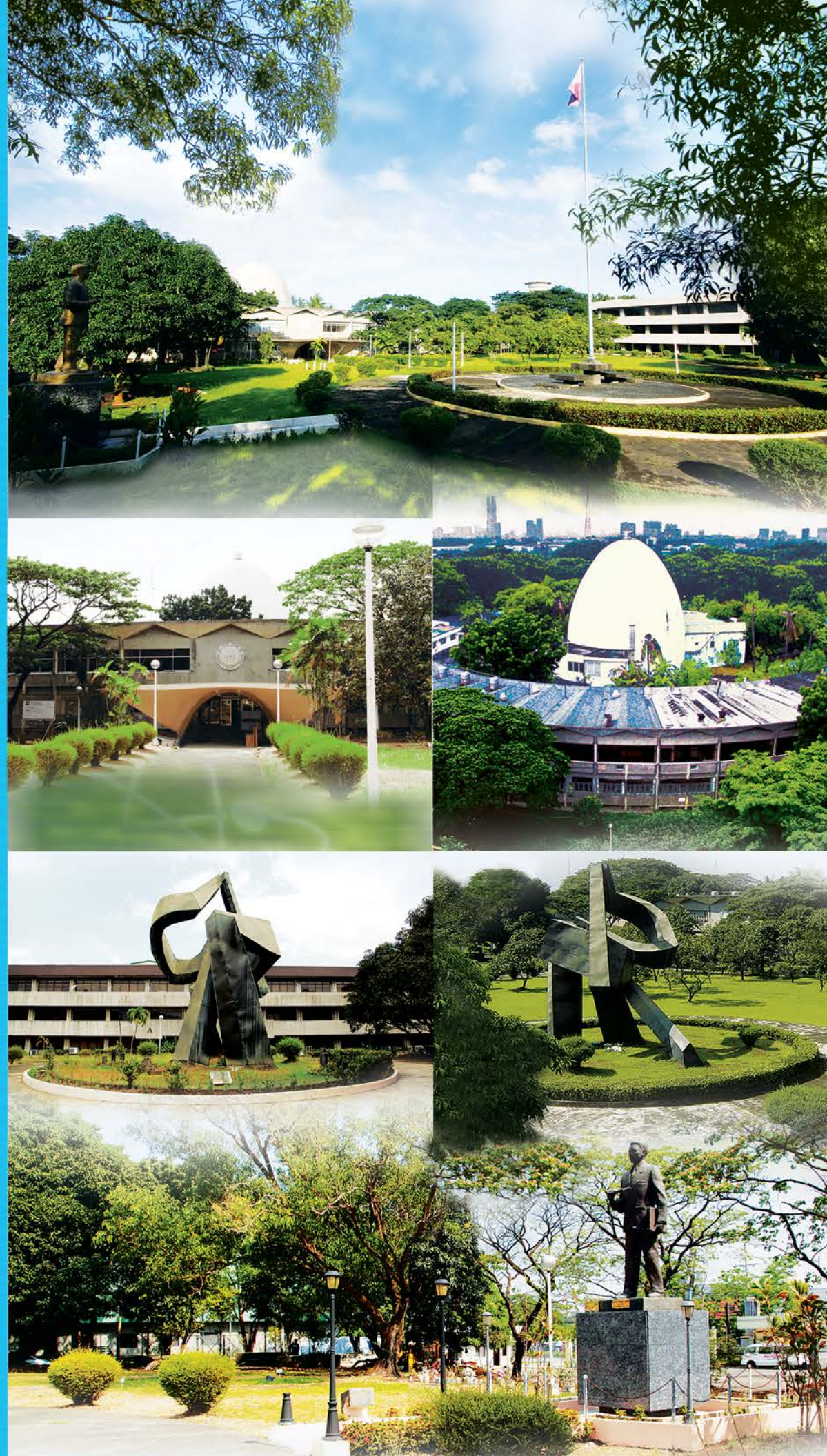



PNRI

ANNUAL REPORT
2016



Department of Science and Technology
PHILIPPINE NUCLEAR RESEARCH INSTITUTE

Commonwealth Avenue, Diliman, Quezon City
Tel: (632) 929.6010 to 19 (connecting all units)
Fax: (632) 920.1646
www.pnri.dost.gov.ph

Like us on  DOST-Philippine Nuclear Research Institute



PHILIPPINE NUCLEAR RESEARCH INSTITUTE



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.

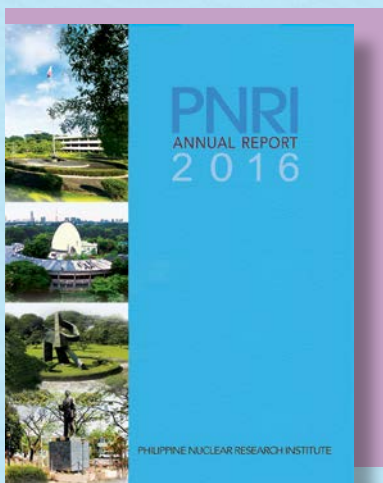
Our Vision

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."

About the COVER



Being the quintessential color for peace, blue best represents the aspect of nuclear science and technology that PNRI is mandated to promote and regulate: its safe and beneficial applications. Blue, along with white and black, are also the colors representing PNRI's mother agency, the Department of Science and Technology (DOST).

On the left side are some of the landmarks at PNRI (from top): the General Medina Park; the historic Philippine Research Reactor - 1 and the Atomic Research Center; the 1977 brass sculpture by Eduardo Castrillo entitled "Humane Growth of Nuclear Science"; and the monument of General Florencio A. Medina, the first commissioner of the Philippine Atomic Energy Commission (now the PNRI).

Table of CONTENTS

4	Message from the DOST Secretary
5	Message from the PNRI Officer-in-Charge
6	Generation of New Knowledge and Technologies
24	Provision of Quality S & T Services
30	Ensuring the Safety and Security of Radioactive Sources
38	Diffusion of Knowledge and Technologies
46	S & T Linking and Networking
48	44 th Atomic Energy Week
50	Philippine Nuclear Science Quiz
51	Philippine Nuclear Youth Summit
52	Human Resources Development
55	Financial Resources
57	Appendices
70	PNRI Officials
71	Organizational Chart



Department of Science and Technology

G

It is my great pleasure to commend the Philippine Nuclear Research Institute (PNRI) for a job well done in 2016. The Department of Science and Technology (DOST) takes pride in the Institute's achievements, having garnered local and international awards and distinctions such as the Atoms for Peace award given during the 4th Nuclear Security Summit hosted by the United States and the Best DOST Institute Award by the National Academy of Science and Technology for producing the most number of articles in internationally-recognized research publications among DOST agencies.

At the forefront of these accomplishments are the hardworking staff of PNRI who have endeavored to make nuclear and radiation applications beneficial for the people. You are all worthy of such awards!

I also take pride of PNRI's achievements in various fields. In agriculture, the PNRI-developed plant growth promoter was able to increase the yield of staple food crops such as rice. In health, PNRI researchers used radiation applications to produce hydrogel and honey alginate wound dressings, hemostats and other medical products. Equally laudable are PNRI's expanded irradiation service capabilities which continue to improve the quality of tons of commercial products and raw materials alike. In the environment, radiation and isotope techniques also proved useful as we fight in different fronts to protect us from the effects of air and water pollution, as well as harmful algal blooms or red tide.

I would like to congratulate the PNRI for its efforts in going above and beyond its roles as the regulatory body for the peaceful uses of nuclear and radioactive materials by meeting international standards on nuclear regulations, safety and security, while at the same time streamlining its processes to make regulations more efficient as we look forward to the creation of an independent nuclear regulatory body that will be beneficial to all the sectors involved.

Your DOST family wishes you success in the years to come as we contribute to bring science and technology closer to the Filipino people.

Congratulations and *Mabuhay!*

Fortunato T. Dela Peña
Secretary, DOST



Philippine Nuclear Research Institute

2016 was a very productive year for the Philippine Nuclear Research Institute. We challenged ourselves this year, and I am proud to say that the men and women of PNRI have stepped up their efforts to bring the benefits of the atom to the general public.

Research and development is, of course, at the heart of this nuclear enterprise, and scientists and researchers are its lifeblood. We are proud to say the PNRI's productivity in terms of research journals went unmatched this year among other DOST agencies, with a total of eleven DOST International Publication Awards. Thanks to this, our very own National Academy of Science and Technology (NAST) saw fit to award PNRI the Best DOST Institute Award for 2016.

The applications of these research projects is a testament to the diverse coverage of nuclear science and technology, including the cutting-edge development of polymer grafts, neutron imaging detectors and hemostats, agricultural applications such as mutation breeding, and environmental studies such as red tide and air pollution monitoring.

We have also come closer than ever in making nuclear-based products and services competitive, if not superior, to its conventional counterparts. These include PNRI's radiation-processed plant growth promoter capable of increasing our rice production by 20 to 30 percent and our hydrogel wound dressing for burns, wounds and bedsores.

With the improved capacities of our Electron Beam and Cobalt-60 Irradiation Facilities, PNRI widened the applications of radiation-based research while also serving more clients from the commercial and industrial sectors. Stable and radioactive isotopes have also been harnessed for the analysis of food products, condiments, air pollutants and rock samples, to name a few.

Beyond research and services, the Institute also continues to spread knowledge and competency in the nuclear field through the conduct of various training courses and nuclear information and promotion activities in partnership with various institutions. PNRI's regulatory function has also been strengthened in time for the renewed efforts to establish an independent nuclear regulatory body. Indeed, nuclear regulation has always involved more than just nuclear power. With hundreds of licensees using nuclear and radioactive materials for industrial, medical and research purposes, PNRI continues to be relevant in protecting the general public against the risks of radiation exposure.

Truly, PNRI has accomplished much for 2016. But it is imperative that we never rest on our laurels, as we have more challenges to meet ahead. It remains our promise to not only fulfill our dual mandate, but to exceed what is expected of us in contributing to national development.

Mabuhay tayong lahat!

CARLOS PRIMO C. DAVID, Ph. D.

Officer-in-Charge, DOST-PNRI



Generation of New Knowledge and Technologies

Food and Agriculture

Crop Improvement

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

Adlai (*Coix lacryma-jobi* L)

Irradiation technology has been used in PNRI's studies on improving the characteristics of adlai, a crop which is considered nutritious and potentially a good substitute for rice and corn.

In 2016, PNRI researchers planted the fifth generation (M_5) of irradiated adlai seeds (Guinampay variety) at the PNRI experimental field. These were planted for further selection of mutant lines with desirable agronomic traits such as early maturity and reduced plant height. Adlai plants with reduced height are more desirable because they are resistant to lodging during strong winds and typhoons.

The results showed that adlai plants treated with 100 gray (Gy) dose of gamma radiation matured 28 days earlier than the control. The shortest plant height at harvest time was observed in plants irradiated at 100 Gy dose with an average of 213 centimeters (cm). Plants irradiated at 200 Gy dose grew up to 234 cm and the control up to 281 cm.



The dynamic range of nuclear and radiation applications is the fruit of hundreds of man-hours of research and development.

PNRI scientists and researchers are working on these knowledge and technologies to improve agricultural productivity; enhance public health and safety; improve the quality of industrial products; and to help protect the environment, among others.



Adlai plants (M_5 generation) treated with 100 Gy dose gamma radiation matured 28 days earlier than the control

Nuclear Technology Applications to Enhance Agricultural Productivity

Nutrient Management for Enhanced Coffee Productivity

In collaboration with Cavite State University and Sultan Kudarat State University, PNRI continued to implement the studies on nutrient and water management for coffee with funding from the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD). These activities aim to update the fertilizer recommendation existing in the Philippines for top coffee producing areas to increase and sustain coffee crop productivity and quality through nitrogen-15 (^{15}N) stable isotope tracer and related techniques.

This year, PNRI researchers conducted the field experiments for Liberica coffee and Arabica coffee in previously selected sites in Lipa City, Batangas and Kidapawan City, Cotabato. The experiments involved the application of different levels of ^{15}N urea fertilizer in the soil followed by monthly collection and chemical analyses of soil and leaf samples.

Preliminary results of the ^{15}N tracer experiments showed that as early as the first split application of urea labelled fertilizer, it is possible to quantify the amount of nitrogen derived from the fertilizer and the amount of fertilizer derived from soil.

Efficient Nutrient and Irrigation Management in Corn Production

This project aims to increase the nutrient uptake and reduce the loss of soil nutrients and water in corn production through nuclear analytical techniques. It is being carried out with funding from the DOST-Grants-in-Aid and the Philippine Council



Coffee beans harvested from an experiment site



Researcher collects leaf samples from coffee trees for chemical analysis.

for Agriculture, Aquatic and Natural Resources, Research and Development (PCAARRD).

The activities for this year focused on further evaluation and validation of the best fertilizer rate recommendations formulated under the project to achieve optimum corn grain yield. The recommendations, which were based on a mathematical model, were tested at the project site in Cagayan Valley Research Center in Ilagan, Isabela for refinement of the model. Samples obtained at the project site are currently being analyzed at PNRI.

Water Balance and Loss Assessment in Irrigated Rice Fields

The Institute implemented this project to assess water losses and recommend measures to increase water use efficiency in irrigated rice fields in the Upper Pampanga River Integrated Irrigation System and Magat River Integrated Irrigation System. This project is funded by the DOST Grants-in-Aid and the PCAARRD.



PNRI researcher presents the project activities to stakeholders during the 12th Philippine National Corn Congress held in Koronadal City, South Cotabato.



Project team members set up the multi-channel data logger and tri-sensors for monitoring evapotranspiration fluxes to assess water losses in irrigated rice fields.

As part of this project, PNRI researchers gathered data on soil water evaporation and crop transpiration (ET_c) using the automatic weather stations located at the Philippine Rice Research Institute central experimental station in Muñoz, Nueva Ecija and in the University of the Philippines lysimeter experimental area in Los Baños, Laguna. The stable isotope ratio of oxygen-18 (^{18}O) in water samples will be tested to quantify separately the amount of water loss through ET_c .

The researchers also determined the most appropriate method for estimating ET_c in the Philippine climatic condition. Based on observed values obtained through lysimetric technique, the Penman-Monteith Method was identified as the most appropriate compared to other methods.

Further examination of the performance of tested methods showed that the dominant factors in estimating ET_c in the Philippine condition are ambient temperature and net solar radiation.

Nutrient Dynamics Assessment of Inorganic and Organic Rice-Based Farming Systems

In cooperation with the Bureau of Soils and Water Management (BSWM) and the Department of Agriculture Regional Field Office 3 (DA, RFO 3), PNRI implemented this project to determine the following: (1) efficiency in the use of nitrogen fertilizer in inorganic and organic rice-based farming system using nitrogen-15 isotope technique, and (2) nitrogen losses from inorganic and organic rice-based farming system using lysimeters.

In 2016, researchers conducted field experiments on the use of lysimeters to assess nutrient utilization and losses in lowland and rainfed rice coupled with the use of isotope tracer and related techniques. These were undertaken at the National Soils and Water Resources Research and Development Center (NSWRRDC) in San Ildefonso, Bulacan.

The experiments confirmed the previous PNRI findings that applying fertilizer in multiple splits result to about 30 and 50 percent increase in nutrient-use efficiency and grain yield of rice, respectively, compared to the usual farmers' practice of applying all the fertilizer at once before

transplanting. These outputs were presented and won the 2nd place in Best Technical Paper Senior Category at the 19th Annual Scientific Conference of the Philippine Society of Soil Science and Technology held in Legazpi, Albay in May 2016.

Nutrient Management to Increase Sugarcane Productivity

This study has been implemented to increase the nutrient utilization efficiency of sugarcane, reduce loss of soil moisture, and reduce fertilizer application. Nutrient management using elemental tracer and related techniques were carried out to achieve these objectives.

At the study site at Luzon Agricultural Research and Extension Center (LAREC) experimental station in Floridablanca, Pampanga, PNRI researchers conducted experiments on the application of different levels of nitrogen (N), phosphorous (P) and potassium (K) in sugarcane. Data on agronomic performance of the plants, which were obtained three months after the first application of fertilizers, showed that cane biomass generally increases with increasing application of nutrient. Since sugarcane is an annual crop, the response in biomass will be evaluated continuously until harvest.



PNRI researcher (extreme right) discusses the nitrogen-15 tracer studies in rice-based farming systems with Dr. Silvino Q. Tejada, then BSWM Director, (2nd from left) in the field experiments conducted in San Miguel, Bulacan.

The corresponding yield response will be used to develop nutrient management to boost sugarcane production. Laboratory analysis of samples for nutrient utilization and losses monitoring is ongoing.

Radiation-modified Carrageenan as Plant Growth Promoter

The project aims to evaluate the effects of radiation-modified carrageenan as a plant growth promoter (PGP) for mungbean, peanut and pechay.

Mungbean (*Vigna radiata* L. R. Wilczek)

Field trials on mungbean showed that foliar spraying of carrageenan PGP onto the plants can increase its yield.

Results in San Mateo, Isabela (Region 2) indicated that using one-half of the recommended rate of inorganic fertilizer and 100 parts per million (ppm) of oligo-carrageenan solution increased the yield of experimental crop Pagasa 7 by 86 percent over the current farmers' practice (no fertilizer and no inoculants). A yield advantage of 63 percent over the farmers' practice was also obtained with 100 ppm carrageenan PGP only (without fertilizer application).

Experiments set up at the National Seed Foundation (NSF) Seed Production Area at the University of the Philippines-Los Baños (UPLB) – Region IVA, indicated an increase in yield of 19 percent and 35 percent for Pagasa 3 and Pagasa 7, respectively, compared to the farmers' practice. The treatments used for these results were 200 ppm carrageenan PGP with an inoculant and full recommended rate of inorganic fertilizer.



The PNRI project team and DOST-PCAARRD staff at the project site for sugarcane nutrient studies at Luzon Agricultural Research and Extension Center in Floridablanca, Pampanga

Peanut (*Arachis hypogaea* L.)

Peanut plants also exhibited increase in yield with the application of carrageenan PGP by foliar spraying. In Enrile, Cagayan, a 51 percent increase in yield against the control (no fertilizer and no inoculants) was obtained in the Likas variety (NSIC 2001 Pn 09). This result was achieved through application of full recommended rate of inorganic fertilizer and 100 ppm of carrageenan PGP. Moreover, an increase of 34 percent over the control was also obtained at 100 ppm of carrageenan PGP without fertilizer.

In Magalang, Pampanga (Region 3), the full recommended rate of inorganic fertilizer and 100 ppm carrageenan PGP was best for the *Kalbo* variety which

increased yield by 62 percent against the control.

Without fertilizer, the yield advantage of peanut with 100 ppm carrageenan PGP was 29 percent. In Region IV-A, at the NSF Seed Production Area of UPLB in Laguna, the combination of full recommended rate of inorganic fertilizer and 100 ppm carrageenan PGP gave a yield advantage over the control of 48 percent for *Biyaya* 14 (NSIC 1999 Pn 06) and 24 percent for *Biyaya* 19 (NSIC 2006 Pn 13).

Pechay (*Brassica rapa* L.)

New formulations of the carrageenan plant growth promoter (PGP) were tested on pechay plants. The plants that were applied with PGP irradiated



A farmer applies plant growth promoter on a mungbean experimental site in San Mateo, Isabela.

at 40 to 50 kGy doses had better agronomic traits and higher yield than the control while also remaining stable. The yield of the plants with PGP was also higher than the plants applied with commercial plant growth promoter. The effect of electron-beam-irradiated PGP on pechay plants was comparable to the established gamma-irradiated PGP.



Pechay plants applied with irradiated plant growth promoter (right) have better agronomic traits and higher yield than the control (left).

Nuclear Applications in Health and Medicine

Sterile Insect Technique for Dengue Mosquito Vector Using Gamma Irradiation

The Institute is developing a sterile insect technique (SIT) for controlling the population of the dengue mosquito vector, *Aedes aegypti*. SIT involves the mass-rearing of insects in the laboratory, sterilization of the male mosquitoes by gamma irradiation followed by release of the sterile males in the target area to mate with the female mosquito to prevent production of offsprings. In support of this project, PNRI conducted studies to improve the rearing and develop trapping methods for the dengue mosquito vector.

This year, PNRI researchers explored several methods to improve the artificial feeding system of the established colony of *Ae. aegypti* and to replace the use of live mice for blood feeding of adult female mosquitoes. Different kinds of commercially available cat food were also evaluated to identify an alternative larval food for *Ae. aegypti*.

Results showed that cat food was comparable to the International Atomic Energy Agency (IAEA) recommended diet and commercial fish meal diet in terms of various parameters such as pupal and adult recovery, and adult emergence.

Mosquito trapping systems were also evaluated as a monitoring tool for *Ae. aegypti* in field tests.

The results of a 12-month study showed that the Ovicidal/Larvicidal (OL) traps proved to be a far more efficient and sensitive tool to measure the density of *Ae. aegypti* population compared to BG Sentinel and vacuum aspirator. The findings also demonstrated that the OL trap has the potential to be a versatile and simple surveillance tool for *Ae. aegypti*.

Development of ^{99m}Tc and ^{99m}Tc Radiopharmaceuticals

This year, the PNRI Isotope Techniques Section (ITS), worked on the application for renewal of the License to Operate and Certification for Good Manufacturing Practices of the Technetium-99m (^{99m}Tc) Generator Facility from the Food and Drug Administration.

ITS also continued the experimental production and quality control of pharmaceutical cold kits which are necessary for the intravenous administration of ^{99m}Tc to patients.



PNRI mosquito research laboratory for sterile insect technique studies



IAEA Deputy Director General Dr. Mikhail Chudakov visits the Technetium-99m Generator Facility at PNRI.



Hemostat prototype agents (top) granule type and (bottom) dressing type

Two pharmaceutical kits, namely diethylene triamine penta acetate (DTPA) and methyl diphosphonate acid or MDP, were produced to establish their optimum parameters. Quality control procedures such as radionuclidic purity and labeling efficiency are also being tested and validated.

Development of Novel Biomedical Products Utilizing Gamma and Electron Beam Facilities

Studies on the use of gamma and electron beam irradiation technologies are being undertaken to develop new radiation-processed biomedical products that could contribute to public health.

Hemostatic Agents from Radiation-Modified Polysaccharides and their Derivatives

PNRI has developed two prototype hemostatic agents (granule and dressing type) from radiation-modified polysaccharides based on carboxymethylcellulose (CMC) and polyethylene oxide-kappa carrageenan blends (PEO-KC). These prototypes passed laboratory screening tests based on simulated blood clotting assays showing efficiency in clotting a large volume of blood at an accelerated rate.

The prototype hemostatic agents were tested on animal bleeding models to assess their efficacy on live specimens and compare these with a commercial product. The prototypes were proven to be highly effective on animals with moderate to severe bleeding caused by femoral artery and aorta puncture, deep stab wound (i.e. includes torn skin, muscle and punctured artery) and bleeding associated with kidney surgery.

The prototype dressing was found to be more efficient than Celox gauze in reducing bleeding time with a 100 percent survival rate (80 out of 80 animals survived). The prototype granules on the other hand, was as efficient as Celox granules in reducing

bleeding time but with better survival rate and easier handling such that there were less complications causing adhesions and inflammations.

Biocompatibility tests showed that both prototypes are considered safe to use as they did not exhibit cellular or systemic toxicity. The prototypes were also non-irritating with low sensitizing effect. Stability testing of the prototypes showed that gamma irradiation at 25 kGy can provide effective sterilization so that the products remain functional even after 9 to 18 months (shelf-life) when kept at ambient or cool temperature.

Honey Alginate Wound Dressing

PNRI researchers continued to conduct tests on the shelf-life of the gamma sterilized honey alginate product developed by PNRI as dressing for exuding wounds.

Results of pre-clinical trials both for animals and humans showed that the product has excellent absorbancy, low pH content and effectiveness in wound healing. The study also indicated that the application of radiation technology to sterilize the honey alginate wound



Physicochemical analysis of honey alginate wound dressing (inset) for shelf-life study



dressing did not significantly alter the physicochemical qualities (moisture vapor transmission rate, fluid handling capacity, gel fraction and moisture content) of the dressing stored for six months.

This year, PNRI also developed a wound dressing in patch form from a mixture of ethanol extracts of propolis from beehive and alginate. Tests done on animals showed that the propolis-alginate dressing promotes faster incisional wound healing in cats. Furthermore, it promotes faster and better healing of sutured and incisional wounds in mouse compared to conventional antibiotic dressing.

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

This study aims to assess the effect of gamma and electron beam irradiation on the quality of food to ensure food safety and quality and to extend its shelf-life.

Improving Quality of Burger Patties Using Irradiation

Preliminary results indicate that a minimum dose of 2 kGy can improve the quality of burger patties by reducing the microbial load. Irradiation of beef patties can help the local meat industry and meat processors to ensure the quality and safety of their products.

Increasing the Shelf-life of Honey Nutribars Using E-Beam

Microbiological quality testing of the irradiated nutribars developed by the PNRI as an alternative energy rich food for calamity victims showed that after nine months of storage at room temperature, the microbes were still within the acceptable limit for aerobic microorganisms (less than 250 colony forming units/gram (cfu/g), molds and yeast (less than 10 cfu/g) and *Clostridium sp* as anaerobic microorganism (less than 10 cfu/g). The results also showed that irradiation does not affect its overall sensory acceptability and nutritional content. The sensory qualities of irradiated nutribar (such as texture, color, odor, flavor) also remain unchanged after nine months of storage.

Organic Production System and Irradiation Technology in the Production of Safe and Quality Bee Products

In cooperation with the honey bee experts from the University of the Philippines in Los Baños, PNRI researchers harvested samples of honey and propolis following good practices in handling bee products in the following apiary sites: Barangay Cambuja in Sta. Maria, Laguna and Barangay Uno Poblacion in Lobo, Batangas.

