesus and Ma. Visitacion B. Palattao	12 – 14 Nov	Malacañang, Manila
Philippine Environmental Mutagen Society Meeting	Lucille V. Abad, Elizabeth P. Cabildo, Roland V. Rallos & Raymond J. Sucgang	22 Nov	PNRI
OTHERS			
3rd Bioanalytical Nanotechnology School	Jordan Madrid	29 Jan – 1 Feb	University of Santo Tomas
NAST Roundtable Discussions on Assessment of the Micro-biological Needs of the Food and Pharmaceutical Industries	Zenaida M. De Guzman and Levelyn Mitos M. Tolentino	27 Jan	Acacia Hotel, Manila
Consultative Assembly of DOST System FAD Chiefs, Accountants and Budget Officers for CY 2014	Graceta DI. Cuevas, Bernard M. De Lara, and Susan M. Pascual	20 – 21 Feb	Batangas City
Inter-agency Tabletop Exercise Under Chemical, Biological, Radiological and Nuclear-Commodity Identification Training (CBRN-CIT)	Teresita G. De Jesus, Teofilo V. Leonin, Jr. and Mary Rose Q. Mundo	18 – 21 Feb	Philippine National Police
First Global Terrorism and CBRNE Conference in the Philippines	Teresita G. De Jesus, Mary Rose Q. Mundo, and Ma. Teresa A. Salabit	4 – 7 Mar	Shangri-la Hotel
Seminar on Radioactive Waste Management for Radiation Safety Course for Health Professionals	Editha A. Marcelo	22 Mar	University of Sto Tomas Hospital
2nd Forum on ICT Infrastructure	Ana Elena L. Conjares	28 Mar	Hyatt Hotel, Manila
Roundtable Discussion on Water Supply and Wastewater (Sewerage) Disposal	Preciosa Corazon B. Pabroa and Raymond J. Sucgang	2 Apr	Hyatt Hotel, Manila
ASEAN Economic Community Forum: Converging Towards AEC Game Plan	Alan M. Borras	10 Apr	Crowne Plaza
6th Safety Summit: Merck Milipore: Raising the Bar on Safety	Jordan F. Madrid	6 June	Marriot Hotel
Discussion of Code of PNRI Regulations (CPR) Part 13: Licenses for Medical Use of Unsealed Radioactive Material	Teresita G. De Jesus, Ma. Visitacion B. Palattao and Jeanna P. Sablay	19 Jul	University of Sto Tomas
9th Knowledge Exchange Conference	Ana Elena L. Conjares	22 Jul	Century Park Hotel
Follow Through Activity for the Development of National Disaster Preparedness Plan and Disaster Preparedness Standards	Cecilia M. De Vera and Mary Rose Q. Mundo	17 – 18 June	BSA Twin Towers
Third National Climate Conference	Soledad S. Castañeda	25 Sept	Traders Hotel
Program on Disaster Risk Reduction Management	Emma L. Cancino, Ana N. VIllanueva	3 – 4 Sept	DOST -PAGASA
Planning Conference on Humanitarian Assistance and Disaster Response Subject Matter Expert Change	Estrella S. Caseria	18 – 19 Aug	Marco Polo Hotel
4th Philippine Anti-Counterfeiting and Piracy Summit	Gregory R. Ciocson, Ana Elena L. Conjares and Christina A. Petrache	20 Oct	Marriot Hotel
Third National Climate Conference	Raymond J. Sucgang	25 Sept	Traders Hotel
Expert Mission on Groundwater Vulnerability Assessment in the Philippines	Charles Darwin T. Racadio and Jennyvi D. Ramirez	29 Sept – 10 Oct	National Water Resources Board
Third GAD Budget Forum	Emma L. Cancino Bernard M. De Lara	9 Oct	Commission on Audit
Participation to the Association of Government Internal Auditors, Inc.	Marife R. Roa	12 – 14 Nov	Hotel Kimberly
	Dante Q. Bajet	19 – 21 Nov	
Roundtable Discussion on Rare Diseases	Gilbert T. Diano	30 Oct	Traders Hotel
Resource Speaker in the Seminar on Chemicals Procurement and Disposal: Updates and Implementation	Lynette B. Cayabo	11 – 12 Dec	Pugad Lawin, Quezon City
Open Computer Conference	Jeza A. Buctot, Christopher G. Halnin, and Ma. Celerina M. Ramiro	25 – 26 Nov	Shangri-la Hotel