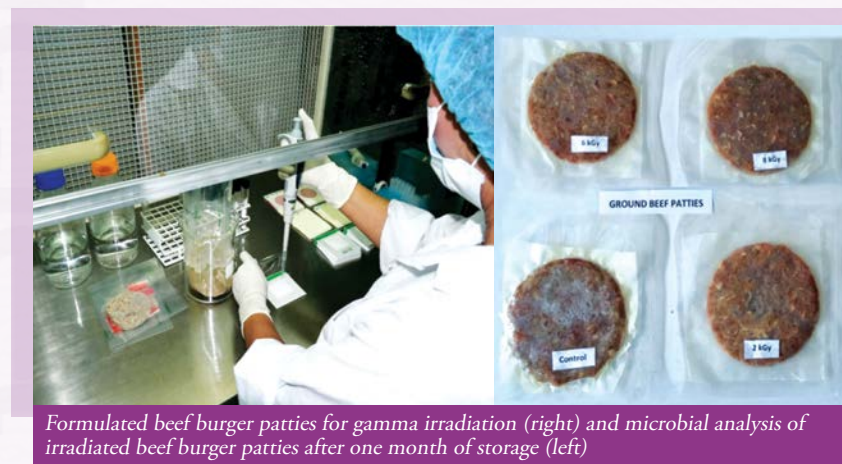
Initial assessment of both honey and propolis revealed that the amount of



Collection of raw propolis and honey from the main apiary site in Sta. Maria, Laguna for analysis



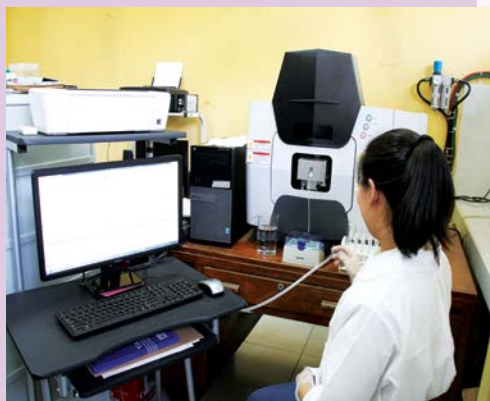
Samples of radiation-treated honey nutribar (in new label)



Formulated beef burger patties for gamma irradiation (right) and microbial analysis of irradiated beef burger patties after one month of storage (left)

trace metals (like cadmium, nickel, lead, chromium and zinc) in the samples were within acceptable limits. Microbiological evaluation of honey harvested from the main apiary site showed the presence of acceptable amount of molds and yeast, coliforms and aerobic microorganisms.

These results indicate that the use of good beekeeping practices as well as the guidelines set forth by organic agriculture on beekeeping are effective in ensuring production of



Trace metal analysis of honey and propolis at PNRI using atomic absorption spectrometry

safe and quality bee products. These also showed that the bee products can be used as raw materials for the development of biomedical products utilizing radiation technology.

Cytogenetic Biological Dosimetry Capabilities for Nuclear Incident Preparedness

This project focuses on strengthening the capability of the Philippines in biological dosimetry as part of PNRI's radiological emergency preparedness as well as on routine monitoring of workers occupationally exposed to radiation.

In line with this project, the Biomedical Research Section conducted in vitro irradiation using peripheral blood lymphocytes from three donors in order to establish the response curve for micronucleus. Micronucleus is one of the chromosome aberrations that can be used as a biomarker to measure absorbed radiation dose in persons accidentally exposed to radiation.

Nuclear Analytical Techniques in Harmful Algal Bloom Studies

The Institute implements three projects under the Harmful Algal Bloom (HAB) Program to enhance early warning and monitoring of HAB (or red tide) to ensure public health and safety in the country.

Technology Transfer of AOAC Accredited Isotope-Based Receptor Binding Assay for Paralytic Shellfish Toxins

PNRI has successfully transferred the receptor binding assay (RBA) for paralytic shellfish poisoning (PSP) to the Bureau of Fisheries and Aquatic Resources (BFAR), the Philippine HAB monitoring and regulatory agency. This is through the support of the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development – Grants-in-Aid Program (PCAARRD-GIA). BFAR had established their human resource capabilities and facilities with the assistance of PNRI for this purpose.

Meanwhile, the Quality Manual for ISO/IEC 17025:2005 accreditation of the PNRI RBA Laboratory has been submitted for review of the PNRI Quality Manager.

Receptor Binding Assay for Ciguatera Fish Poisoning Toxin Analysis in Seafood

In collaboration with the International Atomic Energy Agency Environment Laboratories in Monaco (IAEA-EL-Monaco), the ciguatera fish poisoning (CFP) – RBA was optimized. A fellow



PNRI researcher working on the receptor binding assay optimization for ciguatera fish poisoning

from the Philippines performed the optimization experiments in Monaco, and will continue with the single laboratory validation activities at PNRI.

Building Capacity for the Monitoring of Ciguatera Fish Poisoning in the Philippines

Under the National Technical Cooperation Project of the IAEA entitled: "Building Capacity for the Detection, Quantification and Monitoring of Emerging Harmful Algal Bloom (HAB) Toxins", the Institute is formulating a ciguatera fish poisoning (CFP) monitoring strategy in the Philippines in collaboration with BFAR. A pilot site was identified and preliminary monitoring was conducted for this study. This is aimed at contributing to the global initiative to come up with a regulatory guideline for CFP management.

Enhancing the Receptor Binding Assay Technique for Diagnosis of HAB Food-Borne Illness

PNRI is also exploring the applicability of CFP-RBA as a medical diagnostic tool to address food-borne illnesses related to HABs.

The Institute received blood samples of patients suspected to be intoxicated by ciguatoxin (CTX), the toxin responsible for CFP, from the Epidemiology Bureau of the Department of Health. However, the assay showed that the samples were below the detection limit of the method (~0.1 ng/ml in blood). PNRI researchers are currently improving the sensitivity and selectivity of the assay for the said matrix.

Technical Assistance to IAEA Member States Establishing Receptor Binding Assay Capabilities

As the IAEA Collaborating Center on HAB Studies in the Context of Environmental and Global Changes, the PNRI trained two fellows from the African region on RBA technique.

Expertise of the Institute to conduct HAB studies using the RBA and other nuclear and isotopic techniques was imparted to the fellows.

Moreover, a PNRI researcher was invited as a lecturer in a two-week IAEA Regional Training Course in Mombasa, Kenya. The course, which aims to build capacity on HAB monitoring in the African region, covered topics on sampling strategy, PSP and CFP toxin extraction techniques, RBA demonstration and data analysis.



Training of two fellows from the African region on receptor binding assay technique by PNRI which is the IAEA Collaborating Center on harmful algal bloom studies

Environmental Protection and Management

Nuclear and Isotope Techniques Applications for Hydrological and Environmental Studies

The project deals with the development or continuous improvement of isotope technique methods for hydrological studies to efficiently and effectively develop and manage freshwater resources.

In support of this, PNRI implemented a project on the assessment of deep groundwater in Pampanga river basin using isotope techniques in collaboration with the National Water Resources Board (NWRB). Isotope techniques, such as water stable isotopes ($\delta^2\text{H}$ and $\delta^{18}\text{O}$) and tritium (^3H), were applied in conjunction with hydrogeological techniques to better understand deep groundwater dynamics in the basin which include identification of groundwater origin, recharge source, recharge rate and mean residence time.

The Isotope Hydrology Group participated in this year's International Atomic Energy Agency (IAEA) Inter-laboratory comparison for measuring stable isotopes in water. The results were submitted to the IAEA and the

evaluation of the IAEA results indicated that all samples analyzed were within the acceptable range from true value.

The tritium dating capability of the PNRI isotope Hydrology Center has also been upgraded with the acquisition of a new tritium enrichment system which is capable of enriching tritium in a larger volume of water. This, in tandem with the Quantulus ultra low level liquid scintillation counter (LSC), will enable the detection of tritium in concentrations that are one magnitude lower than the current detection capability, allowing quantitative determination of groundwater age.

Furthermore, with enhanced capabilities in isotope hydrology techniques, the PNRI was designated to host six IAEA fellows from Lao, Myanmar, and Thailand for one month on-the-job training on the principles and applications of isotope hydrology on 7 November to 2 December 2016. The group training course consisted of formal lectures, demonstrations, laboratory exercises, and field work. The pool of lecturers was composed of PNRI experts in the field of environmental isotope and radioanalytical techniques.

Nuclear Analytical Techniques in Marine Environment

Sedimentation Rate Determination and Age Dates Calculation Using ^{210}Pb Dating Method

The lead-210 (^{210}Pb) dating technique is being used by PNRI to provide a historical record of sediment contamination levels, to measure sedimentation rate in the different parts of the study areas, and to identify areas of erosion and deposition. The results of this project will help strengthen the Environment Management Bureau's efforts in protecting and maintaining the quality of the country's fresh and marine water environment.

As part of this project, PNRI researchers processed sediment cores from several areas of Manila Bay and its watershed for ^{210}Pb measurement and sedimentation rate determination, particularly from the Marikina River, the Marilao-Obando River System and Sta. Maria River in Bulacan, Talisay Bridge in Bataan, and Cañas River in Cavite.

The sediment cores from these areas were found to have short ^{210}Pb profiles and no observable expected or ideal trend of decreasing ^{210}Pb activity with depth. As such, no sedimentation rate estimates could be calculated or estimated for these sediment cores.

In Pasig River (Pasig Mouth2 core), the obtained ^{210}Pb value seemed to be almost uniform for the entire core length and similar to the supported ^{210}Pb values ($8.3 \pm 0.8 \text{ Bq/kg}$) measured in previous research studies in 2002 and 2004 in Manila Bay.



Collection of sediment cores in Manila Bay using a gravity corer
Photo credit : Dr. Fernando Siringan (UP-MSI)

Assessing the Applicability of ^{210}Pb Dating Technique in Selected Mangrove Areas

Aside from its economic and ecological benefits, mangroves serve as carbon sinks that are valuable for the protection of the environment. Hence, in collaboration with researchers from Ateneo de Manila University, PNRI processed sediment core samples from mangrove areas in Zambales and Subic Bay to determine the applicability of the ^{210}Pb dating technique for determining the sedimentation rates in these areas. Processing of research data for the mangrove area study sites is ongoing.

Nuclear Analytical Techniques for Better Air Quality Management

PNRI applies nuclear and related analytical techniques to generate multi-element data of air particulate matter for air pollutant source identification and apportionment in Metro Manila.

Air Pollution Monitoring

PNRI collected samples of air particulate matter, fractionated into the coarse (PM_{10}) and fine ($\text{PM}_{2.5}$), using Gent air samplers at three sampling sites, namely, in the National Mapping and Resource Information Authority (NAMRIA), Metro Manila Development Authority (MMDA), and Valenzuela City. Particulate mass was

determined by gravimetry and black carbon by reflectometry.

Analysis of the samples showed that the PM_{10} levels across the three Metro Manila sites are in compliance with the Philippine one-year guideline value of 60 micrograms per cubic meter ($\mu\text{g m}^{-3}$) but are in exceedance of the World Health Organization (WHO) one-year guideline value of 20 $\mu\text{g m}^{-3}$.

The $\text{PM}_{2.5}$ levels are also in exceedance of the WHO guideline value of 10 $\mu\text{g m}^{-3}$ which makes the ambient air quality in the Valenzuela, MMDA (EDSA) and NAMRIA sites unhealthy for both PM_{10} and $\text{PM}_{2.5}$ by the WHO standards.

Analysis of black carbon (BC), a fingerprint of incomplete combustion products, showed levels at an average of 8.7 $\mu\text{g m}^{-3}$ across all sites with percentage BC at an average of 31 to 46 percent of the fine particulate mass. The BC composition at Valenzuela is 31 percent while comparable BC compositions are seen in MMDA and NAMRIA (45 and 46 percent, respectively). Thus, a big portion of the particulate can be attributed to BC contribution. Extreme high level of BC at Valenzuela City was traced to a fire in Quezon City.

Multi-element analysis of air samples showed that sulphur has the highest contribution to the fine air particulate pollution across the three sites with

the highest in Valenzuela City. The sampling sites in Valenzuela also exhibits lead and zinc levels higher than that of MMDA and NAMRIA which point to a unique industrial source in this area.

Air Pollution Source Identification and Apportionment

Results showed six sources impacting the three sampling sites. These are sea spray, fine soil, vehicular emissions, biomass burning, industrial and secondary sulfur. Vehicular emissions comprise 30 to 50 percent of the



Air sample collection for air pollution studies at PNRI using Gent samplers

apportioned sources. An industrial source, predominantly zinc and lead, is seen in Valenzuela City.

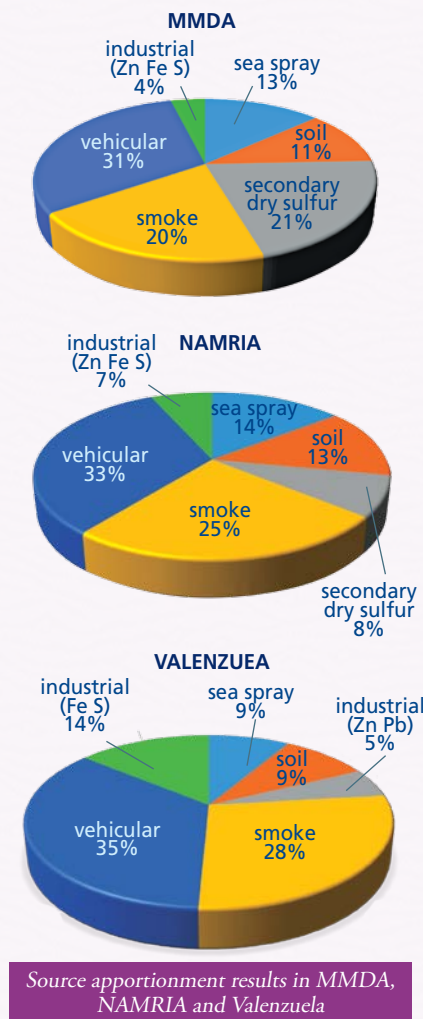
Isotope Provenance and Elemental Composition of Philippine Rice

The Institute has an ongoing project on the use of nuclear and isotopic analytical techniques to determine the place of origin of food, condiments and beverages as well as to strengthen the food regulatory system which currently relies heavily on paper traceability.

In line with this project, PNRI researchers analyzed rice samples provided by the Philippine Rice Research Institute and the National Bureau of Investigation (NBI) for multi-element determination. Some of these have been analyzed for carbon-13 ratio using isotope ratio mass spectrometry at PNRI. Other samples have been sent to Japan for stable isotope analysis and to New Zealand for elemental and/or stable isotope analyses. Principal component analysis showed Palawan rice to be distinct from samples collected from other locations in terms of its stable isotope and multi-element signatures.

Ensuring Authenticity and Safety of Skin Care Formulation

In this project, PNRI researchers used nuclear analytical techniques to test the effectiveness of skin



care formulations in inhibiting transepidermal water loss (TEWL) which causes dry skin. Moisture loss rate was estimated using tritium measurement.

PNRI researchers also analyzed vegetable oil samples which can

be used as major components or ingredients in cosmetic formulations.

The oil samples were obtained from the accessions of coconut meat, palm pulp, corn ears, ginger tubers and sesame seeds. Castor oil and mineral oil were also purchased for this purpose.

Using both isotope ratio mass spectrometry and liquid scintillation spectrometry, PNRI was able to identify the oil samples of botanical origin and distinguish plants from animal-derived oils.

PNRI also investigated the possibility of developing skin formulations without paraben and phthalate preservatives. Accessions from natural products with innate antiseptic and antimicrobial properties were combined to come up with a synergistic mixture that can be used both as an active and as a natural preservative. This study resulted in the development of preservative-free skin formulations.

Ensuring Groundwater Quality After Yolanda (Typhoon Haiyan) in Tacloban City

Under the IAEA project entitled "Complementing Conventional Approaches with Nuclear Techniques Towards Flood Risk Mitigation and Post-Flood Rehabilitation Efforts in Asia," PNRI studied the impact of groundwater and surface water in Tacloban City in Leyte Island, which bore the extent of Typhoon Haiyan's devastation in November 2015.

The groundwater and surface water impacts were investigated using a variety of methodologies, including detailed chemical and isotope analyses. The result of the study indicated that the mechanisms contributing to nutrient retention included sedimentation, uptake and long-term storage in vegetation, and denitrification. Changing factors that limit nitrogen uptake or denitrification were found to enhance these processes.



Analysis of samples for multi-element determination at the PNRI Isotope Ratio Mass Spectrometry Laboratory

Using nuclear and isotopic techniques, in combination with conventional approaches, PNRI also studied the effects of flooding on groundwater and aquifer systems, and determine the time needed for these resources to heal themselves and return to pre-flood status.

Environmental Radioactivity Monitoring in Metro Manila

The Health Physics Research Section (HPRS) conducts regular monitoring of ambient gamma radiation levels in the environment to detect anomalous increase of radiation levels due to a nuclear incident/accident and for dose assessment of the general public due to exposure to radiation.

As part of this project, HPRS researchers continued to measure ambient gamma radiation and evaluate gamma dose rates in PNRI grounds and its perimeter as well as in various locations in Metro Manila using portable gamma meter.

Radiation Monitoring in PNRI Grounds and its Perimeter. The average ambient gamma radiation measurement obtained within the PNRI grounds and its perimeter was 51 ± 6 nanosieverts per hour (nSv/hr). The average level of radioactivity on selected monitoring sites outside the PNRI perimeter was found to be 46 ± 7 nSv/hr. These values, which are within the normal background level of 42 to 61 ± 7 nSv/hr at PNRI, do not pose any hazard to the general public and the environment.

Radiation Monitoring in Metro Manila. Ambient gamma radiation monitoring in 20 selected locations in northern and southern parts of Metro Manila were conducted. The dose rates measured ranged from 28 to 57 ± 8 nSv/hr with an average value of 40 ± 7 nSv/hr. These values are within the normal background level and as such do not pose any hazard to the general public and the environment.

Assessment of Radioactivity in the Philippine Marine Environment

This project involves surveillance, monitoring and conduct of sampling activities in coastal areas throughout the archipelago to assess the possible long-term effects to the Philippine marine environment of the release of radioactivity from the 2011 Fukushima nuclear power plant accident in Japan.

Collaborative Project on Monitoring Marine Coastal Areas of Surigao del Norte and Surigao del Sur

The launching of a collaborative project on "Analysis of Natural and Anthropogenic Radionuclides in Marine Samples Near the Mining Sites of Surigao del Norte and Sur" was carried out under a Memorandum of Agreement between Surigao del Sur State University (SDSSU) and PNRI. The coasts of Surigao del Norte and Surigao del Sur are areas of special interest for this study because of



Ambient gamma radiation monitoring in PNRI grounds using SAM-940 portable gamma meter

extensive mining operations being done in the province.

Initial activities included provision of hands-on training at PNRI to five faculty members of SDSSU on the preparation, techniques for handling samples, and analysis of terrestrial and marine samples for radioactivity measurements. The collection and analysis of seawater, sediment and marine biota by gamma spectrometry were also carried out for key anthropogenic radionuclides cesium-134 (^{134}Cs), cesium-137 (^{137}Cs) and naturally-occurring radionuclides potassium-40 (^{40}K), thorium-232 (^{232}Th) and radium-226 (^{226}Ra).

Results of analysis showed that the mean activity concentration of ^{137}Cs in surface seawater collected from Surigao Province was found to be 1.14 ± 0.34 Bq/m³. This value is less than the mean ^{137}Cs concentration in surface seawater reported in the Asia Pacific Marine Radioactivity Database (ASPAMARD) 2004 which was 2.4 ± 1.4 Bq/m³.



Radiation Monitoring Map in Metro Manila



Collection of sediment samples in Surigao del Sur for radioactivity analysis

Monitoring of Coastal Areas of Palawan and Manila Bay

In line with this project, PNRI researchers collected marine biota samples and sediments in Manila Bay and also in Palawan Island which has been designated as one of the regular sampling stations in the country. The Palawan station co-exists with the on-line radiation monitoring station that was installed in the province in 2016.

The mean activity concentration of ^{137}Cs in sediment samples from Manila Bay was found to be 1.1 ± 0.4 Bq/kg. The analysis of the samples in Palawan showed a mean ^{137}Cs activity concentration of 0.61 ± 0.1 Bq/kg in sediments from Honda Bay. There were no ^{137}Cs detected in biota samples, including mussels, from Manila Bay and no ^{134}Cs in all samples analyzed. The data gathered will be very useful for pre-assessment studies on radiation levels. All Philippine data will be submitted to the Asia-Pacific Marine Radioactivity Database (ASPAMARD) for which PNRI remains as the focal point in the region. ASPAMARD is a compilation of available data on radionuclide concentrations in seawater, sediment and marine biota.

Generating Radiological Data from CTBTO Stations in the Philippines

Operation and Maintenance of CTBTO Stations

As part of its commitment to the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO), the PNRI extends technical support to the operation and maintenance of the Radionuclide Monitoring Station PHP52 in Tanay, Rizal. This station generates data which are sent to CTBTO's International Data Center (IDC) in Vienna, Austria for processing and review. The processed data are then sent to the National Data Center NDC-PH in PNRI for use in environmental radioactivity monitoring and other relevant civil and scientific applications.

This year, the following upgrades were carried out at the NDC PHP52 Radionuclide Monitoring Station in Tanay, Rizal, which has been operational since 2006: (1) installation of NDC Capacity-Building System Server at NDC-PH with the assistance of Mr. Waseem Allan, CTBTO Services Officer; (2) reconfiguration of Global Communications Infrastructure (GCI) at NDC-PH with the remote assistance from UltiSat, Inc.; and (3) installation of a new Snow White Air Sampler QLC50 Data Logger.

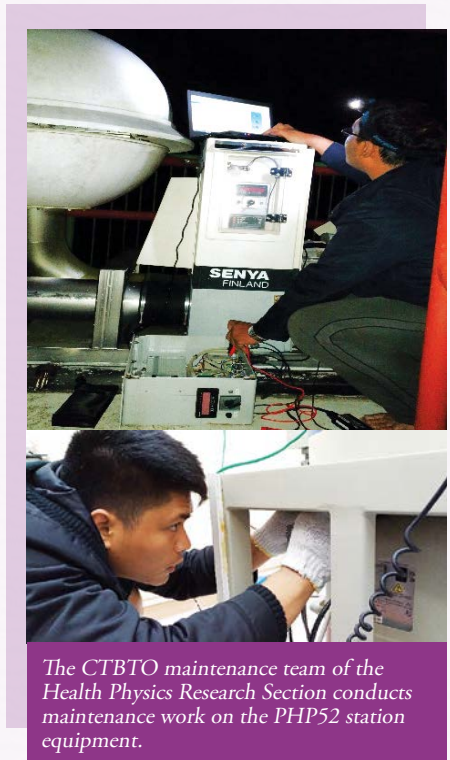
Monitoring of 2016 DPRK Nuclear Weapons Testing

Through the Health Physics Research Section, PNRI monitored the radionuclide data generated from the CTBTO Radionuclide Monitoring Station PHP52 after an unusual seismic event was reported by the seismic monitoring stations under the CTBTO International Monitoring System (IMS) Network. The events occurred on 6 January 2016 at 01:30:00 UTC and on 09 September 2016 at around 00:30H (UTC) at a location similar to a previous nuclear weapons test conducted by the Democratic People's Republic of Korea (DPRK) on 12 February 2013.

The event on 6 January involved a nuclear weapons test by DPRK using a hydrogen bomb. Although the suspected nuclear test on 9 September registered slightly higher signals compared to previous DPRK nuclear tests, radionuclide concentrations detected during these 2016 events were still found to be within normal levels and do not have any significant effect on the Philippine environment.

Radiological Assessment of NORM/TENORM in Geothermal Power Plants

This project involves measurement of activity concentrations of naturally-occurring radioactive materials



The CTBTO maintenance team of the Health Physics Research Section conducts maintenance work on the PHP52 station equipment.

(NORM) and technologically enhanced NORM (TENORM) in geothermal power plants and determination of its implications to human health and the environment.

Radiation Monitoring at Geothermal Power Plants

In 2016, the Health Physics Research Section environmental radioactivity monitoring team conducted sampling trips in two Philippine geothermal plants, namely Malitbog Geothermal Power Plant (MGPP) in Leyte, and the Philippine Geothermal Production Plant (PGPC) in Laguna. Ambient gamma dose rates in air were measured inside the facilities and nearby towns using the SAM 940 portable dose rate meter. Samples collected for gamma radioactivity analysis included soil, scales, sludge, and liquid (river, brine, and drinking water). The solid samples were analyzed for radium-226 (^{226}Ra), thorium-232 (^{232}Th) and potassium-40 (^{40}K), while the liquid samples were analyzed for radon-222 (^{222}Ra).

The gamma dose rate measurements obtained at MGPP ranged from 30 to 60 nanosieverts per hour (nSv/hr) while measurements ranging from 66 to 103 nSv/hr were obtained at PGPP. These measurements are within the range of the background ambient gamma dose rate in air measured in the Philippines, ranging from 21 – 124 nSv/h (n = 1691) (Nazarea, et al., 2004).

The activity concentrations of radon-222 in water samples range from 2 to 38 Bq/L. Five water samples were observed to be above the Philippine regulatory limit of 11 Bq/L. Soil samples were also collected from Aparri, Cagayan, and Leyte towns and analyzed for ²²⁶Ra and ²³²Th and ⁴⁰K for updating of the Soil Radiation Map of the Philippines developed by PNRI.

The activity concentrations obtained in becquerel per kilogram (Bq/kg) for ²²⁶Ra, ²³²Th and ⁴⁰K in all samples analyzed range from less than 3 to 150; 4 to 207, and less than 27 to 1470, respectively.

Real-time Environmental Radiation Monitoring System in the Philippines

PNRI is establishing a country-wide network of detectors for the real-time monitoring of ambient gamma radiation and for immediate detection of anomalous radiation levels. This is aimed at strengthening the preparedness and response capabilities of the country in an event of a radiation emergency.

In support of this project, the PNRI worked on the installation of a radiation monitoring station in Puerto Princesa, Palawan in May 2016. The instrument installed was sodium iodide spectroscopic dose rate detector with GM counter, manufactured by SI Detection of South Korea. The monitoring station which continuously measures 24/7 real-time gamma radiation dose rate in nSv/h can be viewed through the internet.

This radiation monitoring station is the second of two units of radiation detectors acquired through the IAEA-



Real-time radiation monitoring station established in Puerto Princesa, Palawan

Technical Corporation (TC) Project “Strengthening National Capability to Respond to Radiation Emergencies”. The first of the two units was installed in Aparri, Cagayan in November 2015. These units were in addition to the radiation monitoring station, donated by SI Detection Company from Republic of Korea and installed in December 2014 at the PNRI grounds.

The average ambient gamma dose rate from June to December 2016 at Puerto Princesa radiation monitoring station was 18 ± 0 nSv/h. This value is below the mean outdoor terrestrial gamma dose rate reported in UNSCEAR 2008 Report - Annex B, which is 58 nSv/h using 1 nSv/nGy conversion. Further studies will be conducted using the radiation monitoring station to establish a one-year average baseline and to study the occurrence of seasonal and diurnal variations.

Temporal Variation of Ambient Gamma Dose Rate Levels in Aparri, Cagayan with Meteorological Conditions

To determine anomalous increases in radiation levels during radiation emergencies, PNRI researchers worked on establishing the background radiation levels at the environmental monitoring sites. In 2016, the baseline radiation level in Aparri, Cagayan with meteorological condition was



Radiation dose rate measurements and soil sampling at SS3 station of Philippine Geothermal Production Plant in Bay, Laguna

determined through the real-time radiation monitoring station using a sodium iodide spectrometric radiation dose rate detector.

Results showed an average ambient gamma radiation dose rate measurement of 15.0 ± 0.6 nSv/hr for a one-year period. This ambient radiation is due to naturally occurring radionuclides thorium-232, uranium-238, and potassium-40 contributing 19 percent, 28 percent and 53 percent, respectively. The baseline data will serve as a reference during an event of a radiation emergency. Moreover, the ambient gamma dose rate was found to decrease weakly with increasing monthly rainfall, as caused by the weakly decreasing ^{232}Th and ^{40}K dose rates. The ^{238}U dose rate

scarcely increases with monthly rainfall, thereby affecting the seasonal behavior of ambient gamma dose rate to a lesser extent than the other two natural radionuclides.

Radon Levels and Its Possible Implications to Human Health

Radon is an odorless, tasteless and invisible radioactive gas that occurs naturally in rocks and in soil. It may enter the house through cracks in solid floors, through construction joints, and through gaps around service pipes. Once inside and in enclosed space such as the house, radon can accumulate and reach high concentrations, which can increase the incidence of lung cancer.

Under this project, PNRI monitored the radon concentrations in selected houses in Region 4A (CALABARZON) through the deployment of Passive Alpha Track Etch CR39 detectors.

The radon activity concentration measurements obtained from these houses ranged from 9 to 43 Bq/m³ with a mean value of 17 ± 9 Bq/m³. These values are higher than the values measured in other parts of Luzon (in different towns in Pampanga and Zambales) but still are generally well below the action level of 200 Bq/m³ set by International Basic Safety of Radiation Sources, 1996 that was adopted by the Philippines through an Administrative Order of the PNRI.

Harnessing Emerging Technologies to Boost Competitiveness

Electron Beam-induced Grafting of Abaca/Polyester Nonwoven Fabric and its Application as Toxic Metal Ion Adsorbent

In line with the thrust of DOST-PCAARRD towards applications for processing/ value-addition of abaca fibers, PNRI implements this project to develop a high-value adsorbent material from abaca-polyester nonwoven fabric (NWF) using radiation grafting technology.

PNRI researchers successfully modified the abaca containing NWF by attaching chemical groups anchored on grafted polymer chains to its component fibers. The grafted NWF was proven capable of removing more than 95 percent of lead, nickel and cadmium dissolved in five parts-per-million solutions, showing its potential for treatment of contaminated waters containing low levels of dangerous heavy metals. The metal ions can be easily removed from the spent adsorbent using mild organic acids, making the NWF reusable. Laboratory

scale column experiments also showed that the synthesized adsorbent can remove heavy metals even at flow rates higher than those applied in resin-based treatments.

Application of electron beam radiation eliminated the use of chemical initiators and allowed the use of relatively mild conditions for graft polymerization during synthesis.

Radiation-Induced Grafting on Nonwoven Fabrics for Tanning Industry Waste Water Treatment

In this project, PNRI researchers applied radiation-induced grafting technology to produce polypropylene based adsorbents that can remove heavy metals such as chromium, lead, mercury and cadmium.

The grafted polypropylene exhibited high affinity towards the cancer-causing hexavalent chromium, which is present in leather tanning industry waste water. The synthesized adsorbent can be packed in columns



for easier application in industrial wastewater treatment.

Results showed the high potential of radiation-grafted polypropylene for removing heavy metals. The fibrous

nature of the grafted material allows the use of flow rates higher than the conditions employed for resin materials, translating to a higher volume of treated wastewater in the same amount of time. The spent adsorbent can be regenerated with alkali or acid solution and can be reused afterwards.



PNRI chemist uses the column-packed radiation grafted adsorbent in treating actual tannery waste water

Research and Development on Nuclear Materials

Extraction of Uranium, Rare Earth Elements and Other Useful Commodities from Phosphoric Acid

PNRI is currently working on the development of a method to extract uranium and rare earth elements (REEs) from phosphate fertilizer plants to produce cleaner fertilizers. If recovered, uranium would be a valuable material for nuclear fuel cycles while REEs will be useful in the development of high technology electronic circuits. The project is being undertaken with support from the International Atomic Energy Agency (IAEA) and the National Research Council of the Philippines.

In 2016, PNRI researchers completed Phase I of the project which focused on

the characterization of feed ore, process streams and products of a phosphate fertilizer plant and preliminary laboratory-scale experiments on uranium extraction from phosphoric acid.

Results of the study on characterization showed that impurities found in phosphate rocks are often increased in the fertilizer. Uranium content in the phosphate rocks was found to be in the range of 71 to 145 parts per million (ppm) while in the phosphate fertilizers, it was found to be in the range of 55 to 228 ppm. These values are above the average normal uranium content in soils which is 3 to 11 ppm (UNSCEAR 2000).

Initial results of the experiments on uranium recovery using solvent extraction process showed a promising

92 percent extraction efficiency. In phase II of the project, these chemical characteristics will be further tested in an up-scaled continuous extraction system.

Geochemical and Radiometric Characterization of the Cu-Mo-U Occurrences in the Larap-Paracale Mineralized District

A re-evaluation for the presence of small deposits of uranium at the Bessemer, Dangkalan within the Larap-Paracale mineralized district in Jose Panganiban, Camarines Norte is being undertaken as part of an International Atomic Energy Agency Coordinated Research Project. Its purpose is to verify and add new information to the extent and



A PNRI researcher conducts elemental bulk analysis using X-ray fluorescence spectrometry.



Site in Barangay Nakalaya, Jose Panganiban, Camarines Norte with high uranium concentration adjacent to copper - magnetite mineralization

mineralization of uranium in the Philippines.

Results of the gamma ray spectrometric (radiometric) survey and geochemical analysis indicated a new exposed area where uranium and thorium mineralization occurs. This is located in Barangay Nakalaya, Jose Panganiban which is about two kilometers southeast from the previously delineated Bessemer/Dangkalan area. Further investigations will be done to confirm the presence of uranium in Barangay Nakalaya and adjacent vicinities, including areas farther south and southeast underlain by the metamorphosed universal formation.

Radon Monitoring of the Valley Fault System and Philippine Fault

The PNRI Nuclear Materials Research Section conducted radon gas measurements in soil, coupled with gamma ray spectrometry, to understand the relationship of the earth movements with the variation in the radon concentrations along the trace of the active valley fault system. The collection of data will be continuously done until a conclusive correlation is made.

Verification Survey for Radioactive Rare Earth Minerals in Northern Palawan

PNRI researchers conducted field sampling of heavy mineral samples at the northwest coast of Palawan which is around 150 kilometers away from the capital city of Puerto Princesa. Areas surveyed included Ombo and Irawan, Barangay Sto. Niño and Kauban, Barangay Binga and the municipality of San Vicente. These sites were revisited to verify the presence of anomalous background radioactivity in samples with the use of state-of-the-art portable gamma ray spectrometers. Sampling was carried out along beaches, trails and road cuts to map and measure the radioelements potassium (K), uranium (U), thorium (Th), and non-ferrous ores such as allanite and monazite.

This project is being carried out with assistance from the Nuclear Research Foundation and under the International Atomic Energy Agency Contract Research Project.

The range of values obtained from the samples for the K, U and Th are as follows: 0.09 to 4.6 percent for K;

0.1 to 7.8 parts per million (ppm) for U and 0.5 to 352.3 ppm for Th. Based on the analysis of the readings, it was found that the uranium content is relatively on average, thus the radioactivity of the location could be attributed to the high thorium content. Thorium is also an element associated with the occurrences of rare earth elements. Maps containing data on radionuclide concentrations (U,Th, and K) can show the important mineral resource occurrences, especially the allanite and monazite, which are strategic minerals containing rare earth elements.

Co-Location of the Near Surface Disposal Facility and the Deep Borehole Disposal Concept for Radioactive Waste

The International Atomic Energy Agency (IAEA) currently engages in two Technical Cooperation Projects with the Philippines involving the establishment of a near-surface and borehole facilities for long-term radioactive waste disposal.

In line with this, PNRI hosted a five-day training course on operating the AMBER software for radionuclide migrations. Researchers and nuclear regulators were introduced to the AMBER software used for biosphere modelling of radionuclide contaminants. The participants were also given practical exercises using site-specific data. Exercises were also performed with reference to the IAEA's Generic Safety Assessment in conjunction with the IAEA Borehole Disposal of Disused Sealed Radioactive Sources (BOSS) system.

PNRI also participated in a two-week expert mission held in Vienna, Austria to pilot and test the feasibility of model regulations for the borehole disposal systems within the framework of Ghana, Malaysia and the Philippines. The mission resulted in the completion of CPR Part 29 "Licensing and Safety Requirements for the Disposal of Radioactive Wastes Utilizing the Borehole Disposal Concept".



PNRI and IAEA officials during a discussion on the Borehole and Near-Surface Disposal Project

Establishment and Re-utilization of Nuclear Facilities

Feasibility Studies for the Establishment of a Research Reactor and Accelerator

To support its capacity building activities for the general advancement of nuclear science and technology in the Philippines, PNRI engaged in two feasibility studies on the establishment of a research reactor and an accelerator facility. The feasibility studies were funded by the National Economic Development Authority (NEDA).

The final reports for both the accelerator and research reactor projects were developed by Aspiretech, were reviewed by the technical working group of PNRI as the implementing agency, and endorsed to NEDA as the executing agency.

Research Reactor

The proposal for the research reactor envisioned a 10 MW facility that will help in the education and training of generations of Filipino nuclear scientists, reactor operators, and engineers. It will also be used for basic research, isotope production, neutron radiography, neutron beam research and material characterization and testing, among other applications.

With the decommissioning of the Philippine Research Reactor-1, the Institute's current R & D activities which require the utilization of a research reactor are being conducted in our ASEAN neighbors through a cooperative research agreement and/or participation in regional projects. Comprehensive siting studies will be undertaken to determine the appropriate site of the new research reactor based on IAEA standards.

Accelerator Facility

The proposal for the accelerator involves a plan to establish a 30 MeV cyclotron to be located in PNRI with the capability to produce radioisotopes for medical, industrial and research applications. The accelerator may also be used for neutron radiography, Boron Neutron Capture Therapy (BNCT), heavy ion implantation for novel materials, and the general production of neutrons and heavy ions for various research and development purposes.

Utilization of PRR-1 and TRIGA Fuel Elements for Education and Training

PNRI participated in an IAEA Technical Cooperation Project to use the decommissioned Philippine Research

Reactor – 1 and the remaining fuel elements for its TRIGA reactor for training and education. The project aims to re-establish an operational nuclear facility for capacity building on research reactor technologies, as well as to strengthen nuclear research and expertise in general.

To prepare for the project, PNRI began conducting gamma spectrometry and neutron dose mapping experiments to locate neutron sources at the reactor's storage tank.

Creation of a Reactor Physics Study Group

The Institute formed a Reactor Physics Study Group (RPG) to study the underlying theory of nuclear fission reactors. The RPG held 13 study sessions between February and November with 15 participants. PNRI researchers also went on a scientific visit to the Japan Atomic Energy Agency in September, which enabled them to learn about the JAEA neutron dosimetry facility, how they operate, the safety and security procedures, and instrumentation requirements. The information and knowledge gained from this visit were used in coming up with the design of the PNRI's own neutron dosimetry laboratory.



Artist's concept of a National Research Reactor for various applications (NARRA)

Provision of Quality S & T Services



Irradiation Services

Whether by gamma rays or electron beams, PNRI's irradiation facilities have once again proven useful to the industrial, medical, government and academic sectors engaging in radiation processing and in advanced research applications. These services are provided by PNRI through its Irradiation Services Section (ISS).

Multipurpose Irradiation Facility

Operating on a semi-commercial scale, the Multipurpose Irradiation Facility (MIF) irradiated 35,280 bags and boxes of various samples for 2016. More than 90 percent of the clients who sent their products for irradiation came from the industrial sector, while the rest are from academic and government institutions.

Among the products irradiated with gamma rays from cobalt-60 for microbiological decontamination and sterilization purposes were spices, herbal products, dehydrated



Commercial, industrial, medical, academic and research sectors have been availing of the unique advantages that nuclear and radiation-based technologies can offer. Compared to conventional methods, nuclear S&T services could serve as better alternatives, producing results faster, more efficient and with better quality.



Production of plant growth promoters at the Electron Beam Irradiation Facility for distribution to farmers across the country



vegetables, food seasonings, chocolate powder drinks, glutinous rice, bee pollen powder, enzymes, cosmetics, cosmetic raw materials and accessories, empty aluminum tubes, swab applicator, medical device, cornea, frozen bone grafts and plastic films/packaging.

For research and development studies, the samples irradiated included hydrogels, carrageenan, snack bars, honey, cucurbit male flowers, orthopedic implant, hemostat, circuits, plastic packaging, oyster and paddy straw mushrooms, banana, cocogum, rice grain and seeds, sugar cane seedlings, dried soybeans, cacao beans, whole peppercorns, rambutan, tomato, cellulose, polyethylene bags and papain solution.

The MIF was also used to irradiate plant growth promoters (PGPs), which were distributed to farmers for widespread testing in Luzon,

Panay Island, Zamboanga and Davao. Around 18,480 liters of PGPs were produced in the MIF.

Gammacell 220

PNRI uses the Gammacell 220 irradiator for smaller volumes of samples, making it more suitable to provide special services for academic and research clients. This year, the Gammacell 220 irradiated 515 samples. Among these samples were ornamental plants, Philippine Super mangoes, tomato, mosquito pupae, mice, human blood, duck eggs, molds, yeast and sugarcane plantlets. The samples also included seeds from several kinds of plants such as mungbean, rice, corn, lettuce, soybean, peanut and narra.

Electron Beam Irradiation Facility

The newest addition to PNRI's irradiation capabilities is the 2.5 MeV Electron Beam Irradiation Facility (EBIF). The E-Beam facility was able to provide sterling service to clients from the industry and the academe by irradiating 1,706 samples. Among these samples were abaca/polyester (abaca-PET), polyethylene/polypropylene (PE/PP) non-woven fabric, kappa carrageenan, polyethylene bags, Zener diode, beef patties, petri dishes, polycarbonate sheet, hydrogel, hemostat, seaweed powder, honey alginate dressing and carrageenan powder.

In addition to serving other sectors, the EBIF was used to irradiate more than 57,000 liters of the Institute's recently-developed PGPs for distribution to farmers. The irradiation and processing of large volumes of PGPs in the EBIF was made possible through the use of the liquid handling system designed by Irradiation Services Section (ISS) personnel and fabricated by a local contractor.

All in all, the ISS rendered a total of 769 irradiation services – 626 with the MIF, 46 with the Gammacell 220 and 97 with the EBIF.



The electron beam scanning horn with the fabricated liquid handling system designed by EBIF personnel

Radiation Protection Services

PNRI regularly provides vital radiation protection services for workers occupationally exposed to radiation and to licensed users of radioactive materials and nuclear instruments. These services are

necessary to control the radiation doses absorbed by the workers and to prevent them from exceeding the exposure limits set by national radiation safety standards.



Analysis of radiation dose from an *Optically Stimulated Luminescence (OSL)* dosimeter of a worker occupationally exposed to radiation

Personnel Monitoring

The need for this service is best demonstrated by the ever-increasing demand for personnel dosimeters such as optically stimulated luminescence (OSL) dosimeters and thermoluminescent dosimeters (TLD) for individual monitoring of radiation exposure. The PNRI Radiation Protection Services Section (RPSS) recorded an increase of more than 10,000 personnel dosimeters from last year. This increase can be mostly attributed to clients from the medical and industrial sectors.

Standardization and Calibration of Radiation Instruments

To help ensure accurate and reliable measurements involving radiation, PNRI performed the regular calibration and standardization of radiation detectors and other similar equipment used in hospitals and other institutions. These included survey and contamination meters, personal dosimeters, and brachytherapy units.

Radiation Control

Area monitoring and leak testing of sealed radioactive sources are also crucial in sustaining radiation safety and proper working conditions inside authorized facilities with radiation-emitting devices. The RPSS conducted these services to clients within as well as outside Metro Manila to match the ever-increasing use of nuclear and radioactive sources across the country.

Radioactive Waste Management

PNRI continued to operate the radioactive waste management facility, where the RPSS undertakes the collection, management and proper disposal 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 and intermediate level radioactive wastes in the country.



Calibration of a radiation survey meter at the PNRI Secondary Standards Dosimetry Laboratory

PNRI also offered the rental of its radiation detection instruments (such as survey meters) to authorized users and facilities for area monitoring around radiation emitting devices in their workplace.

RADIATION PROTECTION SERVICES * 2016		
Personnel radiation monitoring	<ul style="list-style-type: none"> 37,417 OSLs issued 15,809 TLDs issued 	31,149 individuals served 6,745 institutions served 14,423 individuals served 1,386 institutions served
Calibration of radiation detection instruments	<ul style="list-style-type: none"> 696 survey meters 84 contamination meters 638 units of pen dosimeters 19 units of dose calibrators 	<ul style="list-style-type: none"> 569 institutions served 83 institutions served 265 institutions served 15 institutions served
Leak testing of sealed radioactive sources	<ul style="list-style-type: none"> 107 on-site leak testing 828 swipe sampling 	<ul style="list-style-type: none"> 15 institutions served 196 institutions served
Management of spent sealed sources	<ul style="list-style-type: none"> 14 spent sealed sources 	<ul style="list-style-type: none"> 13 institutions served
Rental of survey meters and other equipment	<ul style="list-style-type: none"> 153 rentals of survey meters 3 rentals of moisture gauges 	<ul style="list-style-type: none"> 153 institutions served
Dose measurement of Iodine-131 capsules	<ul style="list-style-type: none"> 9 Iodine-131 dose measurements conducted 	

Nuclear-Based Analytical Services

The Institute's Nuclear Analytical Techniques Application Section (NATAS) showcases the unique edge of nuclear and isotope-based analysis by providing efficient and accurate analysis for a broad range of purposes, from research projects to regulatory certification of domestic and export products. Many of these techniques are capable of identifying a wider range of compounds and elements without risking the sample to damage or irretrievability.

Two of PNRI's several analytical procedures, namely gamma spectrometry and gross alpha beta analysis services, are accredited under ISO/IEC 17025:2005.

2016 proved a very productive year for PNRI's analytical services as it boasts a 77 percent increase in the number of samples analyzed and a 138 percent increase in generated income. Of the 744 analytical services rendered by NATAS, almost half were for gross-alpha

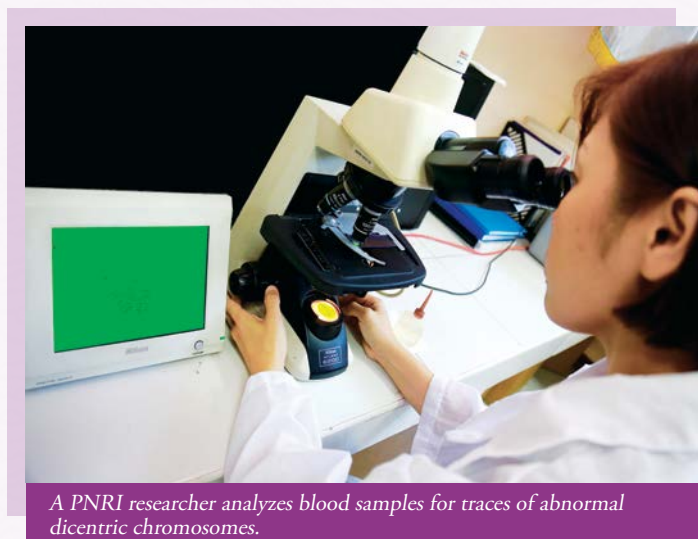
beta analysis of water, followed by radon analysis, which comprised one-third of the procedures. Gammametric analysis of food and other products comprised another one-fifth of the analytical services, and the rest are for vinegar authentication.

NUCLEAR-BASED ANALYTICAL SERVICES * 2016		
Gross Alpha-Beta Analysis in Water	• 317 samples	• 58 customers served
Gammametric Analysis	• 147 samples	• 63 customers served
Vinegar Authentication	• 32 samples	• 4 customers served
Radon Analysis	• 248 samples	• 20 customers served

Microbiological Tests and Cytogenetic Analysis

Through its Biomedical Research Section (BMRS), PNRI used its analytical capabilities for microbiological testing of products, particularly for sterility and bioburden testing of medical products. The Institute also performed cytogenetic analysis, which is another method of monitoring radiation exposure. Biological dosimetry was also done to analyze how much radiation the person has absorbed by finding dicentric chromosomes in blood samples. These abnormal chromosomes are formed due to radiation exposure.

This year, a total of 32 clients were served by the BMRS. Ten clients availed of sterility testing, while six submitted samples for bioburden testing. One client availed of aerobic plate counting, mold and yeast count



A PNRI researcher analyzes blood samples for traces of abnormal dicentric chromosomes.

and aging test for product samples. For their annual required monitoring of radiation exposures, 13 clients from the industrial sector submitted blood samples for dicentric chromosome

analysis. The results showed the absence of abnormal chromosomes, indicating no recent acute exposure from gamma radiation.

Sealed Source Applications

Through its Isotope Techniques Section, PNRI continues to hone its capabilities in column scanning technology using gamma radiation from sealed sources.

Gamma column scanning technology helps improve the maintenance of petroleum and chemical industries by showing the conditions inside process columns and vessels on real-time without interrupting production for a more physical inspection, saving the operation valuable time and resources.

This year, PNRI continued to collaborate with International Atomic Energy Agency through its technical cooperation project “Enhancing National Capability in Applications of Industrial Radioisotope Techniques” which has reached its final year of implementation.

An important component of the project is the provision of fellowship training and scientific visits at the Center of Applications of Nuclear Technique in Industry (CANTI) in Dalat, Vietnam and at the Thailand Institute of Nuclear Technology (TINT) in

Bangkok, Thailand. The purpose is to have a pool of trained personnel and to be abreast with recent developments in the region on sealed sources applications.

The ITS was also able to conduct in-house training, demonstration activities and echo seminars on these technologies, particularly on gamma computed tomography, a computer-aided procedure used in the industrial sector for internal inspections of components.



A PNRI researcher sets up the equipment for experiments on gamma computed tomography.



Repair of radiation survey meters

Engineering Services

PNRI's Engineering Services Section (ESS) provides repair and maintenance services for both nuclear and non-nuclear equipment. Aside from serving clients from various sectors, the ESS plays an active role in keeping the Institute's research facilities and laboratories functional through regular repair, maintenance and fabrication services.

For this year, 35 radiation survey meters were repaired for external clients. Meanwhile, the services provided for the Institute included

the fabrication of vital research equipment such as aluminum sample centering rings for a Wavelength Dispersive X-ray Fluorescence (WDXRF) machine, replacement of an autoclave temperature controller, repair of a microscope light power source, and maintenance of the PNRI liquid nitrogen plant and the electromechanical equipment at the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) Monitoring Station in Tanay, Rizal.

Ensuring the Safety & Security of Radioactive Sources



Through the Nuclear Regulatory Division (NRD), PNRI carries out its regulatory mandate of ensuring the safe and secure utilization of nuclear and radioactive materials and facilities, as well as fulfilling international commitments on nuclear safety, safeguards and security.

Among the activities of the NRD are the crafting and updating of regulations, bulletins, guides and administrative orders; issuance of licenses for the use, possession and transport of nuclear and radioactive materials; inspection of licensees' facilities to ensure compliance with PNRI regulations; coordination of nuclear and radiological emergency preparedness and response activities; conduct of activities in support of nuclear safety, safeguards and security; and implementation of PNRI Policy and Internal Nuclear Regulatory Program.