TABLE 8. LIST OF SCIENTIFIC PUBLICATIONS IN 2014

TITLE OF SCIENTIFIC PAPER	NAMES	E-MAIL OF MAIN AUTHORS	PUBLICATION/NAME/ TYPE OF JOURNAL	DATE PUBLISHED
List of Publications which garnered the 2014 International Publication Awards and Incentives of P60,000 per publication.				
Carbonaceous Particulate Matter Characterization in an Urban and a Rural Site in the Philippines.	Angel T. Bautista VII Preciosa Corazon B. Pabroa, Flora L. Santos, Joseph Michael D. Racho, and Leni L. Quirit	*(atbaustista@pnri.dost.gov.ph)*	Atmospheric Pollution Research, doi: 10.5094/APR.2014.030.	Apr 2014
Molecularly Imprinted Poly(N-Vinyl Imidazole) Based Polymers Grafted onto Nonwoven Fabrics for Recognition/Removal of Phloretic Acid	Ma. Llorina Rañada Meshude Akbulut, Lucille V. Abad, Olgun Güven		Radiation Physics and Chemistry 94, 93-97.	2014

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TABLE 8. LIST OF SCIENTIFIC PUBLICATIONS IN 2014 (continuation)

TITLE OF SCIENTIFIC PAPER	NAMES	E-MAIL OF MAIN AUTHORS	PUBLICATION/NAME/ TYPE OF JOURNAL	DATE PUBLISHED
List of Publications which garnered the 2014 International Publication Awards and Incentives of P60,000 per publication.				
Amine Functionalized Radiation-induced Grafted Water Hyacinth Fibers for Pb^{2}, Cu^{2+} and Cr^{3+} Uptake	Jordan F. Madrid Guillermo M. Nuesca and Lucille V. Abad	(jfmadrid@pnri.dost.gov.ph)	ISSN 0969-806X Radiation Physics and Chemistry, 97: 246-252	Apr 2014
Emerging Applications of Radiation-modified Carrageenans",	Lucille V. Abad Lorna S. Relleve, Charito T. Aranilla, and Alumanda M. Dela Rosa	lvabad@pnri.dost.gov.ph	ISSN 0168-583X Nuclear Instruments and Methods in Physics Research B -Beam Interactions with Materials and Atoms 336, 2014336, 167–172.	2014
Radiation-treated ready-to-eat Chicken Breast Adobo for Immuno-compromised Patients.	Chitho P. Feliciano Zenaida M. de Guzman, Levelyn Mitos M. Tolentino, Maria Lucia C. Cobar, Gina B. Abrera	cpfeliciano@pnri.dost.gov.ph	ISSN 0308-8146 Food Chemistry 163	2014
Age and Temperature-related Pupal Eye Color Changes in Various Tephritid Fruit Flies with a View to Optimizing Irradiation Timing	Sotero S. Resilva Ruy Pereira	(ssresilva@pnri.dost.gov.ph)	International Journal of Tropical Insect Science 34: S59-S65	Nov 2014
Improvements in Mass-Rearing of the Philippine Fruit Fly, *Bactrocera Philippinensis (Diptera: Tephritidae)*	Sotero S. Resilva Glenda B. Obra	(ssresilva@pnri.dost.gov.ph)	International Journal of Tropical Insect Science 34: S45-S52	Nov 2014
Suitability of a Liquid Diet for Rearing the Philippines Fruit Fly *Bactrocera philippinensis (Diptera: Tephritidae)*	Sotero S. Resilva Glenda B. Obra and Chion Ling Chang	(ssresilva@pnri.dost.gov.ph)	International Journal of Tropical Insect Science 34: S53-S58	Nov 2014
Large-scale Confirmatory Tests of a Phytosanitary Irradiation Treatment Against *Sternochetus frigidus (Coleoptera: Curculionidae)* in Philippine Mango	Glenda B. Obra Sotero S. Resilva, Pe ter A. Follet and Louella DJ. Lorenzana	(gbobra@pnri.dost.gov.ph)	Journal of Economic Entomology 107 (I): 163-165	Feb 2014
Other List of Publications				
The Application of Isotope and Geochemical Techniques to Reveal Contributions of Submarine Groundwater and Septic Systems Discharges to Algal Bloom in Boracay Island	Raymond J. Sucgang Preciosa Corazon B. Pabroa, Norman DS. Mendoza, Joseph Michael D. Racho, Angel T. Bautista VII, Gloria R. Jimenez, Danilo A. Cuyco, Carla S. Dawal, Christina A. Petrache, Soledad S. Castañeda and Alumanda M. Dela Rosa	(rjsucgang@pnri.dost.gov.ph)	Transactions of the National Academy of Science and Technology, Vol. 36 No. 1, page 193-	Jul 2014
Fabrication of an Inexpensive Photosensitive Flow Through Device for Turbidity Measurement	Ryan P. Morco Micah S. Dawal and Raymond J. Sucgang (PNRI)	(rpmorco@pnri.dost.gov.ph)	Transactions of the National Academy of Science and Technology (Philippines) Vol. 36 No.1, page 194	Jul 2014
Accurate and Precise Major and Trace Element Determination in Marine Samples by Neutron Activation Analysis	Cao Dong Vu and Raymond J. Sucgang (PNRI) Tran Quang Thien, Ho Van Doanh, Naoki Shirai and Mitsuru Ebihara	(rjsucgang@yahoo.com)	Transactions of the National Academy of Science and Technology (Philippines) Vol. 36 No.1 page 195	Jul 2014
Neutron Flux Measurements inside the Americium-Beryllium Neutron Calibrator Source			Philippine Physics Society	Apr 2014
"Effects of Gamma Irradiation on Commercial Food Packaging Films",	Lucille V. Abad Patrick Jay Cabalar and Christian Laurio	lvabad@pnri.dost.gov.ph	http://www-naweb.iaea.org/napc/iachem/working_materials/TR-RCM2,	14 Oct 2014
Roadmap Towards Registration and Technology Transfer of Radiation Processed Plant Growth Promoters/Elicitors: Philippine Experience	Lucille V. Abad Gil Magsino, Constancio Asis, Charito Aranilla	lvabad@pnri.dost.gov.ph	IAEA-TECDOC-1745, Radiation Processed Materials in Products from Polymers for Agricultural Applications International Atomic Energy Agency,	2014