Regulations and Standards Development

Through its Regulations and Standards Development Section (RSDS), PNRI continuously develops, maintains, revises, and updates as needed the Code of PNRI Regulations, administrative orders, and other regulatory issuances in keeping with internationally acceptable guidelines and best practices for ensuring the safe use of radioactive materials by various sectors. The Institute also issues regulatory guides to assist licensees in complying with the regulatory requirements.

Code of PNRI Regulations (CPRs) and Other Publications

CPR Part 21 *"Licensing and Safety Requirements of Particle Accelerator Facilities for the Production of Radioisotopes"* was approved on March 11 and published on May 30 in the Official Gazette (OG), Volume 112 No. 22.

This was followed by the approval of the amendments to CPR Part 22 *"Fees and Charges for Radioactive Material License and other Related Regulatory*



CPR Volumes published

Services". The amendments were approved on June 30 and published on October 3 in the Official Gazette, Volume 112 No. 40 along with PNRI Administrative Order No. 3 Series of 2015 regarding the amendment of CPR Part 22. An information notice on the amendment was also disseminated to the licensees after its approval on October 18.

CPR Part 4 on "Regulations on the Safe Transport of Radioactive Materials in the Philippines" was submitted for approval to the PNRI Director. A regulatory conference was also conducted at PNRI on September 14 with the licensees and other stakeholders concerned with the implementation of CPR Part 4.

PNRI continued to review CPR Parts 5 "Site Evaluation for Nuclear Installations" and CPR Part 7 "Licensing of Nuclear Installations", which were reviewed by experts from the European Union under the Project on "Technical Assistance for Improving the legal framework for nuclear safety and strengthening the capabilities of the regulatory authority in the Philippines and its TSO".

A regulatory guide for CPR Part 17 "Licenses for Commercial Sale and Distribution of Radioactive Materials" was approved for implementation on September 8. An information notice

was approved on March 3 regarding an amended CPR provision on the renewal of licenses and specific condition for expired licenses. Two regulatory bulletins were also issued concerning amendment of authorizations to PNRI facilities and the use of secure tags on PNRI licenses.

Legislative Support on the Comprehensive Nuclear Law

With the assistance of the DOST Department of Legislative Liaison Office, PNRI continued to coordinate with members of the legislature from both houses of Congress for the enactment of a law providing for the creation of an independent nuclear regulatory body. This is in consonance with the latest International Standards recommending the existence of a regulatory body independent of promotional aspects of the uses of nuclear energy.

As of 2016, there are six bills pending before the various committees of the House of Representatives during the 17th Congress (namely House Bills 25, 1691, 2977, 3651, 4369 and 4788). The bills on a Comprehensive Nuclear Law are for preparing the establishment of a Philippine Nuclear Regulatory Commission that will serve as the country's new independent regulatory body.

Technical Assistance for the National Regulatory Framework

The Philippines continued to participate in the European Union (EU) Project, which allows PNRI to receive technical assistance through the hosting of expert missions and conduct of training courses/workshops by visiting regulators from the EU. The project aims to strengthen both the legal framework on nuclear safety as well as to strengthen PNRI's own regulatory capabilities.

Several workshop meetings were conducted which tackled topics on regulations development for siting, design and construction of nuclear facilities, inspection capabilities for site characterization and environmental impact assessment related to nuclear power plants, and the development of quality management systems for regulatory process. A five-day training was also held on environmental impact assessment and emergency preparedness and response.

The Institute also hosted a five-day EU workshop entitled "Technical Assistance for Improving the Legal Framework for Nuclear Safety and Strengthening the Capabilities of the Regulatory Authorities of the Philippines and its Technical Support Organization (TSO)".



PNRI regulators and European Union experts deliberate on improvements to the various standards and regulations set by the Institute.

Licensing, Review and Evaluation

The PNRI Licensing, Review and Evaluation Section (LRES) issued 363 licenses for authorization to use, possess, produce, store, sell or import radioactive materials. Thirty-one (31) of the approved applications for licenses were for new licenses, 60 were for amendment of previous licenses and the rest are for renewal of licenses.

Overall, PNRI is in charge of 366 licensees, the great majority of which are in Luzon. A total of 200 licensees from the National Capital Region account for more than half of these licensees, followed by Regions IV and III with 51 and 40 licensees, respectively. There were 19 license holders from the Visayas and 36 from Mindanao.

A total of 158 (43%) of the licensees were from the industrial sector, where radiation is mostly utilized for density, level and thickness gauging of products and materials. This is followed by the medical sector, which comprises 116 (32%) of the total number of licensees, most of which are for radiation applications for diagnosis or treatment purposes. The rest of the licensees, comprising the last fourth of the total, are engaged in selling and distribution of radioactive materials (31), research (31) and

industrial radiography (28). There are now two licensed production facilities (medical particle accelerators) for the production and distribution of fluorine-18 to four positron emission tomography (PET) facilities.

On the implementation of the PNRI Internal Regulatory Control Program (IRCP), the LRES has prepared the renewal and amendment of seven authorizations of PNRI laboratories and facilities.

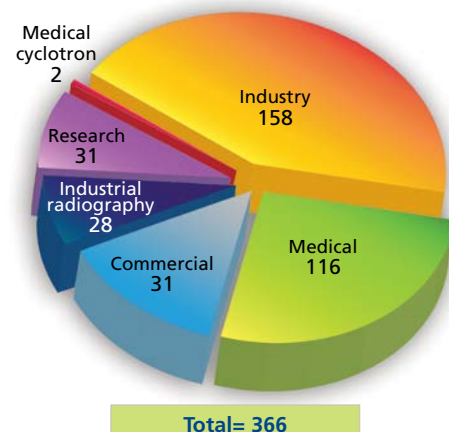
As part of its licensing process, LRES conducted 12 pre-licensing and/or verification inspections of facilities, issued 544 Certificates of Release for imported radioactive materials released by the Bureau of Customs and prepared six certificates for materials entering the country that do not contain any radioactive material. Meanwhile, 21 license exemption certificates were issued to the licensees whose activity of radioactive material/s are of exempt levels.

LRES maintained and updated two databases of PNRI licensees: PNRI RAM Licensing System and Regulatory Authority Information System (RAIS).

Distribution of Licensed Users According to Geographical Locations and Classification

Region I - Ilocos Region)	7
Region II - Cagayan Valley	5
Region III - Central Luzon	40
Region IV A - CALABARZON Region IV B - MIMAROPA	51
Region V - Bicol Region	4
Region VI - Western Visayas	9
Region VII - Central Visayas	8
Region VIII - Eastern Visayas	2
Region IX - Zamboanga Peninsula	3
Region X - Northern Mindanao	14
Region XI - Davao Region	9
Region XII - Soccsksargen	4
Region XIII - CARAGA	6
CAR - Cordillera Administrative Region	4
NCR - National Capital Region	200
TOTAL:	366

Distribution of Radioactive Material Licenses Issued by PNRI in 2016



Inspection and Enforcement

The Inspection and Enforcement Section (IES) conducts regulatory inspections and audits of PNRI licensees to ensure compliance with the law, safety and security regulations and standards of the Code of PNRI regulations, and the license conditions set forth by PNRI.

In 2016, the IES conducted a total of 191 inspections and audits through actual field verification and interface activities. These inspections, which are classified as announced, unannounced, follow-up and reactive inspections, consisted of the following: (1) 168 announced inspections to verify that the licensees comply

with PNRI-approved procedures and best practices contained in the radiation safety programs; (2) five unannounced inspections to allow inspectors a better opportunity to verify regulatory concerns and issues; (3) five follow-up inspections to verify that corrective actions submitted were in place and

implemented according to PNRI's recommendations; and (4) reactive inspections of three licensees to respond to regulatory concerns on reported medical incidents.

The IES also inspected ten PNRI facilities and laboratories using radioactive materials to verify compliance with conditions set forth in the authorization under the PNRI Internal Regulatory Control program, including adherence to standards of radiation safety and security.

PNRI issued and implemented a PNRI Order to a construction company licensee that resulted in the taking

into custody of a nuclear gauge containing radioactive cesium -137 and americium -241. The IES also issued Notices of Violation to 12 licensees who were identified to have violated the regulations and license conditions. The IES sent follow-up letters to 34 licensees who failed to respond to inspection reports, including those who did not renew their PNRI license.

The corrective actions and evidences submitted by licensees in response to cited non-compliances and concerns found during the time of inspection were evaluated. A total of 146 evaluation reports were completed



PNRI nuclear regulatory inspector inside the facility of a licensee from the medical sector

and issued to licensees. The IES also issued a total of 5,978 Authority to Transport Radioactive Materials to 86 PNRI licensees.

Nuclear Safeguards and Security

PNRI, through its Nuclear Safeguards and Security Section (NSSS), is responsible for implementing the Philippines' commitments to the global community in securing nuclear and other radioactive materials and facilities as well as preventing diversion, theft, and sabotage. These include the country's obligations under the Non-Proliferation of Nuclear Weapons Treaty (NPT), Safeguards Agreement with the IAEA, and other international conventions and agreements.

IAEA Nuclear Security Series Implementing Guide and Safeguards Implementation Practices (SIP)

PNRI through NSSS once again participated in the IAEA consultancy meeting held in Vienna, Austria in July for further revision of the IAEA Nuclear Security Series Implementing Guide NSS No. 9, "Security in the Transport of Radioactive Material".

NSSS also contributed to the development of modules/materials



IAEA Safeguards Inspectors conduct their yearly verification inspection of the fuels at the spent fuel storage pool of the Philippine-Research Reactor.

for the workshop regarding the IAEA SIP Guide on "Establishing and Maintaining State Safeguards Infrastructure".

IAEA Nuclear Safeguards Inspections and Nuclear Materials Accounting

Safeguards inspectors from the IAEA successfully conducted the yearly physical inventory verification inspection of the Philippine Research

Reactor - 1 (PRR-1) fuels with assistance from NSSS. The IAEA inspectors also performed their design information verification for the Bataan Nuclear Power Plant in Morong, Bataan which is conducted every two years. The inspectors

verified the status of depleted uranium in radiography facilities as well as in the PNRI Interim Radioactive Waste Management Facility. The corresponding reports, namely five nuclear material accounting reports and four reports on depleted uranium, were subsequently submitted to the IAEA in December.

Nuclear Smuggling Detection and Deterrence (NSDD)

Formerly the Megaports Initiative, the NSDD is a project with the United States Department of Energy (USDOE) intended to prevent the illicit trafficking of unauthorized nuclear and the radioactive materials through major ports such as Manila and Cebu.

In support of this project, PNRI attended several meetings at the Philippine Ports Authority for the repair of the radiation detection systems installed at the Manila International Container Terminal and Asian Terminal Incorporated. Aside from troubleshooting and regular check-ups of the radiation portal monitors installed in Manila, the NSSS also trained the new operators for the Secondary Works Station at the South Harbor in August. PNRI also continued to provide its technical assistance for the operators of the Central Alarm System operators under the Bureau of Customs.



Radiation Portal Monitor at the port of Manila

PNP Operation and Maintenance Training for Mobile Detection Systems

The USDOE conducted a two-week operational and maintenance training in February on the use of the recently-acquired Mobile Detection System (MDS) vans – four for the PNP and one for the PNRI. These vans are intended to improve the capabilities of PNRI and the police in radiation detection, nuclear and radiological emergency response, and other measures. Members of the PNP and the PNRI Mobile Expert Support Team (MEST) participated in the training workshops.

Inauguration of the Radiation Portal Monitor Training Facility

Heralding another high mark in the field of nuclear security, PNRI inaugurated a Radiation Portal Monitor (RPM) Training Facility at the PNRI compound on April 11. Established with the assistance of the European Union Joint Research Centre (EU JRC) and the United States Department of Energy (USDOE), the radiation portal monitor has similar capabilities with those of its larger counterparts deployed at the ports of Manila and Cebu under the Nuclear Smuggling Detection and Deterrence



USDOE-NNSA expert briefs the PNP representatives and a PNRI staff on the capabilities of the Mobile Detection System for radiation detection, and nuclear and radiological emergency response.

Program engaged in by the PNRI, Bureau of Customs (BOC), and the Philippine Ports Authority (PPA) since 2005.

These RPMs are being used to detect possible illicit trafficking of nuclear and other radioactive materials coming through the busy Philippine ports, and are an invaluable asset to the port authorities.

To sustain these efforts, the RPM at PNRI will serve as a training facility for frontline officers from the BOC and port authorities involved in operating the RPMs stationed at the ports. The inauguration was attended by officials, representatives and experts from the European Union, National Security Council, BOC, PPA and the Cebu Port Authority.

Office of Radiological Security (ORS)

PNRI continued to engage in activities with the USDOE Office of Radiological Security (ORS), formerly known as the Global Threat Reduction Initiative. The focus is on addressing the issue of nuclear security around the world and reducing the threat of nuclear terrorism. In support of this activity, the Institute participated in the



Site inspections by USDOE and PNRI regulators at facilities with ongoing upgrades of security alarm system

enhancement of security systems in hospitals/medical centers and PNRI facilities. The PNRI regulators also joined the ORS teams in the conduct of physical protection site visits at facilities with security upgrades and Category 1 radiation sources in June and December.

Partnership Program with Canadian Government

PRR-1 Physical Protection System

After the signing of a memorandum of agreement between PNRI and the Canadian Department of Foreign Affairs, Trade and Development

(DFATD), the Institute continued with its cooperative arrangement in furtherance of the G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction.

A key activity of the cooperative agreement was the installation of the physical protection system for the Philippine Research Reactor – 1 (PRR-1). Meetings were facilitated with representatives of DFATD for the evaluation of the protection system. In October, the installation of the systems was started at the PRR-1 under the oversight of NSSS.



Mr. Achim Tillessen, Head of Development Cooperation at the Delegation of the European Union (EU) to the Philippines and PNRI Director Dr. Alumanda Dela Rosa with PNRI officials and experts from the EU Joint Research Centre (JRC) at the inauguration of the Radiation Portal Monitor Training Facility at PNRI (11 April 2016).

Radiological Impact Assessment

Radiological Impact Assessment Study

Through its Radiological Impact Assessment Section (RIAS), PNRI continued its assessment studies in support of the implementation of its nuclear regulations.

The section conducted a consequence assessment study on the transport and distribution of bulk quantities of radiopharmaceuticals, including radioimmunoassay kits used in nuclear medicine. The study aims to verify and assess the impact from transport incidents involving unsealed sources and provide recommendations on radiological safety using the relevant regulations and radiation safety program.

Two licensees who were issued certificates of transport served as the bases of the study. From more than 1,000 data sets compiled from the licensees, RIAS was able to generate graphical information of radioactivity concentrations, dose rates at contact

and at one meter, transport indices and modes of transport.

The results of the transport study will be integral in the final assessment of the in-vitro application of iodine-125 radioimmunoassay kits for diagnostic assay.

National Radiological Emergency Preparedness and Response Plan (RADPLAN)

As part of its continuing effort to adapt current emergency measures to the evolving demands of disaster preparedness, PNRI continued to update the National Radiological Emergency Preparedness and Response Plan (RADPLAN).

The draft of the RADPLAN Revision 3 was completed in September. This was based on the requirements of the new IAEA General Safety Requirements Part 7 and harmonized with the national disaster risk reduction and management plan for

disaster preparedness as stipulated in Republic Act 10121. The revision also incorporated the review by RADPLAN members in consultative meetings held in the last three years, including lessons learned from emergency drill and field exercises conducted since 2013 during PNRI workshops or training courses.

Furthermore, PNRI conducted a consultative meeting with the various RADPLAN members and other concerned agencies on October 27. The meeting aimed to discuss the draft plan and to review the roles and responsibilities during preparedness and response, as well as the integrated concept of operations.

The comments and suggestions in the consultative meeting were incorporated into an updated draft that will be presented to RADPLAN member agencies and to the Office of Civil Defense (OCD), National Disaster Risk Reduction and Management Council (NDRRMC) for its final review and approval in 2017.



The RADPLAN Consultative Meeting held at PNRI



Participants of the follow-up training course on Nuclear Emergency Preparedness and Response during a decontamination exercise

Participation in the IAEA ConvEx Exercises

PNRI actively participated in two IAEA Convention Exercises (ConvEx) facilitated by the IAEA Incident Emergency Center (IEC) in Vienna, Austria. These exercises are conducted to help Member States like the Philippines to gain practical experience on the execution of nuclear and radiological emergency preparedness and response procedures.

For 2016, the PNRI participated in the ConvEx 2a notification exercise, ConvEx 1c validation of alert channels, and ConvEx 1b communication exercise.

The participation to the IEC exercises requires Member States to inform the IAEA on the nature of the accident or emergency under the Convention on Early Notification of Nuclear Accidents and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. PNRI uses the Unified System for Information Exchange (USIE) platform for the exercises to practice the exchange of information during emergencies, including the request of international assistance, if necessary.

Awareness Seminars on the PNRI Emergency Plan

RIAS facilitated the conduct of five seminars on the PNRI Emergency Plan (PEP) for 55 members. The seminars highlighted the PEP objectives and scope of emergency preparedness and response from radiological hazard in facilities owned and operated by the Institute.

from PNRI and DOST-PAGASA. The participants of the second FTC were composed of personnel from PNRI radiation facilities and the Chemical, Biological, Radiological, Nuclear (CBRN) Explosive Ordinance Division (EOD) of the Armed Forces of the Philippines.

Training and Maintenance of Emergency Preparedness and Response Capabilities

In collaboration with Japan Atomic Energy Agency (JAEA), PNRI successfully conducted two Follow-up Training Courses (FTC) on Nuclear and Radiological Emergency Preparedness and Response for 2016.

The first FTC was attended by representatives of the National Disaster Risk Reduction Management Council (NDRRMC), PATROL 117, Philippine Bomb Data Center (PBDC), Health Emergency Management Bureau (HEMB), Bureau of Fire Protection, Philippine Army and the MMDA, along with researchers



A simulation of a field radiological emergency scenario

Diffusion of Knowledge & Technologies



The cascading of information and knowledge in nuclear science and technology through promotion, training and technology transfer remains to be a major activity of the Institute. This is necessary to enhance awareness and understanding of the technology as well as to develop the nuclear capability of various sectors.

Nuclear Training

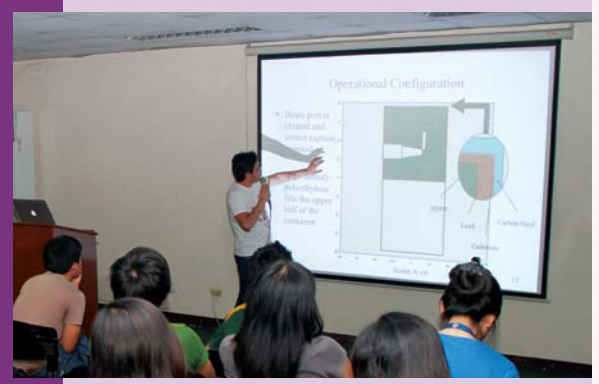
In support of the capability building in the field of nuclear science and technology, the PNRI offers training courses for various sectors. This year, a total of 44 training courses (regular courses, follow-up training courses and nondestructive testing courses) were conducted with 756 participants. The courses are conducted by the PNRI Nuclear Training Center in cooperation with the PNRI technical staff and resource persons from other institutions/agencies. (See Appendices, Table 1 on page 57 for list of PNRI Training Courses)

Regular Training Courses

PNRI conducted 23 training courses on radioisotope techniques, nuclear science and technology and radiation safety. These courses were participated in by 392 individuals from the industrial, research, academic and medical sectors.

Follow-up- Training Courses (FTC)

In cooperation with Japan Atomic Energy Agency, PNRI conducted five FTC sessions on reactor engineering, nuclear and radiological emergency, and on environmental radioactivity monitoring. These were attended by 95 participants from PNRI, other government agencies and the academe.



The FTCs are a continuation of human resource development efforts in the peaceful uses of nuclear energy disseminated by Japan to several Asian countries through the Instructor Training Course and other seminars. Successful FTC participants are required to disseminate the nuclear-related knowledge and experience acquired in their training in Japan to their respective countries through the FTC.

Nondestructive Testing

The importance of nondestructive testing (NDT) as a safe and reliable tool to detect defects without damaging the material being tested has been demonstrated in the training courses conducted by PNRI in partnership with the Philippine Society for Nondestructive Testing, Inc.

This year, a total of 248 participants availed of the NDT courses on radiographic, ultrasonic and eddy current testing, infrared thermography and surface methods. A welding inspectors' course was also conducted for 26 participants.

PNRI Undergraduate Program

To be able to generate awareness and understanding on nuclear science and technology through first hand experience, the Institute continued to offer on the job-training and thesis advisorship opportunities for high school and college/university students.

This year, a total of 139 high school and college students from 29 schools undertook their training in research and development and nuclear services. On the other hand, a total of 11 college students from two schools availed of the PNRI thesis advisorship program.

Capacity Building in the Use and Operation of Small Neutron Source

Annual Neutron School 2016

PNRI successfully conducted the 5th Annual Neutron School (ANS) in July with the objectives of developing the knowledge and expertise of nuclear scientists of the next generation, and of promoting nuclear research to the academe. This was participated in by PNRI researchers and 19 PNRI on-the-job trainees from four universities namely, the Mindanao State University – Iligan Institute of Technology (MSU-IIT); University of the Philippines-Los Baños (UPLB); Ateneo De Manila University (ADMU), and the University of Santo Tomas (UST).

Experimental ANS modules

The modules implemented dealt with topics such as (a) radiation safety (b) gamma-ray detection, calibration and spectroscopy; (c) determination of naturally occurring radioactive materials (NORMs) in fruits and mineral sands; (d) determination of pulse height spectrum of boron trifluoride (BF₃) neutron detector; (e) neutron activation analysis and;

(f) neutron dosimetry. A new module on the Monte Carlo N-Particle Simulation was introduced in this year's ANS. To date, there are 61 individuals who have participated in the ANS since its establishment in 2012.

Undergraduate ANS Thesis

In line with the goal of the ANS to build expertise in the use of simulation codes in nuclear science, one undergraduate thesis was completed. The thesis entitled "Monte Carlo Evaluation of Field Parameters and Dosimetric Characteristics of an ²⁴¹Am-Be Neutron Calibrator" was performed and successfully defended by the undergraduate applied physics student from the University of the Philippines-Manila. The main objectives of the study were to characterize the radiation beam emanating from the neutron calibrator and to determine the best and safest location where the neutron calibrator will be placed.



PNRI on-the-job trainees from four universities conduct experiments as part of the modules of ANS.

The results of the study have been very useful in the upgrading of the PNRI neutron laboratory. Some of the results of this research were also presented in the 34th Samahang Pisikang Pilipinas (SPP) Physics Conference in August 2016.

Nuclear Information, Education and Communication

The PNRI, through its Nuclear Information and Documentation Section (NIDS), continued to promote the beneficial uses of nuclear science and technology among different sectors as well as the general public through its various nuclear information, education and communication activities.

Development of Information Materials

As additional complementary resource materials on nuclear science and technology, PNRI developed and produced information materials in various formats. These included the 2015 PNRI Annual Report; flyers on nuclear services and technologies; and Volumes 9 to 11 of the PNRI Online Newsletter. Copies of these materials were provided to various clients.

The NIDS also developed exhibit banners and posters on nuclear services, nuclear safety and security, S & T linking and networking as well as applications of nuclear science and technology in agriculture, environment, industry, health and medicine. These were displayed during the PNRI open house

celebration of the National Science and Technology Week celebration in July. A congratulatory banner was also prepared for PNRI being the recipient of the Best DOST Institute Award for 2016 awarded by the National Academy of Science & Technology Philippines (NAST PHL).

This year, around 3,500 clients from institutions in various regions were provided with guided tours by NIDS in coordination with other research and service sections of the Institute. The visitors were composed of 95 professionals from the medical and industrial sectors; 29 secondary school teachers and college instructors; and more than 3,000 high school and college students.



During educational tours at PNRI, visitors are able to explore the Institute's facilities and interactive exhibits

Educational Tours

To further enrich knowledge on nuclear science and technology through first hand experience, the PNRI provided educational tours of its facilities and laboratories, lecture-demonstrations and video showings to various sectors.

Moreover, PNRI information staff attended to the inquiries of more than 500 walk-in visitors and those who asked for information through phone, email (information@pnri.dost.gov.ph) or the PNRI Facebook page (<https://www.facebook.com/DOST-Philippine-Nuclear-Research-Institute>).

Nuclear Awareness Seminars

To further raise awareness on nuclear science and technology, the PNRI continued to conduct seminars for different sectors. This year, the Institute conducted 18 nuclear awareness seminars for around 730 clients from 18 institutions in cooperation with the Nuclear Training Center and other PNRI technical staff.



PNRI banners and exhibit materials for the National Science and Technology Week and Atomic Energy Week celebrations.



Media interviews on PNRI research project and nuclear regulatory activities

Participation in Special S & T Events

As an opportunity to showcase nuclear technologies and services, the Institute participated in six science and technology events. These events included the 2016 National Science and Technology Week (NSTW) held from July 25 to 29 from which the Institute was involved in the various activities like Quezon City Science Community exhibit at PAGASA in Quezon City; PNRI open house and exhibit; Disaster Summit at PHIVOLCS; and Trailblazers of Science for Secondary School students at PNRI. The latter was organized by the National Academy of Science and Technology in cooperation with PNRI.

PNRI also participated in the Department of Education – National Capital Region Science Quest for high school and elementary students last November 19 and 26, 2016. In these events, the Institute featured the beneficial applications of nuclear science and technology in agriculture, health and medicine, environmental protection, safety and security, and industry.

Nuclear S & T Promotion Through Media Publicity

The importance of the media as a channel for information dissemination has always been recognized by PNRI. Hence, the Institute carries out

various activities to inform the public about nuclear science and technology through broadcast, print and cyber media. These activities included (1) nine television and radio interviews on PNRI programs, projects and nuclear technology applications with the Institute's officials, scientists and researchers; (2) a press conference for the 44th Atomic Energy week celebration at PNRI in December; and (3) preparation of a total of 61 press releases, 12 of which were posted on the PNRI website and some were featured and published in daily broadsheets, news/ media agencies, and government agencies, including their online versions.

Website and Social Media Presence

In close cooperation with the Management Information System Section, the NIDS worked on updating the PNRI Website (<http://www.pnri.dost.gov.ph/>), and the official Facebook page (https://www.facebook.com/Philippine-Nuclear-Research-Institute-DOST-138921663119914/?fref=ts&ref=br_tf), which is another avenue for promoting the Institute's technologies, services, events and other activities.



PNRI exhibits during the Quezon City Science Community celebration of the 2016 NSTW



National Scientist Fr. Bienvenido Nebres is one of the guest speakers at the National Academy of Science and Technology - Trailblazers of Science event held at PNRI during the 2016 NSTW.

Library Services

This year, the PNRI Library acquired 357 volumes of publications. These publications were composed of 44 volumes of books, 83 volumes of journals/technical publications and 13 volumes of annual reports through donation and exchange from local

and foreign institutions. Together with other library holdings, the publications were made available to around 315 clients, composed mostly of students and researchers.

PNRI has been actively participating in the International Nuclear Information

System (INIS) through the preparation and submission of inputs of nuclear-related literature published in the Philippines. This year, PNRI contributed 70 bibliographic records on research and development of nuclear technology in agriculture, health, environment and industry.

Nuclear S & T Outreach Program for Secondary Schools

As a pilot country for the International Atomic Energy Agency (IAEA) Technical Cooperation Project on Supporting Sustainability and Networking of National Institutions in Asia and the Pacific Region, the Philippines has successfully implemented the IAEA outreach program for secondary school students from 2015 to 2016 in cooperation with the Department of Education-Division of City Schools in Quezon City. The project aims to increase the youth's interest in nuclear science and technology and inspire them to

consider a future career related to Science, Technology, Engineering and Mathematics (STEM) courses.

Educating Secondary Schools on Nuclear Science

As part of the international effort to bring nuclear science to classrooms, 24 science teachers and educators throughout the Asia-Pacific region participated in a five-day Regional Training Course for Secondary School Educators in August at the Novotel

Manila Araneta Center in Quezon City. The course was organized by the IAEA in cooperation with the DOST- PNRI and the DepEd – QC.

The training course supported the participants in Member States in developing their competency in delivering nuclear science and technology topics as effective and engaging teaching and learning processes. The week-long event also fostered a healthy discussion on the experiences and strategies of various countries in the Asia-Pacific region



Group activities, lecture demonstrations and presentations were the activities implemented during the IAEA Regional Training Course for Secondary Schools

in integrating nuclear S&T in their curriculum to meet their national perspectives.

Among the 24 participants were government officials and science educators from Bangladesh, Jordan, Pakistan, Philippines, Israel, Thailand, Vietnam, Myanmar, Sri Lanka, Malaysia and Indonesia. Three IAEA lecturers shared their expertise in teaching as well as promoting nuclear S & T to the younger generation. Several teachers from two pilot schools in Quezon City – San Francisco High School and Quezon City Science High School – also performed classroom demonstrations during the training course. These teachers were previously trained in conducting lectures and radiation-related activities under the IAEA TC project.

Activities for the Pilot Schools of IAEA Outreach Project

Photo Essay Contest

A photo essay contest was conducted for the members of the Powerful Opportunities for Women Eager and Ready for Science, Engineering and Technology (POWER SET) organization from two secondary schools in Quezon City – San Francisco High School and Quezon City Science High School. The students were toured among the facilities and exhibits of PNRI and were expected to take photos of the various applications of nuclear science and technology.



POWERSET members participated in photo essay contest. The topics of their creative works were the various beneficial applications of nuclear science and technology. Cash prizes were awarded to the top three winners



IAEA Deputy Director General Dr. Mikhail Chudakov (6th from right) visited the Institute on August 31 to meet with the senior officials of PNRI as well as members of the youth sector.

The contest aims to challenge the students' creativity as well as to test how much they have learned about the benefits of nuclear and radiation applications in the Philippines. Out of 13 entries, three students from Quezon City Science High School bagged the top prizes.

Philippine Nuclear Youth Summit and Philippine Nuclear Science Quiz

POWERSET members as well as students from the pilot schools participated in the Second Philippine Nuclear Youth Summit (PNYS) and in the 2016 Philippine Nuclear Science Quiz (PNSQ) held in December at PNRI. San Francisco High School, one of the pilot schools, was one of the qualifiers in the national level.

Management Information System

In 2016, the Management Information System Section (MISS) continuously provided timely services in terms of information systems development and maintenance, local area network, internet and intranet service and IT helpdesk activities.

Through the MISS, PNRI acquired an ICT budget of Php 4.8 M as a result of the approval of the PNRI's Information Systems Strategic Plan for 2015-2017 (PNRI ISSP 2015-2017). This plan was submitted to the DBM – MITHI Program through the DOST-Information and Communication Technology Office (DOST-ICTO).

Information Systems Operationalized in 2016

Document Tracking and Monitoring System (DTMS) • This was operationalized for externally-sourced documents and purchase requests. The system will be used for a wider set of documents in 2017. The system

provides for real-time tracking of routed documents within the PNRI.

NTC Information Management System (NTC-IMS) – Phase 3 The system is used by the Nuclear Training Center in managing the topics, courses, schedules, and grades of participants, creation of log files monitoring, import and export functions, course summary reporting and automatic notification of participants via email.

Nuclear Knowledge Management Information System • Training Module (NKMIS-Training): The system provides for the recording, monitoring and reporting of the PNRI personnel's capacity building activities, both local and foreign. The module also records compliance to the PNRI's NKM policy of sharing materials and knowledge gained from these activities.

Information Systems Developed in 2016

Nuclear Analytical Techniques Application Laboratory Information Management System (NAT-LIMS) • An IT management tool in the conduct of the Nuclear Analytical Techniques Application Section services to clients, from creation of job order requests to report and certificate generation.

Web-based Payroll System • This new system will replace the existing MS-Access stand-alone payroll program that is being used by the Institute.

Cashier Payment Recording Program

• The program will provide for the generation of Order of Payment and recording of payment by PNRI clients such as the radiation protection services.

Chemical Inventory System • This system which was developed in 2015 was rolled out for user testing in early 2016. Modifications are being done based on new requirements specifications provided by the end-user.

Enhancement / Maintenance of Information Systems

Regulatory Authority Information System (RAIS) • This IAEA-developed system assists the Institute in managing its regulatory activities in accordance with IAEA Safety Standards and guidance, including the Code of Conduct on the Safety and Security of Radioactive Sources and Supplementary Guidance. The Inspection and Enforcement Section, Nuclear Regulatory Division has been using the system in the course of their work.

Personnel Information System (Infosys) Attendance Computation Module • This is being used as the Personnel Information System of the Institute.

Local Area Network, Internet and Intranet System

To provide a continuous flow of information within and outside the Institute, the MISS upgraded the

PNRI's network infrastructure through the installation and configuration of (1) additional WiFi access points for better wireless coverage at the NART Building; (2) new and improved network firewall policies to improve bandwidth usage; (3) new network file storage and sharing service using file transfer protocol (FTP) available in the Institute; (4) PNRI Cloud Server for file storage and sharing services over the Internet; (5) new email server with higher storage capacity; (6) network monitoring tool (Cacti) with installed plugins such as Nectar for email reporting and Weathermap for visualized network connection and bandwidth usage; (7) new open source firewall (pfSense) program; and (8) assistance to the iGov Project Team in installing the government's public WiFi service within the vicinity of the Institute.

IT Helpdesk Services

For 2016, the MISS provided and completed 316 IT Helpdesk services to PNRI staff in various forms of troubleshooting, maintenance and enhancements related to email and other related concerns.

IT-related orientation/ awareness seminars

The MISS conducted awareness seminars to 16 sections of the Institute. The activity sought to make PNRI staff aware of network security issues, basic computer troubleshooting, new developments in PNRI's Intranet and Internet services and new information systems being operationalized in the Institute.

MISS expertise on RAIS

The MISS continued to be recognized by the IAEA as an expert in the installation, configuration and training of users of the Regulatory Authority Information System (RAIS). In 2016, the IAEA deployed to Brunei Darussalam a staff of the MISS for this purpose.



IT staff of the Management Information System Section at the PNRI server room

Business Development

Technology Transfer

Through its Business Development Section, PNRI successfully obtained a signed licensing term sheet from adopters of the hydrogel wound dressing. It was subsequently adjudged as 'fair to the licensor' by the Fairness Opinion Board headed by the DOST Secretary. The next phase will be commercialization by the adopters in 2017.

Technology Promotion

PNRI embarked on a marketing campaign in 2016 in promoting PNRI technologies to other potential adopters. Various meetings, presentations, and negotiations were conducted the whole year which included technical and site visits of potential adopters and business partners. The campaign included PNRI participation as resource person/exhibitor in five Technology Transfer Day events of DOST held at Sofitel Hotel in Manila; Asian Institute of Management in Makati City; SMX Convention Center in Davao; Batangas State University in Batangas; and Ormoc Superdome in Leyte.



PNRI Business Development Section Officer-in-Charge presents the Institute's technologies for commercialization

Intellectual Property Management

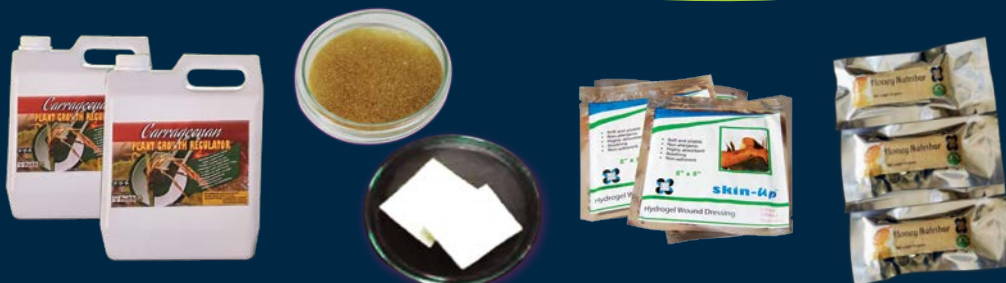
To secure intellectual property rights involving PNRI projects and products, the BDS facilitated the signing of 11 Confidentiality and Non-Disclosure Agreements (CNDAs) between PNRI and interested potential adopters. Eight assessment meetings to audit documents for potential technologies and intellectual properties (IP) were also conducted with the PNRI researchers. BDS has been able to successfully process eight PNRI invention disclosures in agriculture, health and medicine, environment,

and in industry into intellectual property protection applications. A total of eight invention disclosures have been processed and are now filed at the Intellectual Property Office. It is expected that these processed applications can become either patents or utility models.

Policy Development

Through its participation in DOST policy development initiatives, the PNRI was able to actively work from drafting to signing of IP Policies and protocols for research and development institutes (RDIs) and public-funded research and development which were promulgated after getting published in the Official Gazette.

The PNRI-developed technologies, namely, carrageenan plant growth promoter (PGP) as plant food supplement; hemostats; polyvinyl pyrrolidone (PVP) carrageenan hydrogel dressing; and honey nutribar are now ready for licensing by any individual or corporation wanting to commercialize the technologies.



S & T Linking and Networking



Representatives of various colleges and universities along with PNRI officials and staff during a meeting for future collaboration in research and education activities on nuclear S & T

Local S & T Networking

The implementation of the Institute's various activities was successfully carried out in partnership with private companies and government agencies which include the following:

- Ateneo de Manila University
- Bureau of Customs
- Department of Agriculture
 - Bureau of Fisheries and Aquatic Resources
 - Bureau of Soils and Water Management
 - Philippine Center for Postharvest Development and Mechanization
- Department of Science and Technology (DOST) and DOST Councils, Research and Service Institutes
- Department of Education, Division of City Schools National Capital Region
- FEATI University
- Katy's Farm, Cavite City
- Luzon Agricultural Research and Extension Center in Floridablanca, Pampanga
- Manila Observatory
- National Fisheries Research and Development Institute
- National Disaster Risk Reduction Management Coordinating Council (NDRRMC) and member agencies of the National Radiological Emergency Preparedness and Response Plan (RADPLAN)
- Partnership for Clean Air, Inc.
- Philippine Rice Research Institute
- Philippine Society for Nondestructive Testing, Inc.
- Quezon City Science Community
- Sugar Regulatory Commission
- Surigao del Sur State University – Cantilan Campus

Most of PNRI's nuclear S & T projects receive invaluable support from various local and international organizations, both in terms of financial assistance and technical expertise. The Institute's success in establishing and strengthening these linkages and networks is an important foundation for fulfilling its mandate, as well as in sustaining the Philippines' good standing among members of the local and international communities.



PNRI Director Dr. Alumanda Dela Rosa and Partnership for Clean Air (PCA) President Mr. Renato Pineda Jr. sign the Memorandum of Agreement for Air Pollution studies (June 20, 2016)

Foreign S & T Networking

The Philippines, through the PNRI, continued to nurture its collaborations with the International Atomic Energy Agency and other institutions/organizations including the following:

- Asian Network for Education in Nuclear Technology
- Asian Nuclear Safety Network
- Australian Nuclear Science and Technology Organization
- Comprehensive Nuclear-Test-Ban Treaty Organization
- European Commission
- Forum for Nuclear Cooperation in Asia, Japan
- Hirosaki University, Japan
- Japan Atomic Energy Agency
- Korea Institute of Nuclear Safety
- Ministry of Education, Culture, Sports, Science and Technology of Japan
- Nuclear Safety Research Association, Japan
- Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA)
- RCA Regional Office in Korea
- United States Department of Agriculture
- United States Department of Energy



PNRI Officer-in-Charge Dr. Carlos Primo C. David and PNRI officials and researchers with representatives from Japan Atomic Energy Agency

FOREIGN S & T NETWORKING AT A GLANCE

8 IAEA research contracts implemented

7 IAEA technical cooperation projects implemented

85 IAEA experts/mission delegates

13 PNRI hosting of regional meetings, seminars, workshops and regional training courses

108 PNRI and **47** non-PNRI personnel received training/ fellowship grants from foreign institutions/agencies

IAEA TECHNICAL COOPERATION PROJECTS* IMPLEMENTED IN 2016

TITLE/DESCRIPTION OF RESEARCH	NAME OF CONTACT PERSON
Building Capacity in Nuclear Science and Technology by Re-establishing the Research Reactor-I as a Triga Fuel Subcritical Assembly	Kristine Marie Romallosa PNRI
Assessing the Development of a Nuclear Power Programme	Jesus Tamang Department of Energy
Building Capacity in Using the Sterile Insect Technique Against Dengue and Chikungunya Vectors	Glenda Obra PNRI
Enhancing Capacity for Synthesis and Characterization of Medical Diagnostic Kits for Nuclear Pharmacy Applications	Adelina Bulos PNRI
Establishing Quality Management Systems in Nuclear Medicine and Radiotherapy	Dan Joseph Manlapaz, National Kidney and Transplant Institute
Building Capacity for the Detection, Quantification and Monitoring of Emerging Harmful Algal Bloom (HAB) Toxins	Rhett Simon Tabbada PNRI
Supporting Safety Assessment and Safety Case for the Near Surface and Borehole Disposal Facilities	Alfonso Singayan PNRI

*Technical Cooperation Projects are under the IAEA Technical Cooperation Program and funded by the Technical Assistance Committee Fund and extrabudgetary contributions to the IAEA. Financial support is provided into their components, namely, expert assistance, equipment donation and overseas training.

IAEA RESEARCH CONTRACTS* IMPLEMENTED IN 2016

TITLE/DESCRIPTION OF RESEARCH	NAME OF RESPONSIBLE AGENCY STAFF
Philippine Nuclear Research Institute	
Application of Radiation Technology in the Development of Advanced Packaging Materials for Food Products	Zenaida De Guzman
Development and Characterization of Packaging Materials for Irradiated Food Products	Lucille Abad
Enhancing Cytogenetic Biological Dosimetry Capabilities of the Philippines for Nuclear Incidence Preparedness	Celia Asaad
Development of Handling, Transport, Release and Trapping Methods of Dengue Mosquito Vector <i>Aedes aegypti</i> in the Philippines	Sotero Resilva
Uranium/Thorium Fuelled High Temperature Gas Cooled Reactor Applications for Energy Neutral and Sustainable Comprehensive Extraction and Mineral Product Development Processes	Rolando Reyes
Geochemical and Mineralogical Characterization of Uranium and Thorium Deposits	Edmundo Vargas
Collection and Analysis of Radiation Detection Data for Alarming Containers	Julietta Seguis
Food and Nutrition Research Institute	
Measurement of Breast Milk Intake Among Filipino Urban Children Aged 12-18 Months to Estimate Vitamin A Intake Amidst Multiple Large Scale Vitamin A Programs	Mario Capanzana

*IAEA Research Contracts are grants under the IAEA Contract Research Programme whose funding source from the IAEA Regular Budget and also from the extra budgetary contributions to the IAEA. Through this program minor equipment and miscellaneous local purchases are provided. The grant to a project on average is 5,000 US dollars per year.

44th ATOMIC ENERGY WEEK

December 5 - 9, 2016

Teknolohiyang Nukleyar Para sa Kaunlaran ni Juan



As mandated under Presidential Proclamation No. 1211 in 1973, the Department of Science and Technology – Philippine Nuclear Research Institute (DOST-PNRI) celebrated the 44th Atomic Energy Week (AEW) from December 5-9, 2016 with the theme “Teknolohiyang Nukleyar Para sa Kaunlaran ni Juan”, at the PNRI compound. The annual AEW celebration aims to help generate the awareness of the Filipinos on the beneficial uses of nuclear science and technology in food, agriculture, industry, medicine and the environment.

OPENING CEREMONIES

PNRI Officer-in-Charge Dr. Carlos Primo David delivers an inspirational message during the AEW opening ceremonies. Behind him (from left) are 44th AEW Chairperson Ms. Ana Elena Conjares, Atty. Al-may Sair Patangan, representing Congressman Seth Frederick Jalosjos, and PNRI Officer-in-Charge, Office of the Deputy Director Dr. Soledad Castañeda



AEW EXHIBITS

PNRI staff featured their various projects and services to compete for the Best Technical Exhibits Category.

- **First place:** The PNRI Chemistry Research Section exhibit entitled "Chemistry Research Section, We Explore, We Develop"
- **Second place:** Agriculture Research Section exhibit "Smart Juan: Ang Makabagong Dalubsaka"
- **Third place:** The Biomedical Research Section's "Teknolohiyang Nukleyar: Kalusugan Ang Handog Para Kay Juan"
- **People's Choice Award** went to the Radiological Impact Assessment Section's PNRI Emergency Response: Minimizing the Consequences of Ionizing Radiation.



PRESS CONFERENCE

PNRI Officer-in-Charge Dr. Carlos Primo C. David addresses the questions and concerns of the members of the media regarding the PNRI technologies, products, facilities and services being featured at the 44th AEW.



TECHNICAL SESSIONS

On December 5 to 6, experts from PNRI and other scientific institutions delivered lectures on the applications of nuclear analytical and isotopic techniques in air quality and algae studies; records of nuclear activities through Philippine corals; radiation processing; nuclear medicine; and the establishment of several advanced facilities such as a research reactor, accelerator, subcritical reactor assembly and neutron laboratory. Around 400 participants from the academic, commercial and government sectors attended the sessions.



PNYS / PNSQ

(Left) The 2nd Philippine Nuclear Youth Summit participants and (Right) The Philippine Nuclear Science Quiz finalists



GUIDED TOUR AT PNRI FACILITIES AND LABORATORIES

Students, teachers, members of the media, representatives from the medical sector and the public visited the open house exhibits and facilities of the PNRI.



AEW 2016 Best PNRI Tour Guides:

Junior Category - Ronald Daryll Gatchalian
Senior Category - John Faustus Vidal



CLOSING CEREMONIES

Dr. Teofilo O. San Luis, President of the Philippine Society for Nuclear Medicine, was the guest speaker during the 44th AEW closing ceremonies on December 9. At the closing ceremonies, the PNRI gave awards and recognitions to the following: winners of the various competitions for the AEW activities; scientists and researchers who won DOST International Publication Awards for their articles published in internationally-recognized journals; PNRI employees and project teams who performed exceptionally well in their respective divisions; and employees who have dedicated decades of their lives in service to the Institute.



PNSQ 2016

PHILIPPINE NUCLEAR SCIENCE QUIZ



(Foreground) The 2016 PNSQ First Prize winners and their coach, 3rd, 4th and 5th (from left) from Manila Science High School. The award was given during the closing ceremonies of the 44th AEW on December 9.
(Background) The 2nd and 3rd PNSQ winners

Twenty teams of high school students from across the country competed in the national level of the 2016 Philippine Nuclear Science Quiz (PNSQ). Manila Science High School won first place, followed by Pasig City Science High School and Philippine Science High School – Eastern Visayas. The first placer received a cash prize of Php 50,000, the second placer Php 40,000 and the third placer Php 30,000, all including plaques and certificates of recognition.

The elimination round was conducted in October featuring a video-making competition among would-be contestants about the benefits of nuclear S&T. Out of 26 video entries reflecting the theme “Teknolohiyang Nukleyar para sa Kaunlaran ni Juan”, the entry entitled “Nuclear Technology in the Philippines: Risk with Opportunity” by Davao City National High School won the first prize.

PNSQ 2016 WINNERS

- 1st PLACE (Php 50,000) Manila Science High School, NCR ***
Ferdinand S. Bautista (Coach); Mark Allen V. Facun and Allen J. Mesa, Jr.
- 2nd PLACE (Php 40,000) Pasig City Science High School, NCR ***
Villa-Michelle P. De Vera (Coach); Carl Terence S. Valdelion and Theodore Dave T. Comentan
- 3rd PLACE (Php 30,000) Philippine Science High School, Eastern Visayas Region ***
Herma Z. Morales (Coach); Rikki Justin A. Chu and Deitro L. Dazo
- CONSOLATION (Php 15,000) Tuguegarao City Science High School ***
Sheela A. Apostol (Coach); Mariah Hannah R. Salvanera and Dennis Gabriel F. Velasco
- Negros Occidental High School * Eunice A. Malala (Coach);**
Lizily R. Castro and Brynx Junil T. Alegarbes

VIDEO ENTRY WINNER:

Nuclear Technology in the Philippines: Risk with Opportunity
Davao City National High School



PHILIPPINE NUCLEAR YOUTH SUMMIT

PNYS 2016

More than 160 students and young professionals participated in the Second Philippine Nuclear Youth Summit (PNYS) held on December 7, 2016 as part of the 44th Atomic Energy Week. The PNYS aims to provide a forum for the youth to share information and scientific knowledge as potential future leaders and scientists.

Speakers from PNRI along with Young Generation in Nuclear (YGN) leaders from Malaysia and Indonesia inspired the students to engage in science and mathematics-related courses, while the participants showcased Filipino creativity and skill by competing in various games and group dynamics.



TECHNICAL POSTER WINNERS	
RANK	SCHOOL/PARTICIPANTS
1st PLACE (Php 5,000)	Commonwealth High School 1. Marck Anjelou A. Calindatas 2. John-Niel T. Masong
	Commonwealth High School 1. Lawrence F. De Leon 2. John-Niel T. Masong



TOPICS PRESENTED BY EXPERTS FROM DIFFERENT FIELDS

1. **"What is it like to be a Scientist?"** by Dr. Angel T. Bautista, VII, PNRI
2. **"Plain Curiosity / Let's Start With The Children"** by Mr. Raymond J. Sucgang, PNRI
3. **"Building Nuclear Youth Community"** by Mr. Dimas Irawan, National Nuclear Energy Agency of Indonesia (BATAN)
4. **"Shaping a Nuclear Future for Malaysia"** by Ms. Myra Razali, Malaysian Nuclear Power Corporation



Human Resources Development

Behind all the successes and accomplishments are the men and women of PNRI, whose academic and professional development are necessary not only for sustaining but also for enhancing the Institute's capabilities, whether in research, services, technology diffusion or nuclear regulations.