ABBREVIATIONS

ANSN	Asian Nuclear Safety Network
ANSTO	Australian Nuclear Science and Technology Organization
BATAN	National Nuclear Energy Agency (Indonesia)
BCDA	Bases Conversion Development Authority (Philippines)
CSCAP	Council for Security Cooperation in the Asia-Pacific
CSIS	Canadian Security Intelligence Service
CTBTO	Comprehensive Nuclear-Test- Ban Treaty Organization
DEVCO	Development Cooperation- Europe
DOST	Department of Science and Technology (Philippines)
ENSTTI	European Nuclear Safety Training and Tutoring Institute
EEIG	European Economic Interest Grouping
EU	European Union
IAEA	International Atomic Energy Agency
ICP	Inter-Agency Chemical, Biological, Radiological, Nuclear Response Programme
ISCN	International Soil Carbon Network
FNCA	Forum for Nuclear Cooperation in Asia
FNRI	Food and Nutrition Research Institute (Philippines)
JAEA	Japan Atomic Energy Agency
JSNDI	Japanese Society for Non-Destructive Testing
KINAC/INSA	Korea Institute of Nuclear Nonproliferation and Control/ International Nuclear Safety Academy
KINS	Korea Institute of Nuclear Safety
NNSA	National Nuclear Security Administration
NRCP	National Research Council of the Philippines
NSRA	MEXT Nuclear Safety Research Association of Japan
OAP	Office of Atoms for Peace, Thailand
PTS –CTBTO	Provisional Technical Secretariat-Comprehensive Nuclear Test-Ban Treaty Organization
RCA	Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific
RCARO	RCA Regional Office in Korea
UNDP	United Nations Development Programme
US DOE	United States Department of Energy
WERC	Wakasa Energy Research Center