2 PNRI staff who obtained their doctoral and masteral degrees in 2016:

Angel T. Bautista, VII
 Science Research Specialist II
 Nuclear Analytical Techniques Application Section
 Nuclear Services Division
 PhD in Nuclear Engineering and Management
 University of Tokyo, Japan

Jorge R. Sahagun
 Science Research Specialist I
 Agriculture Research Section, Atomic Research Division
 MS in Agricultural Biotechnology
 Naresuan University, Thailand

15 PNRI staff pursued post graduate degrees through local/foreign scholarships

44 Nuclear training courses conducted by PNRI with 756 participants

11 Students from two schools were accepted for thesis advisorship at PNRI

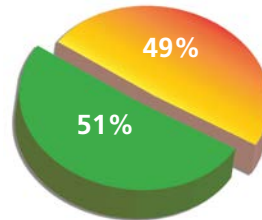
139 Students from 29 schools were accommodated for on-the-job training at PNRI

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

108 PNRI personnel and **47** non-PNRI personnel received training/fellowship grants from foreign institutions/agencies

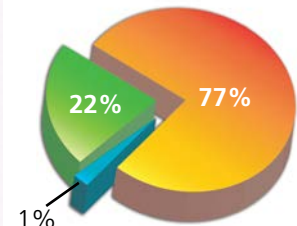
DISTRIBUTION OF PERSONNEL

BY GENDER



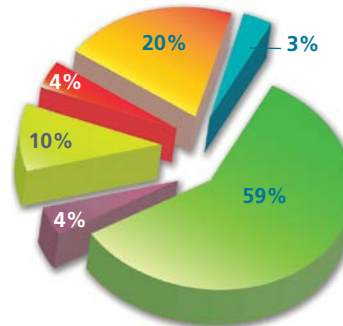
■ FEMALE 101
■ MALE 106
TOTAL 207

BY STAFF CATEGORY



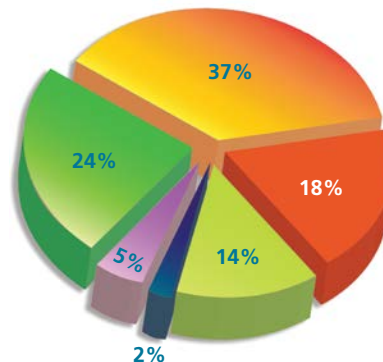
■ TECHNICAL
■ MANAGERIAL
■ ADMINISTRATIVE
TOTAL 207

BY EDUCATION



■ With PhD
■ MS/MA
■ Post BS/BA
■ BS/BA
■ Post High School
■ High School and below
TOTAL 207

BY PNRI STAFF ACTIVITY



■ R&D
■ Technology Delivery
■ S&T Services
■ S&T Education
■ Regulatory
■ Administrative
TOTAL 207

PNRI RECOGNITION AWARDS

MODEL EMPLOYEES

P.R.A.I.S.E. Special Award

The Program and Awards and Incentives for Service Excellence (PRAISE) Special Award for expertise shared to the Institute on matters relating to nuclear technology



¹ Teofilo Y. Garcia, ² Ryan Joseph Aniago, ³ Eliza B. Enriquez, ⁴ Christopher O. Mendoza, ⁵ Charles Darwin T. Racadio, ⁶ Juanario U. Olivares and ⁷ Christian L. Delasada

For establishing the online and real-time environmental radiation monitoring system in PNRI, Quezon City, in Aparri, Cagayan and in Puerto Princesa, Palawan in pursuit of strengthening the capability of the Philippines to face radiation emergencies, despite all the difficulties endeavoring to perform its responsibilities with utmost commitment and virtuosity amidst adversity



¹ Vangeline K. Parami, ² Kristine Marie D. Romallosa, ³ Neil Raymund D. Guillermo, ⁴ Alvie A. Astronomo, ⁵ Ryan U. Olivares, ⁶ Unico A. Bautista and ⁷ Ma. Celerina M. Ramiro

For performing their assigned duties as Technical Working Group with utmost competence and integrity in the conduct of NEDA-funded Feasibility Studies (FS) on the establishment of Accelerator and Research Reactors undertaken by Aspiretech

Director's Choice Award

Radiation-Modified Carrageenan Plant Growth Promoter Project Team

For engaging in the development and field testing of PNRI's irradiated Plant Growth Promoter formulation which was proven effective in improving the growth, health and yield of food crops such as rice, mungbean and peanut.

DIVISION AWARD

For contributing greatly to the accomplishment of the division's functions and goals



Atomic Research Division
CHRISTOPHER O. MENDOZA
Science Research Specialist I
Health Physics Research Section



Nuclear Regulatory Division
NORMAN JAY V. BARRO
Science Research Analyst
Licensing, Review and Evaluation Section



Nuclear Services Division
GEOFFREY O. TRANQUILAN
Science Research Assistant
Irradiation Services Section



Technology Diffusion Division
ABIGAIL D. CLEMENTE
Science Research Specialist I
Nuclear Training Center



Finance and Administrative Division

(Left) **CAMILLE GRACE B. BEREDO**
Administrative Assistant II,
Human Resource Management and
Records & Communication Section

(Right) **AILEEN B. CEZAR**
Administrative Aide VI, Human Resource
Management and Records & Communication Section



LOCAL & INTERNATIONAL AWARDS

Atoms For Peace Award

DOST Secretary Mario Montejo with President Barack Obama of the United States.

During the 4th Nuclear Security Summit hosted by the US, the Philippines received the Atoms for Peace Award in recognition of its contributions in nuclear security, particularly through the removal of highly-enriched uranium from the country's territory.



Photo from the Department of Foreign Affairs

IMRP Best Poster Award



Dr. Lucille V. Abad, PNRI scientist received the Best Poster Award from the International Irradiation Association (IIA) for the PNRI project's E-poster "E-beam production of Radiation-Modified Carrageenan as Plant Growth Promoter" during the International Meeting on Radiation Processing (IMRP) held from November 7 to 11 in Vancouver, Canada.

PNRI's Plant Growth Promoter were proven effective in increasing the yield of crops such as rice, mungbean and peanut, as well as in improving resistance against diseases such as tungro bacilliform virus infestation and bacterial leaf blight.

Best Oral and Poster Presentation Awards in Japan



Mr. Chitho Feliciano of the PNRI Biomedical Research Section won the De Silva Prize for Best Oral Presentation in Tsukuba, Japan, the Best Poster Presentation Award during the AsiaNANO Conference in Sapporo, Japan, and the Best Poster Presentation Award at the Chemistry Society of Japan Festa in Tokyo, Japan.



His studies aim to use nanoparticles to improve the therapeutical effect androoxide radicals and to reduce the effects of skin aging skin lesions and other skin inflammatory disorders caused by UV rays and other forms of ionizing radiation as well as radiation-induced reactive oxygen.

2016 Best Institute Award

PNRI scientists garnered awards for 11 papers published in internationally recognized journals. The awards were given by the National Academy of Science and Technology during the 4th DOST International Publication Award ceremonies held on December 1, 2016 at the Manila Hotel.



2016 International Publication Award*

- "Insecticidal Activity of Four Essential Oils against Diamondback Moth, *Plutella xylostella* Linnaeus (Lepidoptera: Pyralidae)" (by Abigailie Mia V. Javier, Virginia R. Ocampo, Flor A. Ceballos, Pio A. Javier) ISSN 0031-7454; Philippine Agricultural Scientist 99(2): 156-163 2016
- "Grafting of N,N-dimethylaminoethyl methacrylate from PE/PP nonwoven fabric via radiation-induced GRAFT polymerization and quaternization of the grafts" (by Jordan F. Madrid, Murat Barsbay, Lucille V. Abad, Olgun Güven) ISSN 0969-806X Radiation Physics and Chemistry 124:145-154 2016
- "Pupal eye color of *Bactrocera philippinensis* (Drew & Hancock) as tool for radiation sterilization" (by Sotero S. Resilva, Glenda B. Obra) ISSN 0031-7683 Philippine Journal of Science 145(2): 139-151 2016
- "Homeostatic efficacy evaluation of radiation crosslinked carboxymethyl kappa-carrageenan and chitosan with varying degrees of substitution" (by Charito T. Aranilla, Bin Jeremiah D. Barba, Jeanine Richelle M. Vista, Lucille V. Abad) ISSN 0969-806X Radiation Physics and Chemistry 124:124-128 2016
- "Size-dependent changes in toxicity of *Perna viridis* mussels exposed to natural populations of *Pyrodinium bahamense* var. *compressum*" (by Ma. Llorina O. Rañada, Rhett Simon dC. Tabbada, Aileen DL. Mendoza, Juan Relox Jr., Elvira Z. Sombrito) ISSN 2352-4855 Regional Studies in Marine Science 3: 176-180 2016
- "Fish diversity and trophic interactions in Lake Sampaloc (Luzon Is., Philippines)" (by Jonathan Carlo A. Briones, Rey Donne S. Papa, Gil A. Cauyan, Norman Mendoza, Noboru Okuda) ISSN 0564-3295 Tropical Ecology 57(3):567-581 2016
- "Microstructured boron foil scintillating G-GEM detector for neutron imaging" (by Takeshi Fujiwara, Unico Bautista, Yuki Mitsuya, Hiroyuki Takahashi, Norifumi L. Yamada, Yoshie Otake, Atsushi Taketani, Mitsuru Uesaka, Hiroyuki Toyokawa) ISSN 0168-9002 Nuclear Instruments & Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 838:124-128 2016
- "Microbiological quality of brown rice, ready-to-eat pre-cut fresh fruits, and mixed vegetables irradiated for immuno-compromised patients" (by Chitho P. Feliciano, Zenaida M. de Guzman, Levelyn Mito M. Tolentino, Celia O. Asaad, Maria Lucia C. Cobar, Gina B. Abrera, Davison T. Baldos, Gilberto T. Diano) ISSN 0969-806X Radiation Physics and Chemistry 130(2017): 397-399 2016
- "Historical record of nuclear activities from ^{137m} in corals from the northern hemisphere (Philippines)" (by Angel T. Bautista VII, Hiroyuki Matsuzaki, Fernando P. Siringan) ISSN 0265-931X Journal of Environmental Radioactivity 164:174-181 2016
- "Triterpene and sterols from *Hoya pubicalyx* Merr." (by Nelson M. Panahon, Fernando B. Aurigue, Ian van Altena, Consolacion Y. Ragasa) ISSN 0975-5071; Der Pharmacia Lettre 8(13): 270-273 2016
- "Triterpenes and sterols from *Hoya diversifolia* Blume" (by Nelson M. Panahon, Fernando B. Aurigue, Chien-Chang Shen, Consolacion Y. Ragasa) ISSN 2231-3354 Journal of Applied Pharmaceutical Science 6(6):79-82 2016

*See Appendices, Table 6 for list of publications.

2016 DOST Utility Award

Certificate of Recognition was given to Lorna S. Relleve, Lucille V. Abad, David T. Bolong and Carlo C. Bisnar for garnering a NAST International Publication and Intellectual Property Award for Registration of a Utility Model on "Polyvinyl pyrrolidone-chitosan implant for endoscopic treatment of Vesicoureteral Reflux"

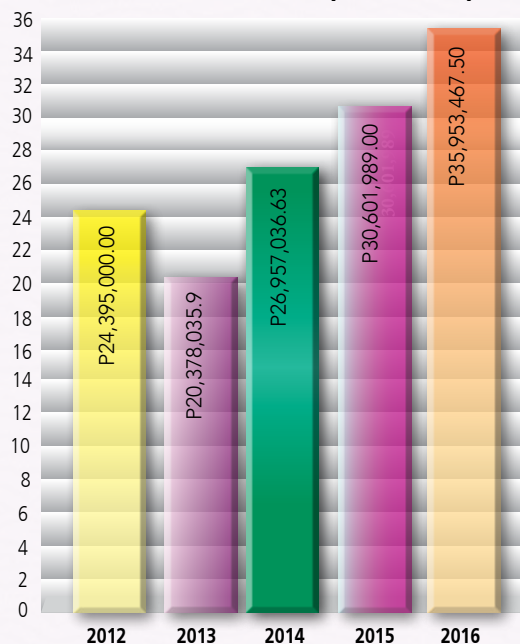
Financial Resources



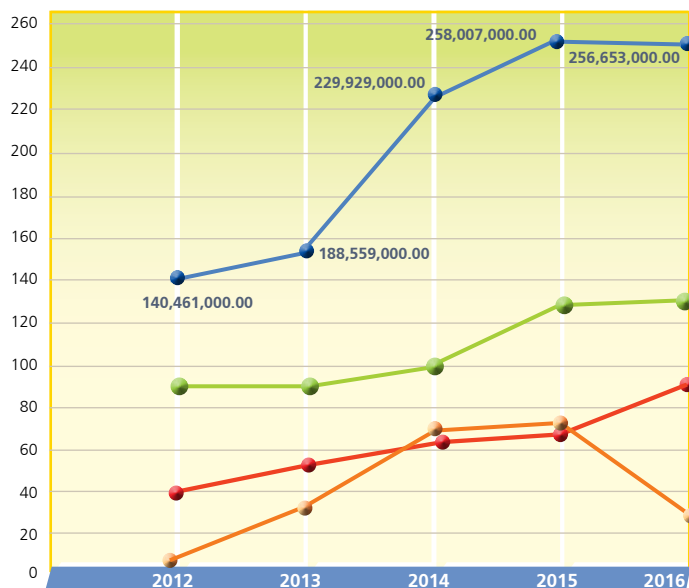
In 2016, PNRI had a budget allotment of P256,653,000.00 by class and P153,506,000.00 by major final output. Additional resources were also generated through local and foreign-funded projects on nuclear science and technology applications.

The Institute generated an annual income of P35,953,467.50 for this year. (Please see page 56 for details on PNRI 2016 Income.)

ANNUAL INCOME (2012-2016)



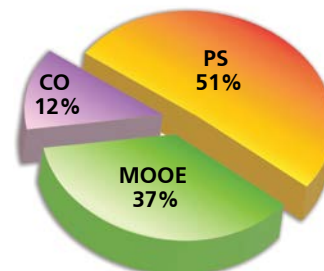
ANNUAL PNRI BUDGET (2012-2016)



Legend:

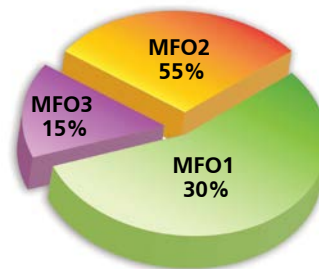
- PS (Personal Services)
- MOOE (Maintenance & Other Operating Expenses)
- CO (Capital Outlay)
- TOTAL

YEAR	PS	MOOE	CO
2012	91,892,749	40,089,251	8,479,000
2013	92,679,000	56,844,000	31,000,000
2014	101,931,000	65,065,000	62,933,000
2015	129,813,000	65,194,000	63,000,000
2016	131,949,000	93,839,000	30,865,000



2016 ALLOTMENT BY EXPENSE CLASS

PS	₱ 131,949,000.00
MOOE	₱ 93,839,000.00
CO	₱ 30,865,000.00
Total	₱ 256,653,000.00



2016 EXPENDITURES BY MAJOR FINAL OUTPUT (MFO)

MFO1	₱ 45,375,000.00	• Scientific Research & Development
MFO2	₱ 84,514,000.00	• Technical Advisory Services
MFO3	₱ 23,617,000.00	• Nuclear Regulatory Services
Total	₱ 153,506,000.00	

Additional Resources Generated from External Sources - 2016

Grant	Amount
Local Grants-in-Aid	Php 107,060,555.00
Foreign Grants	Php 2,602,505.00
TOTAL	Php 109,663,060.00

INCOME FROM PNRI SERVICES *2016

SOURCE OF INCOME	INCOME GENERATED (in Pesos)	SOURCE OF INCOME	INCOME GENERATED (in Pesos)
A. NUCLEAR PERMITS & LICENSES	3,638,200.00	Radioactivity Analysis	2,233,050.00
• Licensing Fees	1,423,500.00	Gammametric Analysis	668,400.00
• Permit Fees	2,214,700.00	Gross Alpha-beta Analysis	1,564,650.00
Transport Certificate	2,023,200.00	Radioactive Waste Management	207,600.00
Release Certificate	188,700.00	Biological Test	138,150.00
Certificate of Exemption	2,800.00	Cytogenetic Analysis	22,750.00
B. SERVICE INCOME	32,282,967.50	Sterility Test	44,800.00
Inspection & Audit Fees	651,250.00	Bioburden Test	56,000.00
Fines & Penalties (Late Charges - OSL/TLD/ Survey Meter)	212,374.00	Aerobic Plate Count	1,000.00
Radiation Protection Services	21,455,280.00	Mold and Yeast Count	1,000.00
Monitoring films/OSL/TLD and Cassettes	17,511,630.00	Aging Test	12,600.00
Calibration	2,128,000.00	Radioanalytical and Related Tests	819,493.50
Leak Test/Spent-Sealed Sources	118,600.00	Vinegar Adulteration	76,000.00
Swipe Test	977,900.00	Radon Analysis	742,056.00
Radiation Monitoring/Hazards Evaluation	73,000.00	Elemental Analysis	1,437.50
Rental of Survey Meter	406,150.00	C. BUSINESS INCOME	32,300.00
Rental of Moisture Density Gauge	220,000.00	Other Business Income	32,300.00
Repair of Survey Meter	20,000.00	Use of Dose Calibrator	700.00
Gamma Irradiation Services (Use of Co-60 facility)	6,565,770.00	Use of Diagnostic Instrument/Rotary Evaporator	25,000.00
		Miscellaneous	6,600.00
		TOTAL INCOME	35,953,467.50

LIST OF ABBREVIATIONS

ANSTO	Australian Nuclear Science and Technology Organization	MEXT	Ministry of Education, Culture, Sports, Science and Technology of Japan
ANSN	Asian Nuclear Safety Network	OAP	Office of Atoms for Peace, Thailand
CTBTO	Comprehensive Nuclear Test Ban Treaty Organization	KOTRA	Korea Trade Promotion in Asia
DOE/NNSA	Department of Energy/National Nuclear Security Administration (U.S.)	PCAARRD	Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development
DOST	Department of Science and Technology	PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
DOST-HRD	DOST- Human Resource Development	PCHRD	Philippine Council for Health Research and Development
ENSTTI	European Nuclear Safety Training and Tutoring Institute	PCIEERD	Philippine Council for Industry, Energy and Emerging Technology Research and Development
EU	European Union	RAIS	Regulatory Authority Information System
EC-JRC	European Commission Joint Research Center	PHIVOLCS	Philippine Institute of Volcanology and Seismology
FNCA	Forum for Nuclear Cooperation in Asia	RCA	Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific
IAEA	International Atomic Energy Agency	RCARO	RCA Regional Office in Korea
INSEP	International Nuclear Safeguards and Engagement Program	UNDP	United Nations Development Programme
JAEA	Japan Atomic Energy Agency	USDOE	United States Department of Energy
JSPS	Japan Society for the Promotion of Science	WERC	Wakasa Energy Research Center
KINAC/INSA	Korea Institute of Nuclear Nonproliferation and Control/ International Nuclear Nonproliferation and Security Academy		
KINS	Korea Institute of Nuclear Safety		

TABLE 1. PNRI TECHNICAL TRAINING COURSES CONDUCTED IN 2016

TITLE OF TRAINING	TRAINING VENUE/LOCATION	NO. OF PARTICIPANTS	INCLUSIVE DATES CONDUCTED
RADIOISOTOPE TECHNIQUES			
Course on Medical Uses of Radioisotopes (CMR)	PNRI	85 (*10)	18 Jan - 12 Feb; 20 June - 15 July; 5 - 30 Sept
NUCLEAR SCIENCE AND TECHNOLOGY			
Seminar on Nuclear Science for Teachers (SNST)	PNRI	18 (*2)	18 April - 20 May
Course on Nuclear Technology (CNT)	PNRI	2	18 April - 20 May
RADIATION SAFETY			
Radiation Safety Course- Industrial Radiography (RSC-IR)	PNRI	10	1 - 12 Feb
Radiation Safety Course – Sealed Sources in Industrial Devices (RSC-ID)	Tomorrow's Plastic, Mandaue City, Cebu; Taganito THPAL, Surigao Del Norte; CBNC, Palawan; PNRI	143	4 - 8 Jan; 25 – 29 Jan; 7 – 11 March; 28 May – 1 Apr; 30 May - 3 June; 22 – 26 Aug; 24 – 28 Oct
Radiation Safety Course – Commercial Sale involving Radioactive Materials and Low Activity Sources (RSC-CL)	Glimex Inc., Makati City; CRL Environment, Clarkfield, Pampanga; PNRI	51	12 - 13 Jan; 5 - 6 April; 11 - 12 April; 26 - 27 July; 11 - 12 Oct
Radiation Safety Refresher Course (RSRC)	PNRI; EEI Corp., Quezon City	66	12-14 April; 27 – 29 July; 2- 4 Aug
Seminar on Radiation Safety	Siemens Power Operations, Inc., Batangas City	12	7 - 8 April
NUCLEAR POWER (conducted in cooperation with the Japan Atomic Energy Agency)			
JAEA Follow-up Training Course on Reactor Engineering – Level 1	PNRI	20	6 – 17 June
EMERGENCY PREPAREDNESS (conducted in cooperation with the Japan Atomic Energy Agency)			
JAEA Follow-up Training Course on Nuclear and Radiological Emergency Preparedness and Response	PNRI	38 (*18)	29 Feb - 4 March; 3 - 7 Oct
ENVIRONMENTAL RADIOACTIVITY (conducted in cooperation with the Japan Atomic Energy Agency)			
JAEA Follow-up Training Course on Environmental Radioactivity Monitoring	PNRI	37 (*18)	22 - 26 Feb; 19 - 23 Sept
NON-DESTRUCTIVE TESTING (conducted in cooperation with the Philippine Society for Nondestructive Testing, Inc.)			
Surface Methods – Level 2	PNRI	43 (*1)	11 – 22 Jan; 25 Apr – 6 May; 10 – 21 Oct
Radiographic Testing – Level 2	PNRI	70 (*3)	9 – 22 Feb; 6-17 June; 7 -18 Nov
Ultrasonic Testing – Level 2	PNRI	89 (*1)	7 – 18 Mar; 16 – 27 May; 11 – 22 July; 5 – 16 Dec
Eddy Current Testing – Level 2	PNRI	27	11 – 22 Apr; 8 – 22 Aug
Infrared Thermographic Testing – Level 1	PNRI	19	23 – 27 May; 10 – 14 Oct
WELDING TECHNOLOGY (conducted in cooperation with the Philippine Society for Nondestructive Testing, Inc.)			
Welding Inspectors	PNRI	26	25 – 29 Jan; 5 – 9 Sept

TOTAL NO. OF COURSES CONDUCTED BY PNRI: 44

TOTAL NO. OF PARTICIPANTS: 756

* Number of PNRI Participants

TABLE 2. PNRI HOSTINGS IN 2016

FIELD	PHILIPPINE PARTICIPANT	AGENCY / INSTITUTE	ORGANIZER/S	VENUE	DATE
ANSN Regional Workshop on Safety Culture Self Assessment (SCSA) for Middle Managers	Guisepppe Filam O. Dean; Celia Asaad; Christopher Halnin; Mylene Espinal; and Cecilia de Vera	PNRI	IAEA/ANSN	Hotel Novotel Quezon City	18 – 22 Jan
FNCA Workshop on Electron Accelerator Application Project	Charito T. Aranilla	PNRI	FNCA	Meranti Hotel Quezon City	8 – 11 Feb
Regional Training Course on Integrated Good Agricultural Practices/Technology Packages Based on Innovative Soil, Water and Nutrient Management under RAS 5073 Project (CRIPS)	Elvia Bayalas and Perla Estabillo Willy Hart Cullano Filomena Grospe	BSWM PNRI PhilRice	IAEA		11 – 20 April
11th ANSN Information Technology Support Group Annual Meeting	Ana Elena Conjares; Christopher Halnin; Marlon Dave Regoso; and Christine Singayan	PNRI	IAEA/ANSN	B. Hotel, Quezon City	20 – 24 June
Regional Workshop on Identifying Trans-boundary Air Pollution Events Across Asia-Pacific	Julieta Manlapaz; Wilfren Clutario; Jean Rosete; Joseph Michael Racho; and Therese Jean Sarabia	Partnership for Clean Air	IAEA	Hotel Novotel, Quezon City	27 June – 1 July
Regional Workshop on Implementation of Optimization, ALARA Principles and Radiation Protection Program for Medical Applications	Norberto Abella Julie Cruz Ma. Gladys Cabrera	UP-PGH-Dr. Jose G. Tamayo Medical Center East Avenue Medical Center CDRRHR DOH	IAEA	Hotel Novotel, Quezon City	1 – 5 Aug

TABLE 2. PNRI HOSTINGS IN 2016 (continuation)

FIELD	PHILIPPINE PARTICIPANT	AGENCY / INSTITUTE	ORGANIZER/S	VENUE	DATE
Regional Training Course for Teachers to Introduce Nuclear Science in Secondary Schools Through Innovative Approaches	Liza Alvarez; Maria Pilar Capalongan; Isabel Palomar; Rebecca Roxas; and Arturo Tolentino	Department of Education - National Capital Region	IAEA	Hotel Novotel, Quezon City	22 – 26 Aug
IAEA/IFNEC International Conference for Asia and the Pacific	Donato Marcos; Jesus Tamang; Angelina Manga; Mylene Capongcol; Rino Abad; and Carmencita Bariso	Department of Energy	IAEA	Diamond Hotel, Manila	30 Aug – 1 Sept
	Lorna Dy; Urbano Mendiola, Jr.; Enelita Delos Reyes; Manuel Luis Plofino; and Charity Jayma	National Power Corporation			
	Alumanda M. Dela Rosa; Soledad Castaneda; Teofilo V. Leonin, Jr.; Graceta de Leon Cuevas; Nydia Medina; Ma. Celerina Ramiro; Rhodora Leonin; Kristine Marie Romallosa; and Neil Guillermo	PNRI			
Regional Training Course on Intensity Modulated Radiation Therapy for Prostate Cancer and other Urological Cancers	Maria Lourdes Lacanilao and Mary Anne Marasigan	Davao Regional Medical Center	IAEA	Hotel Novotel, Quezon City	6 – 9 Sept
	Raquel Louise Munsayac and Charito Uy	Chong Hua Hospital Mandaue and Cancer Center			
Regional Training Course on Security of Radioactive Material in Transport	Richard Fernandez; Jeana Lee Sablay; and Ma. Allis Uriarte	PNRI	IAEA	Hotel Novotel, Quezon City	3 – 7 Oct
Regional Training Course on Orphan Source Search Training under RAS9062 Project	Norman Jay Barro; Eugene Gregorio; and Albert Llagas	PNRI	IAEA	Hotel Novotel, Quezon City	17 – 21 Oct
Regional Training Course on the Development and Clinical Application of Radiosynovectomy Agents	Irene Bandong	St. Luke's Medical Center	IAEA	Eastwood Richmond Hotel, Quezon City	14 – 18 Nov
	Henry Canizares	Vicente Sotto Memorial Medical Center			
	Bonan Achilles Mendoza	JRMCCI			
	Joanna Michelle Chua; Carla Mari Macaaisa; and Ivy Angelica Nunez	PNRI			
Regional Workshop on Radiation Monitoring and Information Sharing in an Emergency under RAS9077 Project	Rosario Encabo; Christopher Mendoza; and Cecilia de Vera	PNRI	IAEA	Hotel Novotel, Quezon City	12 – 16 Dec
	Rozette Mercado	Surigao del Sur State University			

TABLE 3. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016

FIELD	NAME	AGENCY	VENUE	DATE	SPONSOR
TRAINING COURSE					
Regional Training Course on Introduction to Nuclear Forensics	Ruby Grace Diangson	Philippine National Police	Tokai, Japan	29 Feb – 3 March	IAEA
Second Regional Training Course on the Basic of Intensity Modulated Radiotherapy	Janet Martinez Conchita Mendoza	St. Luke's Medical Center	Jakarta, Indonesia	7 – 11 March	IAEA
Regional Training Course on Mutation Detection Methods Applied to Floods	Wilfren Clutario	Eastern Visayas State University	Putrajaya, Malaysia	11 – 15 April	IAEA
Regional Training Course on Developing a National Framework for Managing the Response to Nuclear Security Events	Abe Arenga Loi Solomon Garcia	Armed Forces of the Philippines Philippine National Police	Penang, Malaysia	9 – 13 May	IAEA
Train the Trainer for Embarking Countries in Phase 1 of the Milestones Approach	Angeline Manga Mauro Marcelo, Jr.	Department of Energy National Power Corporation	Argonne, USA	13 – 25 May	IAEA
IAEA/RCA RTC on Application of In-Vitro Techniques in Mutation Breeding of Bioenergy Crops	Ma. Lourdes Almodiente	Sugar Regulatory Administration	Jakarta, Indonesia	23 – 27 May	IAEA
Regional Training Course on Providing Decision Support for Nuclear Power Planning and Development in Tokyo and Other Locations	Dante Caraos	National Power Corporation	Tokyo, Japan	23 May – 3 June	IAEA
Regional Training Course on CT Cancer Staging: Head and Neck	Marie Rhiamer Sauler Asela Bustos-Barroso	De La Salle University	Yangon, Myanmar	4 – 8 July	IAEA
Regional Training Course on Strengthening of National Capabilities for Response to Nuclear Radiological Emergencies	Loi Solomon Garcia Abe Arenga	Philippine National Police Armed Forces of the Philippines	Chiba, Japan	29 Aug – 16 Sept	IAEA
Regional Training Course on the Role of Molecular Imaging and Therapeutic Nuclear Medicine Techniques in the Management and Treatment of Disease in Adult and Pediatric Patients	Emerita Andres Barrenechea, Michele Duldulao, Jeanelle Margareth Tang	Veterans Memorial Medical Center Philippine Heart Center Jose Reyes Memorial Medical Center	Seoul, Republic of Korea	29 Aug – 9 Sept	
Regional Training Course on Data Management and Data Evaluation	Aida Mallillin Amster Fei Baquiran	Food and Nutrition Research Institute-DOST	Jakarta, Indonesia	10 – 14 Oct	IAEA
Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) NDC Capacity Building: NDC Waveform Analyst Training Course	Randall Teodoro	Manila Observatory	Vienna, Austria	7 Nov – 2 Dec	CTBTO

TABLE 3 NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	AGENCY	VENUE	DATE	SPONSOR
WORKSHOP/SEMINAR					
Interregional Workshop on Stakeholder Exchange of Experiences & Challenges for Newcomers and Expanding NPPs	Ma. Gladys Sta. Rita	National Power Corporation	Mexico City, Mexico	15 – 19 Feb	IAEA
East Asia Regional National Data Center Workshop	Jun Bonita	Philippine Institute of Volcanology and Seismology	Beijing, China	16 – 18 May	IAEA
Workshop on the Financial Analysis of Power Sector Projects Using the IAEA's FINPLAN Model	Jhoana Bautista-Limbaga	Department of Energy	Vienna, Austria	9 – 13 May	IAEA
Regional Workshop on Management Systems and Transport Risk Assessments	Carla Dulfo	Assurance Controls Technologies, Co. Inc.	Daejeon, Korea	30 May – 3 June	IAEA
Nuclear Technology Seminar on Basic Radiation Knowledge for School Education Course	Janet Turaray	Cagayan State University	Tokai, Japan	7 – 18 Nov	IAEA
Workshop on Communication with the Public During a Nuclear or Radiological Emergency	Framelia Anonas	Science and Technology Information Institute--DOST	Fukushima, Japan	12 – 16 Dec	IAEA
ANSN Annual Meeting of the Topical Group on Communication and Consultation with Interested Parties and Regional Workshop on National Stakeholder Mapping and Communication Plan	Mona Carina Montevirgen	Science and Technology Information Institute--DOST	Tokyo, Japan	5 – 9 Dec	ANSN/IAEA
MEETING					
IAEA Midterm Review Meeting on RAS6077 "Strengthening the Effectiveness and Extent of Medical Physics Education and Training"	Dan Joseph Manlapaz	Lung Center of the Philippines	Navi Mumbai, India	21 – 25 Mar	IAEA
International Coordination Meeting to Discuss Good Practices and Challenges in Developing and Sustaining a Nuclear Security Detection Architecture	Analyn Ramos	Bureau of Customs	Siem Reap, Cambodia	4 – 8 April	IAEA
IAEA/RCA Mid-term Review Meeting on Strengthening Intensity Modulated Radiation Therapy Capability in the Region	Miriam Joy Calaguas	Jose Reyes Memorial Medical Center	Vienna, Austria	18 – 22 April	IAEA
International Coordination Meeting to Discuss Good Practices and Challenges in Developing and Sustaining a Nuclear Security Detection Architecture	Adelio Benjamin Castillo	Philippine National Police	Siem Reap, Cambodia	4 – 8 April	IAEA
Technical Meeting on the Environmental Impact Assessment Process for Nuclear Power Programmes	Marivic Yao	Department of Environment and Natural Resources	Vienna, Austria	17 - 20 May	IAEA
Final Coordination Meeting on Supporting Early Warning, Response and Control of Transboundary Animal Diseases	Cristina Legaspi	Bureau of Animal Industry	Bangkok, Thailand	23 – 27 May	IAEA
Technical Meeting on Science, Technology and Society Perspectives on Nuclear Science, Radiation and Human Health: The View from Asia	Miriam Joy Calaguas	St. Luke's Medical Center/Jose Reyes Memorial Medical Center	Singapore	23 – 24 June	IAEA
Technical Meeting on Challenges and Issues Related to the Siting of Nuclear Installations	Katherine Velasques	Department of Energy	Xiamen, China	20 – 24 June	IAEA
Regional Coordination Meeting on Food Irradiation and Strength Adaptive Climate Change Strategies for Food Security	Edralina Serrano	University of the Philippine Los Baños	Bangkok, Thailand	22 – 26 Aug	IAEA
ASEAN/RCARO Project Planning Meeting	Nonette Cupino	University of the Philippines – Philippine General Hospital	Seoul, Korea	5 – 6 Sept	RCARO
Technical Meeting on Workforce Planning and Human Resource Modelling for Countries with Expanding or New Nuclear Power Programmes	Lorna Dy	National Power Corporation	Vienna, Austria	19 – 21 Oct	IAEA
RCA 2018-2019 New Project Formulating Meeting	Miriam Joy Calaguas	Jose Reyes Memorial Medical Center/St. Luke's Medical Center	Vienna, Austria	31 Oct – 4 Nov	IAEA
CONFERENCE /SYMPOSIUM					
Fourth International Symposium on the Ocean in a High-CO ₂ World	Mary Chris Lagumen	University of the Philippines	Tasmania, Australia	3 – 6 May	IAEA
60 th Session of IAEA General Conference	Rowena Cristina Guevara	Department of Science and Technology	Vienna, Austria	26 – 30 Sept	IAEA
International Conference on Integrated Medical Imaging in Cardiovascular Diseases	Angeline Apostol Mary Grace Vargas Alvin Quiñon Amalia Casiño Angelica Barrenechea Eduardo Ongkeko Lucille Puracan Irene Bandong	Philippine Heart Center Capitol University Medical Center Northern Mindanao Medical Center St. Luke's Medical Center Seaman's Hospital	Vienna, Austria	10 – 14 Oct	IAEA
International Conference on Nuclear Security: Commitments and Actions	Rowena Cristina Guevara	Department of Science and Technology	Vienna, Austria	5 – 9 Dec	IAEA

TABLE 3. NON-PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	AGENCY	VENUE	DATE	SPONSOR
OTHERS					
Interregional Technical Cooperation Project INT/6058 entitled "Contributing to the Evidence Base to Improve Stunting Reduction Programmes"	Luz Tagunicar Leah Perlas	Department of Health Food and Nutrition Research Institute	Dakar, Senegal	11 – 15 Apr	IAEA
Technical Visit on Radiological and Nuclear Detection and Response Exchange	Christopher Baldovino	Philippine National Police	Los Angeles, USA	19 – 21 Sept	IAEA
2016 Nuclear Law Institute	Maritess Pempena	Congress of the Philippines	Vienna, Austria	10-21 Oct 2016	IAEA
Scientific Visit - PHI16004V Marine Environment and Coast Zone Management	Juan Relox, Jr.	Bureau of Fisheries and Animal Resources	Nelson, New Zealand	10 – 14 Oct	IAEA

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016

FIELD	NAME	COUNTRY	DURATION	SPONSOR
ON-THE-JOB TRAINING				
Fellowship Training in the Field of Raw Material	Estrellita U. Tabora	Randburg, South Africa	11 Jan – 5 Feb	IAEA
Fellowship Training in the Field of Radiation Technologies and Tracer Techniques for Industrial Processes at the Center for Application of Nuclear Technique in Industry (CANTI)	Rollie B. Ilao	Dalat, Vietnam	4 April – 5 May	IAEA
Fellowship Training in the Field of Raw Material	Botvinnik L. Palattao	Nanchang, China	14 March -13 April	IAEA
Fellowship Training in the Field of Radiation Processing Facilities and Applications	Franklin A. Pares	Magurele, Romania	4 April – 3 June	IAEA
Fellowship Training Program on the Field of Emergency Preparedness and Response	Gloriamaris L. Caraos Gerardo Jose M. Robles Gilbert T. Diano	Hirosaki, Japan	16 May – 16 June	IAEA
RCARO Fellowship Programme	Eliza B. Enriquez	Daejeon, Republic of Korea	16 May – 12 Aug	RCARO
On-the-Job Training Session of Subtask 2.2 (Part 2): Inspection of NPP and Radiation Protection	Nelson P. Badinas John Richard A. Fernandez	Prague, Czech Republic	30 May - 1 July	Riskaudit
On-the-Job Training on Safety Evaluation, Licensing and Oversight of NPP during Design and Construction	Romelda P. Azores	Mannheim, Germany	25 July – 19 Aug	European Commission INSC Project MC3.01/13
MEXT Nuclear Researchers' Exchange Program on FR-2 Development of Plant Growth Promoter and Functional Hydrogel from Natural Polymers using Electron Beam Technique	Bin Jeremiah D. Barba	Takasaki, Japan	5 Sept 2016 – 25 Feb 2017	MEXT
On-The-Job Training on Strengthening the Capabilities of the Nuclear Regulator in Deterministic and Probabilistic Safety Assessment	Carl M. Nohay; Maria Elina Salvacion; Kristina V. Ramo; and Eugene S. Gregorio Lynette B. Cayabo and Joseph R. Tugo	Fontenay-Aux-Roses, France Rome, Italy	19 Sept – 14 Oct	European Commission
MEXT Nuclear Researchers' Exchange Program on Nuclear Engineering /Nuclear Safety Engineering	Julius Federico M. Jecong	Fukui, Japan	26 Sept – 16 Dec	MEXT
Fellowship Training in the Field of Radiation Processing Facilities and Applications	Giuseppe Filam O. Dean Geoffrey O. Tranquilan	Ho Chi Minh City, Vietnam	24 Oct - 16 Dec	IAEA
TRAINING COURSE				
Self-Assessment Training Seminar for the Self-Assessment Contact Points	Alan M. Borrás	Vienna, Austria	7 – 11 March	IAEA
INT/9182 Interregional Training Course on the Predisposal and Disposal Management	Ronald E. Piquero John Richard A. Fernandez	Vienna, Austria	21 – 24 March	IAEA
7th KINAC/INSA International Training Course on Nuclear Security	Raymund P. Beredo Dan Benneth C. Mangulabnan	Daejeon, Republic of Korea	21 – 25 March	KINAC
IAEA Interregional Training Course on Train the Trainers for Embarking Countries of Phase I of the Milestones Approach	Neil Raymund D. Guillermo Ryan U. Olivares	Argonne, Illinois, USA	25 Apr – 13 May	IAEA
Regional Training Course on Developing a National Framework for Managing the Response to Nuclear Security Events	Maria Teresa A. Salabit	Penang, Malaysia	9 – 13 May	IAEA
RAS/9080 Advanced Training Course on Assessment of Occupational Exposure Due to Intakes of Radionuclides	Marianna Lourdes Marie L. Grande	Seoul, Republic of Korea	23 – 27 May	IAEA
Regional Training Course on Radiation Protection and Regulatory Emergency Preparedness	Ramoncito F. Sulit; Norman Jay V. Barro; Rosario R. Encabo; and Ma. Allis U. Uriarte	Bangkok, Thailand	23 -27 May	European Commission
Regional Training Course on Application of In-vitro Techniques in Mutation Breeding of Bioenergy Crops	Arvin O. Dimaano	Jakarta, Indonesia	23 – 27 May	IAEA
Course on Fundamentals of Pressurized Water Reactors with PC-based Simulators	Julius Federico M. Jecong	Daejeon, Republic of Korea	23 May – 3 June	IAEA
Basic Laboratory Training on Maintenance and Advanced Use of Handheld Equipment	Maria Teresa A. Salabit Raymund P. Beredo	Vienna, Austria	30 May – 3 June	IAEA

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	COUNTRY	DURATION	SPONSOR
TRAINING COURSE				
Training Course on Requirements and Safety Evaluation of a Nuclear Power Plant (NPP) Probabilistic Safety Assessments (PSA)	Joseph R. Tugo	Arnhem, Netherlands	6 – 10 June	European Commission
KINAC/INSA International Training Course on Nuclear Safeguards	Kristine Marie D. Romallosa	Daejeon, Republic of Korea	20 – 24 June	KINAC/INSA
Instructor Training Course (ITC) on Nuclear and Radiological Emergency Preparedness	Eileen Beth A. Hernandez	Ibaraki, Japan	20 June – 29 July	IAEA
Instructor Training Course (ITC) on Environmental Radioactivity Monitoring Course	Ryan Joseph Aniago	Ibaraki, Japan	20 June – 29 July	IAEA
CTBTO Training Course on NDC Capacity Building: Access and Analysis of Radionuclide IMS Data and IDC Products	Lorna Jean H. Palad Paolo Tristan F. Cruz	Vienna, Austria	20 June – 1 July	CTBTO
Regional Training Course on "Processing of Unconventional Radioactive Mineral Resources"	Botvinnik L. Palattao	Colombo, Sri Lanka	11 – 14 July	IAEA
Regional Training Course on Taxonomy and Identification of Fruit Fly Pest Species for Southeast Asia	Abigaile Mia V. Javier	Bangkok, Thailand	11 – 15 July	IAEA
Training Course on Nutrient and Water Management for Bioenergy Crops in Marginal Lands	Faye G. Rivera	Katmandu, Nepal	11 – 22 July	IAEA
Regional Training Course on Nuclear Security for Research Reactors	Florante C. Valderrama, Jr.	Bangi, Malaysia	18 – 22 July	IAEA
Conduct a Training on the Use of Nitrogen-15 Based Techniques as to Improved Soil Fertility Management in Rice-Based Cropping System	Roland V. Rallos	Phnom Penh, Cambodia	18 – 22 July	IAEA
Training Course on Regulatory Inspections (oversight) during Siting and Construction Phases	Romelda P. Azores; Alan M. Borras; and Jayson V. Godoy	Mannheim, Germany	18 – 22 July	European Commission INSC Project MC3.01/13
Regional Training Course on Safeguards and Security Aspects of Nuclear Material Accounting and Control at Facilities	Albert M. Llagas	Jakarta, Indonesia	18 – 27 July	IAEA
Fellowship Training in the Field of Insect Pest Control	Abigaile Mia V. Javier	Vienna, Austria	1 Aug – 30 Sept	IAEA
Regional Training Course on Advance Characterization Methods of Grafted Polymeric Matrices, Designing and Up-Scaling of Radiation Grafting for Environmental and Industrial Applications	Bin Jeremiah D. Barba Patrick Jay E. Cabalar	Kajang, Malaysia	8 – 12 Aug	IAEA
Practical Hands-on Training to Create Regional Capabilities in Handling and Conditioning Category 3-5 Disused Sealed Radioactive Sources (DSRS)	Abelardo A. Inovero	Bangkok, Thailand	15 – 26 Aug	IAEA
IAEA-UNECE Interregional Training Course on Uranium, Coal, Oil and Gas Classification: Towards a Better Understanding of Energetic Basins and Application of UNFC-2009	Rolando Y. Reyes	Ulaanbaatar, Mongolia	16 – 19 Aug	IAEA
Instructor Training Course (ITC) 2016: Course on Reactor Engineering I	Dan Benneth C. Mangulabnan	Ibaraki, Japan	22 Aug – 14 Oct	IAEA
Joint Basic Professional Training Course for Nuclear Safety	Ma. Allis U. Uriarte Vinz Michael L. Calija	Daejeon, Republic of Korea	29 Aug – 9 Sept	IAEA
IAEA/RCA Regional Training Course on X-ray and Gamma Ray Based DIR for Specialized NDT Requirement in Industry	Roel A. Loteriña Allan Gregor DM. Bulos	Kelaniya, Sri Lanka	19 – 23 Sept	IAEA
Training Workshop on Biosafety Capacity Building	Preciosa Corazon B. Pabroa	Nanjing City, China	19 – 28 Sept	NIES
Training Course on Handling of Mutated Rice Production in Selection through Advance Marker Added Technique on Biotic and Abiotic Traits	Jorge R. Sahagun	Mymensingh, Bangladesh	2 – 11 Oct	IAEA
Training Workshop on the Evaluation of Undiscovered Uranium Resources	Reymar R. Diwa	Buenos Aires, Argentina	24 – 28 Oct	IAEA
International Training Course on Nuclear Forensics Methodologies	Jennyvi D. Ramirez Arvin M. Jagonoy	Karlsruhe, Germany	17 – 28 Oct	IAEA
Training Workshop on Specific Considerations and Milestones for a Research Reactor Project	Neil Raymund D. Guillermo	Vienna, Austria	17 – 21 Oct	IAEA
Regional Training Course on the Assessment of Groundwater by Using Isotope and Related Techniques	Jeff Darren G. Valdez	Xian, China	14 – 25 Nov	IAEA
9th KINAC/INSA International Training Course on Introduction to Strategic Trade Controls	Teresita G. De Jesus	Daejeon, Republic of Korea	14 – 18 Nov	KINAC
EU Dedicated Training Course "Requirements and Safety Evaluation of Research Reactors"	Ryan U. Olivares	Ljubljana, Slovenia	5 – 9 Dec	European Commission
ENSTTI Training Course on Nuclear Materials Protection, Nuclear Safeguards and Interface with Nuclear Safety	Neil Raymund D. Guillermo Ronald E. Piquero	Fontenay-aux-Roses, France	12 – 16 Dec	ENSTTI
WORKSHOP/SEMINAR				
Regional Workshop on Introduction to Nuclear Forensics and Biological Dosimetry	Celia O. Asaad Raymund P. Beredo	Bangkok, Thailand	3 – 5 Feb	OAP
International Workshop on Regional Cooperation on Nuclear Emergency and Preparedness	Teofilo V. Leonin, Jr. Teofilo Y. Garcia	Kuala Lumpur, Malaysia	17 – 18 Feb	European Commission
First Simulation Exercise on Cooperation Simulation of Nuclear Security (COSINUS)	Julietta E. Seguis	Ispra, Italy	7 – 11 Mar	IAEA

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	COUNTRY	DURATION	SPONSOR
WORKSHOP/SEMINAR				
Technical Workshop on Biodiversity-driven Nutrient Cycling and Human Well-being in Social-Ecological Systems	Norman DS. Mendoza	Kyoto, Japan	28 Feb – 23 March	Research Institute for Humanity and Nature/ e-REC Project
Regional Workshop on Best Estimate Plus Uncertainty (BEPU) Calculations and Acceptance Criteria for Emergency Core Cooling Systems	Carl M. Nohay Alfonso A. Singayan	Daejeon, Republic of Korea	21 – 25 March	IAEA
Training Workshop on Uranium Exploration Methods	Jennyvi D. Ramirez	Mendoza, Argentina	11 – 15 April	IAEA
RAS/9067 Regional Workshop on Drafting Regulations for the Safe Transport of Radioactive Material	Teresita G. De Jesus	Vienna, Austria	18 – 22 April	IAEA
Regional Workshop on Knowledge Management at Regulatory Bodies and their Technical Support Organizations (TSO) and on Information and Communication Technology Interfaces	Grace M. Carlos Michael P. Hernandez	Daejeon, Republic of Korea	9 – 13 May	IAEA
Regional Workshop on Quality Assurance and Inspection	Luzviminda L. Venida Jayson V. Godoy	Daejeon, Republic of Korea	9 – 17 May	IAEA & KINS
Regional Workshop on Environmental Radiation Monitoring Systems	Teofilo Y. Garcia	Bangkok, Thailand	21 – 22 March	AOP and KOTRA
Regional Workshop on Management Systems and Transport Risk Assessment	Albert M. Llagas	Daejeon, Republic of Korea	30 May – 3 June	IAEA
Regional Workshop on the Development and Implementation of a Radioactive Waste Management Programme	Editha A. Marcelo	Dengkil, Malaysia	1 – 3 June	IAEA
Regional Workshop on How to Conduct Peer Review for Integrated Management System (IMS) and Safety Culture	Cecilia M. De Vera Maria Celerina M. Ramiro Alan M. Borras	Jakarta, Indonesia	13 – 17 June	IAEA
RAS/0071 Regional Workshop on Nuclear Law and IAEA Legislative Assistance for Member States in the Asia Pacific Region	Teresita G. De Jesus	Singapore	13 – 17 June	IAEA
RAS/9061 Regional Workshop on Drafting Nuclear Safety Regulations	Vangeline K. Parami Alfonso A. Singayan	Hanoi, Vietnam	27 June – 1 July	IAEA
Regional Workshop on the Development of National Training Programmes in Computer Security	Ana Elena L. Conjares Marlon Dave S. Regoso	Ibaraki, Japan	27 June – 1 July	IAEA
Workshop on Paralytic Shellfish and Ciguatera Toxin Receptor Binding Assay (RBA) Validation, Performance and Regulatory (RAS 7/026)	Rhett Simon DC. Tabbada	Charleston, USA	18 – 22 July	IAEA
2016 Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Human Resource Development Project	Roel A. Loteriña	Kajang, Malaysia	1 – 3 Aug	Japanese Government
Regional Workshop on Fuel Behaviour during Accident Conditions	Carl M. Nohay Joseph R. Tugo	Hanoi, Vietnam	3 – 5 Aug	IAEA
RAS/9078 Regional Workshop to Review and Update National Action Plan to Control Public Exposures	Teofilo Y. Garcia	Jakarta, Indonesia	8 – 12 Aug	IAEA
3 rd Asia-Pacific Strategic Trade Experts Network (STEN) Workshop	Teresita G. De Jesus	Kuala Lumpur, Malaysia	09 – 11 Aug	US-DOE INSEP and the US-Department of State Export Control and Related Border Security (EXBS) Program
Additional Protocol (AP) Regional Workshop on Complementary Access (CA) and Locations Outside of Facilities (LOF)	Sylvia S. Busine Raymund P. Beredo	Kuala Lumpur, Malaysia	5 – 8 Sept	DOE/NNSA
Workshop on SIT to Control Mosquito Vectors, Focusing on Dengue, Chikungunya and Zika	Glenda B. Obra	Kuala Lumpur, Malaysia	5 – 9 Sept	IAEA
Regional Workshop on Biological Dosimetry: Cytogenetic Analysis for Radiation Dose Assessment and Applications	Celia O. Asaad Maria Lucia C. Cobar	Bangkok, Thailand	6 – 8 Sept	OAP
Mobile Detection System (MDS) Workshop	Ma. Teresa A. Salabit Paolo Tristan F. Cruz	Zagreb, Croatia	22 – 23 Sept	Office of Nuclear Smuggling Detection and Deterrence (NSDD) of the US DOE
Regional Workshop on Development of Discharge Criteria of Radioactive Waste and Corrective Measures	Christopher O. Mendoza	Kajang, Malaysia	10 – 14 Oct	IAEA
2016 RCARO/KAERI Introductory Workshop on Radiation Technology and its Applications	Ave Ann Nikolle M. Galalde	Daejeon, Republic of Korea	10 – 21 Oct	IAEA
FAO/IAEA-NARO Technical Workshop on Remediation of Radioactive Contamination In Agriculture	Roland V. Rallos	Vienna, Austria	17 – 18 Oct	IAEA
Nuclear Safety Seminar FY 2016: Course of Nuclear Plant Safety (NPS)	Romelda P. Azores	Tsuruga City, Japan	17 Oct – 11 Nov	WERC
Regional Workshop on Integrated Nuclear Security Support Plan and the Nuclear Security Information Management System	Sylvia S. Busine	Hanoi, Vietnam	18 – 21 Oct	IAEA
RAS/0075 Regional Workshop for Developing MOODLE-Based E-Training Course Creation Process Model	Abigail D. Clemente	Daejeon, Republic of Korea	31 Oct – 4 Nov	IAEA
Regional Workshop on the Revised Safety Requirements in Emergency Preparedness and Response (GSR-Part 7)	Mary Rose Q. Mundo	Fukushima, Japan	31 Oct – 4 Nov	IAEA
FNCA 2016 Joint Workshop on Biofertilizer Project and Electron Accelerator Application Project	Fernando B. Aurigue	Hanoi, Vietnam	7 – 11 Nov	Japanese Government