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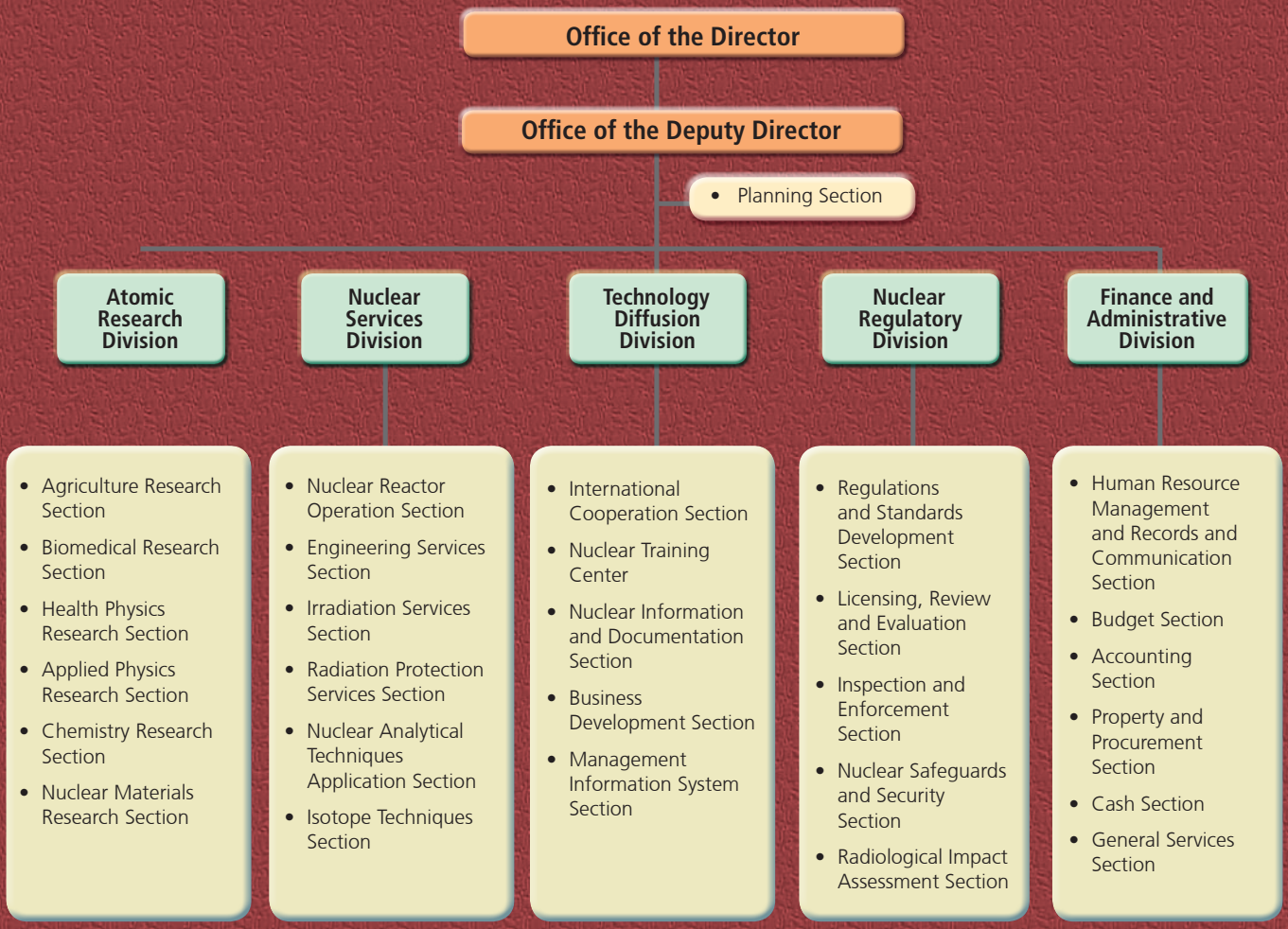

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