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	COUNTRY	DURATION	SPONSOR
WORKSHOP/SEMINAR				
Nuclear Technology Seminar on Basic Radiation Knowledge for School Education Course	Joan L. Tugo	Ibaraki, Japan	7 – 18 Nov	IAEA
Annual Meeting of the Topical Group on Regulatory Infrastructure (RITG) and the Regional Workshop on the Development of Integrated Management System (IMS) based on GSR Part 2	Graceta DL. Cuevas María Celerina M. Ramiro Alan M. Borrás	Chiang Mai, Thailand	21 - 25 Nov	IAEA
Regional Workshop on the Enhancement of Medical Doctors' Competence for Radiological Emergencies	Emma L. Cancino	Phuket, Thailand	21 – 25 Nov	IAEA
Nuclear Safety Seminar on Course of Nuclear Energy Officials	Grace M. Carlos	Tsuruga City, Japan	21 Nov – 09 Dec	WERC
Introductory Workshop for New RCA Government Parties on RCA Programme and its Policy	Soledad S. Castañeda	Nadi, Fiji	23 – 25 Nov	RCARO
CTBTO Workshop on Signatures of Medical and Industrial Isotope Production (WOSMIP VI)	Adelina DM. Bulos	Bariloche, Argentina	28 Nov – 2 Dec	IAEA
FNCA Joint Workshop on Research Reactor Network Project and Neutron Activation Analysis Project	Neil Raymund D. Guillermo Joseph Michael D. Racho	Sydney, Australia	7 – 9 Dec	MEXT
2016 Forum for Nuclear Cooperation in Asia (FNCA) Workshop on Mutation Breeding Project	Ana María S. Veluz	Tsuruga, Japan	12 – 15 Dec	MEXT
14th IAEA-FORATOM Management System Workshop – Leadership and Management: From Standards to Practices	María Celerina M. Ramiro	Vienna, Austria	12 - 15 Dec	IAEA
Lecturer to the 12 th International Workshop on Ionizing Radiation Monitoring	Lorna Jean H. Palad	Ibaraki, Japan	3 – 4 Dec	International Organizing Committee of the Workshop
MEETING				
Technical Visit-Meeting on the Implementation of the Borehole Disposal System	María Visitación B. Palattao Lynette B. Cayabo	Vienna, Austria	18 – 22 June	IAEA
Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure	Graceta DL. Cuevas	Vienna, Austria	2 – 5 Feb	IAEA
Consultancy Meeting for the Development of the Technical Guidance for Planning and Organization of Nuclear Security Systems and Measures for Nuclear and Other Radioactive Material Out of Regulatory Control (MORC)	Soledad S. Castañeda	Vienna, Austria	8 – 12 Feb	IAEA
4th RCA Program Advisory Committee Meeting	Soledad S. Castañeda	Vienna, Austria	15 – 19 Feb	IAEA
RAS/0069 Regional Meeting for TC National Liaison Officers	Alumanda M. Dela Rosa Nydia C. Medina	Vienna, Austria	22 – 25 Feb	IAEA
17th FNCA Coordinators Meeting and Technical Visit to the Takasaki Research Institute	Charito T. Aranilla	Tokyo, Japan	7 – 10 March	Cabinet Office of Japan
Third Research Coordination Meeting of the IAEA CRP "Strengthening of Biological dosimetry in IAEA Member States: Improvement of Current Techniques and Intensification of Collaboration and Networking among Different Institutes"	Celia O. Asaad	Vienna, Austria	7 – 11 March	IAEA
Forum for Nuclear Cooperation in Asia (FNCA) 17th Coordinators Meeting and the Study Panel	Alumanda M. Dela Rosa Soledad S. Castañeda	Tokyo, Japan	8 – 10 March	Cabinet Office of Japan
IAEA National Consultants Meeting under the Technical Cooperation Project RAS/5066 "Promoting the Sharing of Expertise and Infrastructure for Dengue Vector Surveillance towards Integration of the Sterile Insect Technique with Conventional Control Methods among South East Asian Countries"	Glenda B. Obra Sotero S. Resilva	Guangzhou, China	14 – 18 March	IAEA
First Coordination Meeting of the IAEA Technical Cooperation Project RAS2019	Rolando Y. Reyes	Yogyakarta, Indonesia	22 – 25 March	IAEA
Open-ended Meeting of Technical and Legal Experts to Share Information on the States' Implementation of the Code of Conduct on the Safety and Security	Teofilo V. Leonin, Jr.	Vienna, Austria	4 – 8 April	IAEA
Technical Meeting on Radiation Detection Instruments for Nuclear Security: Current Status, Future Needs and Improvements	María Teresa A. Salabit	Vienna, Austria	4 – 8 April	IAEA
International Coordination Meeting to Discuss Good Practices and Challenges in Developing and Sustaining a Nuclear Security Detection Architecture	Sylvia S. Busine	Siem Reap, Cambodia	4 – 8 April	IAEA
5 th Meeting of the Working Group on Radioactive Source Security (WGRSS)	Julietta E. Seguis	Vienna, Austria	18 – 21 April	IAEA
Final Coordinators Meeting on "Building Technological Capacity for Food Traceability and Food Safety Control Systems"	Preciosa Corazon B. Pabroa Raymond J. Sugcang	Beijing, China	25 – 29 April	IAEA
Technical Meeting on the "Assessment of Levels, Trends and Radiological Effects on Radionuclides in the Marine Environment"	Eliza B. Enriquez	Monaco	26 – 29 April	IAEA
23rd Asian Nuclear Safety Network Steering Committee Meeting	Teofilo V. Leonin, Jr.	Beijing, China	27 – 29 April	IAEA
Mid-Term Review and Decision-Makers Awareness Meeting for RAS/5069	Raymond J. Sugcang	Vienna, Austria	3 – 6 May	IAEA
RAS/0075 First Project Planning and Coordination Meeting	Ana Elena L. Conjares	Vienna, Austria	9 – 13 May	IAEA

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	COUNTRY	DURATION	SPONSOR
MEETING				
Technical Meeting on the Environmental Impact Assessment Process for Nuclear Power Programmes	Vangeline K. Parami	Vienna, Austria	17 – 20 May	IAEA
Regional Project Coordination Meeting and Hazard Assessment Workshop	Teofilo V. Leonin, Jr. Teofilo Y. Garcia	Bangkok, Thailand	23 – 27 May	IAEA
Annual Meeting of the ANSN Radioactive Waste Management Topical Group (RWMTG)	Editha A. Marcelo	Dengkil, Malaysia	30-31 May	IAEA
Open-Ended Meeting of Technical and Legal Experts to Share Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and Its Supplementary Guidance on the Import and Export of Radioactive Sources	Teofilo V. Leonin, Jr. Teresita G. De Jesus	Vienna, Austria	30 May – 3 June	IAEA
Technical Meeting on Enhancing Safety and Control Features of Existing Radiation Processing Facilities	Luvimina G. Lanuza	Warsaw, Poland	30 May – 3 June	IAEA
Coordination Meeting and Workshop on Uranium Exploration Strategy, Resources Assessment and Feasibility Studies	Rolando Y. Reyes	Rio de Janeiro, Brazil	31 May – 3 June	IAEA
First Project Coordination Meeting on Assessing Deep Groundwater Resources of Sustainable Management Through the Utilization of Isotope Techniques	Norman DS. Mendoza	Ho Chi Minh City, Vietnam	6 – 10 June	IAEA
Eighth Meeting of Representative of the Competent Authorities on Technical Assistance for Improving the Legal Framework for Nuclear Safety and Strengthening the Capabilities of the Regulatory Authority of the Philippines and its TSO	Teofilo V. Leonin, Jr.	Vienna, Austria	6 – 10 June	IAEA
Ministerial Segment of the 46 th Session of the Preparatory Commission for the CTBTO	Soledad S. Castañeda Teofilo Y. Garcia	Vienna, Austria	13 – 14 June	CTBTO
Second Coordination Meeting of the Training and Tutoring Initiatives and the Progress Meeting of the Project identified under the Early Notification and Assistance Conventions	Vangeline K. Parami	Brussels, Belgium	15 – 17 June	Riskaudit, LDK and Ecorys
Initiatives and the Progress Meeting of the Project PH3.01/09	Teofilo V. Leonin, Jr.	Brussels, Belgium	15 – 17 June	European Commission
Technical Meeting on Specific Applications of Research Reactors: Production and Use of Radiotracers	Adelina DM. Bulos	Vienna, Austria	20 – 23 June	IAEA
Ninth Meeting of the Nuclear Security Guidance Committee (NSGC)	Julietta E. Seguis	Vienna, Austria	20 – 23 June	IAEA
Technical Meeting on Challenges and Issues Related to the Siting of Nuclear Installations	Rolando Y. Reyes	Xiamen, China	20 – 24 June	IAEA
RAS/1020 Mid-Term Coordination Meeting	Renato T. Bañaga Carl M. Nohay	Bangkok, Thailand	27 June – 1 July	IAEA
Open-Ended Meeting of Legal and Technical Experts to Develop Internationally Harmonized Guidance for Implementing the Recommendations of the Code of Conduct on the Safety and Security of Radioactive Sources in Relation to the Management of Disused Radioactive Sources	Editha A. Marcelo	Vienna, Austria	27 June – 1 July	IAEA
3 rd Research Coordination Meeting on "Application of Radiation Technology in Development of Advance Packaging Materials for Food Products"	Lucille V. Abad	Vienna, Austria	11 – 15 July	IAEA
RAS/6082 First Project Coordination Meeting on the Applications of Emerging Radiopharmaceuticals for Targeted Therapy	Adelina DM. Bulos	Bangkok, Thailand	11 – 15 July	IAEA
Technical Meeting on Security of Nuclear and Other Radioactive Material in Transport	Julietta E. Seguis	Vienna, Austria	11 – 15 July	IAEA
Annual Meeting of the Topical Group on Siting and Regional Workshop on Hydrological, Geotechnical and Hazards Relevant to Nuclear Power Plant Site Safety	Edmundo P. Vargas	Jakarta, Indonesia	25 – 29 July	IAEA
INT/9182 Meeting on Existing and New Technologies for Pre-Disposal and Disposal Activities	Editha A. Marcelo Eugene S. Gregorio	Ljubljana, Slovenia	25 – 29 July	IAEA
5 th Regional Review Meeting on Radioactive Source Security	Teofilo V. Leonin, Jr. Julietta E. Seguis	Penang, Malaysia	26 – 29 July	IAEA
13 th Annual Meeting of the Asia Oceania Geosciences Society	Reymar R. Diwa	Beijing, China	31 July – 6 Aug	IAEA
Annual Meeting of the ANSN Topical Group on Safety Assessment	Carl M. Nohay Joseph R. Tugo	Hanoi, Vietnam	01 – 02 Aug	IAEA
Meeting of the Working Groups of the International Network for Nuclear Security Training and Support Centres	Julietta E. Seguis	Vienna, Austria	22 – 26 Aug	IAEA
INT/9182 International Expert Meeting to Discuss Management Systems in Member States Implementing Borehole Disposal System (BDS) and to Elaborate a Draft Report with Lessons Learned	Teresita G. De Jesus Cecilia M. De Vera	Vienna, Austria	30 Aug – 2 Sept	IAEA
Technical Meeting on the Draft Safety Guide on Arrangements for Communication with the Public during a Nuclear or Radiological Emergency	Rhodora R. Leonin	Vienna, Austria	5 – 9 Sept	IAEA
38 th Consultative Meeting of INIS Liaison Officers	Rissa Jane V. Amper	Vienna, Austria	4 – 5 Oct	IAEA
Annual Meeting of the Topical Group on Education and Training (ETT) and the Regional Workshop on Talent Management	Roel A. Loteriña Nydia C. Medina	Hanoi, Vietnam	17 - 21 October	IAEA
53 rd Meeting of the Joint OECD/NEA-IAEA Uranium Group	Rolando Y. Reyes	Buenos Aires, Argentina	18 - 21 Oct	IAEA
Annual Meeting of the Regional Advisory Safety Committee for Research Reactors in Asia and the Pacific (RASCAP)	Thelma P. Artificio	Lemont, Illinois, USA	24 – 28 Oct	IAEA
Final Project Review Meeting on the Development of Regional Infrastructure and Sustainable Networks for the Safe Transport of Radioactive Material	Vangeline K. Parami	Bangkok, Thailand	24 – 28 Oct	IAEA

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	COUNTRY	DURATION	SPONSOR
MEETING				
IAEA/RCA Project Design Meeting	Soledad S. Castañeda	Vienna, Austria	31 Oct – 4 Nov	IAEA
18 th International Meeting on Radiation Processing	Lucille V. Abad	Vancouver, Canada	7 – 11 Nov	
Tenth Meeting of the Nuclear Security Guidance Committee	Julietta E. Seguis	Vienna, Austria	14 - 18 Nov	IAEA
Third Meeting of the Self-Assessment Coordination Group	Alan M. Borrás	Vienna, Austria	14 – 15 Nov	IAEA
Consultancy Meeting on the Dismantling of Industrial Gauges	Ronald E. Piquero	Vienna, Austria	14 – 18 Nov	IAEA
24 th ANSN Steering Committee Meeting	Teofilo V. Leonin, Jr. Alan M. Borrás	Vienna, Austria	16 – 18 Nov	IAEA
Final Coordination Meeting of the Regional Project RAS/9074 and RAS/9073	Vangeline K. Parami	Putrajaya, Malaysia	21 – 25 Nov	IAEA
IAEA RCA Final Progress Review Meeting of Extended RAS/1/014 Project	Lucille V. Abad	Takasaki, Japan	28 Nov – 2 Dec	IAEA
Technical Meeting of the International Predisposal Network (IPN) and the International Low Level Waste Disposal Network (DISPONET) on the Management of Radioactive Waste Streams that Present Specific Challenges	Editha A, Marcelo	Vienna, Austria	28 Nov – 02 Dec	IAEA
17 th Forum for Nuclear Cooperation in Asia (FNCA) Ministerial Level Meeting	Soledad S. Castañeda	Tokyo, Japan	29 – 30 Nov	Cabinet Office of Japan
Technical Meeting of the Representatives of States Parties; Convention on the Physical Protection of Nuclear Material	Julietta E. Seguis	Vienna, Austria	30 Nov – 2 Dec	IAEA
Annual Meeting of the Topical Group on Communication and Consultation with Interested Parties and Regional Workshop on National Stakeholder Mapping and on Transparency and Accountability	Rhodora R. Leonin	Tokyo, Japan	5 – 9 Dec	IAEA
Eight Meeting of the Steering Committee on Regulatory Capacity Building and Knowledge Management	Ana Elena L. Conjares	Vienna, Austria	12 – 16 Dec	IAEA
CONFERENCE/SYMPOSIUM/SUMMIT/FORUM				
International Conference on Human and Organizational Aspects of Assuring Nuclear Safety – Exploring 30 Years of Safety Culture	Alan M. Borrás	Vienna, Austria	22 – 26 Feb	IAEA
Fourth Nuclear Security Summit (NSS 2016)	Soledad S. Castañeda Julietta E. Seguis	Washington D.C., USA	31 March – 1 April	DOST
International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally	Alan M. Borrás	Vienna, Austria	11 – 15 April	IAEA
INPRO Dialogue Forum on Generation IV Nuclear Energy Systems	Neil Raymund D. Guillermo	Vienna, Austria	13 – 15 April	IAEA
49 th Japan Health Physics Society (JHPS) Conference	Teofilo Y. Garcia	Hirosaki, Aomori, Japan	30 June -3 July	Hirosaki University
Newton UK-SEA Innovation Leadership Conference	Gregory R. Ciocon	Bangkok, Thailand	6 – 7 July	UK Government Newton Fund
10 th International Flora Malesiana Symposium with the theme of “Classify, Cultivate, Conserve	Fernando B. Aurigue	Scotland	11 – 20 July	Royal Botanic Garden, Edinburgh
18 th International Symposium on Packaging and Transportation of Radioactive (PATRAM 2016)	Vangeline K. Parami	Kobe, Japan	19 – 23 Sept	IAEA
Consultancy Meeting on the International Radiation Monitoring Information System	Ryan Joseph Aniago	Vienna, Austria	13 – 15 Dec	IAEA
SCIENTIFIC VISIT				
Scientific Visit under the TC Project Enhancing National Capability in Applications of Industrial Radio Isotope Techniques	Denis D. Aquino	Bangkok, Thailand	30 May – 10 June	IAEA
Under the TC project Enhancing National Capacity for Extraction of Uranium RAIS Elements and Other Useful commodities from Phosphoric Acid	Rolando Y. Reyes	Florida, USA	18 – 22 Jan	IAEA
For in-house study of Living and Herbarium Materials of Hojas from the Philippines	Fernando B. Aurigue	London, England	11 – 20 July	Royal Botanic Garden Edinburgh
Technical Visit for New and Prospective Participants in the Coordinated Research Project (CRP) on Alarm Assessment	Ma. Teresa A. Salabit Raymund P. Beredo	Laem Chabang Port, Thailand	8 – 10 Aug	IAEA
Scientific Visit at the Quintessa Limited	Afonso A. Singayan Edmundo P. Vargas	Oxfordshire, United Kingdom	15 – 19 Aug	IAEA
Under TC Project on Building Capacity in Nuclear Science and Technology by Establishing the Research Reactor I	Marianna Lourdes Marie L. Grande	Ibaraki, Japan	12 – 16 Sept	IAEA
Technical Visit on Radiological and Nuclear Detection and Response Exchange	Julietta E. Seguis	Los Angeles, United States of America	19 – 21 Sept	IAEA
Study Visit on Quality Management under the 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 (PMCI)	Teofilo V. Leonin, Jr. Vangeline K. Parami Luzviminda L. Venida	Fontenay-Aux-Roses, France	17 – 21 Oct	European Commission
Scientific Visit on Iteration of Design and Safety Assessment of the Deep Borehole and Near Surface Disposal Facilities in the Philippines	Rhett Simon DC. Tabbada	Monaco	28 Nov – 2 Dec	IAEA

TABLE 4. PNRI HUMAN RESOURCES DEVELOPMENT (FOREIGN) IN 2016 (continuation)

FIELD	NAME	COUNTRY	DURATION	SPONSOR
ACADEMIC				
Research attachment - completion of dissertation entitled, "Manila Bay Environmental Studies: Hydrodynamic Model Evaluation Using 3-Dimensional Numerical Simulations".	Ryan U. Olivares	Tokyo, Japan	23 May to 25 November 2016	PCIEERD/ Graduate School of Frontier Sciences, The University of Tokyo,
Dissertation PhD Program for FY 2016	Jordan F. Madrid	Takasaki City, Gunma, Japan	30 June - 23 Dec	JSPS RONPAKU
CONSULTANCY/LECTURER/EXPERT ASSIGNMENT				
Consultancy Assignment at the ISO-Q Consulting (Proprietary) Limited – To Serve as Facilitator/Lecturer to South African Police Service	Roel A. Loteriña	Noordwyk, Johannesburg, South Africa	14 – 18 Mar	ISO-Q Consulting
Lecturer to the Regional Training Course on Radiation Protection and Regulatory Emergency Preparedness	Cecilia M. De Vera	Bangkok, Thailand	23 – 27 May	ITER
Expert Mission to Pilot and Test Feasibility of Model Regulations For Borehole Disposal System Within Framework of Ghana, Malaysia and the Philippines	Luzviminda L. Venida Alfonso A. Singayan Jeana Lee P. Sablay	Vienna, Austria	23 May – 3 June	IAEA
Expert Assignment to Initiate the Implementation of Regulatory Authority Information System (RAIS 3.3)	Ana Elena L. Conjares	Brunei Darussalam	25 – 29 July	IAEA
Expert Assignment	Soledad S. Castañeda	Vienna, Austria	7 – 9 Sept	IAEA
Guest Lecturer to the Instructor Training Course on Reactor Engineering I, II and III of the MHRDEC of the JAEA	Carl M. Nohay	Ibaraki, Japan	13 – 15 Sept	JAEA and MEXT
Expert Mission - Mechanisms of thermoluminescence dosimeters (TLD) reading & QA/QC	Estrella S. Caseria	Koror, Palau	14 – 16 Sept	IAEA
Lecturer to the IAEA Regional Training Course on Sampling Strategy PSP and CFP Toxin Extraction Techniques, RBA Demonstration and Data Analysis	Rhett Simon DC. Tabbada	Mombasa, Kenya	31 Oct - 11 Nov	IAEA
Expert Assignment in Improving the clinical services in radiology by establishing TLD personnel monitoring program in the island	Estrella S. Caseria	Majuro, Marshall Islands	5 – 9 Dec	IAEA
Expert Assignment to conduct Group Training on Plant Mutation Breeding	Roland V. Rallos	Jakarta, Indonesia	5 – 9 Dec	IAEA
Expert Mission on Improving the Clinical Services in Radiology-Thermoluminescent Dosimeter (TLD) Personnel Monitoring	Estrella S. Caseria	Majuro, Marshall Islands	13 – 16 Dec	IAEA

TABLE 5. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2016

FIELD	NAME	DATE	VENUE
TRAINING COURSE			
Basic Supervisory Skills Training and Basic Leadership Training	Raymond Sucgang	23 Jan & 9 Feb	Atlanta Center, San Juan City
Follow-up Training Course on Environmental Radioactivity Monitoring	Jeff Darren Valdez, Rommel Mascariñas, Mary Gold Dela Cruz, Allan Gregor Bulos, Felix Anthony Dela Cruz	22 – 26 Feb	PNRI
	Janice Mallillin, Roland Rallos, Marianna Lourdes Marie Grande, Ivy Nuñez, Reymar Diwa	19 – 23 Sept	
Follow-up Training Course on Nuclear and Radiological Emergency Preparedness and Response	Charles Darwin Racadio, Christopher Mendoza, Joan Tugo, Hans Joshua Dantes, Abigail Clemente, Davison Baldos, Norman Jay Barro, Jayson Godoy, Vinz Michael Calija	29 Feb – 4 March	PNRI
	Ma. Lucia Cobar, Reymar Diwa, Ma. Teresa Borrás, Mary Gold Dela Cruz, Joanna Michelle Chua, Juanario Olivares, Christine Singayan, Jennifer Sagum, Arnaldo Valenzuela	3 – 7 Oct	
Basic Pollution Control Officer Training	Christopher Mendoza	29 March – 1 April	Lancaster Hotel
Orientation Training on Environmental Regulations for Managing Heads	Soledad Castañeda	6 Apr 2017	Bellevue Hotel
Follow-up Training Course on Reactor Engineering Level 1	Reymar Diwa, Botvinnik Palatiao, Felix Anthony Dela Cruz, Allan Gregor Bulos, Ave Ann Nikolle Galalde	6 – 17 June	PNRI
Training Course on Recruitment, Selection and Placement System	Camille Grace Beredo, Aileen Cezar	13 – 15 June	Civil Service Commission
Radioactive Source Security Inspectors Training	Edgar Racho, Luzviminda Venida, Albert Llagas, Ma. Allis Uriarte, Romelda Azores, Mary Rose Mundo, Joseph Tugo, Eugene Gregorio, Johnylen Melendez, Norman Barro, Jayson Godoy	13 – 17 June	PNRI
On-the-Job/Case Study Patent Search Training	Gregory Ciocson	15, 22 & 29 July; 5, 12, 19 & 26 Aug; 2, 9, 16, 23 & 30 Sept; 7, 14 & 21 Oct	IPO Philippines Office
	Rommel Mascariñas	4, 11, 18 & 25 July; 1, 8, 15, 22 & 29 Aug; 5, 12, 19 & 26 Sept; 3 & 10 Oct	
Training Series on Competency-Based Human Resource Management under the DOST-HRDP	Emma Cancino, Aileen Cezar	7 - 9 Sept; 5-7 Oct, 20 Oct; 26-28 Oct; 17 Nov; 22-23 Nov	DOST-MIRDC
Internal Audit Training based on ISO/IEC 17025:2005	Neil Raymund Guillermo, Charito Aranilla, Norman Mendoza, Lorna Jean Palad, Lorna Rellve, Kristine Marie Romallosa, Maria Lucia Cobar, Rizalina Osorio, Franklin Pares, Ronald Piquero, Jennyvi Ramirez, Davison Baldos, Gilbert Diano, Arvin Jagonoy, Jeff Darren Valdez	20 – 21 Sept	PNRI

TABLE 5. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2016 (continuation)

FIELD	NAME	DATE	VENUE
TRAINING COURSE			
Regional Training Course on Orphan Source Search Training under the IAEA TC Regional Project RAS/9/062 and RAS/9/085	Eugene Gregorio, Norman Jay Barro	17 – 21 Oct	Novotel Manila
Training Workshop on the Application of Updated Technology Needs Assessment (TNA) Protocol for the Staff of the Regional Offices and Research Development Institutes	Gregory Ciocson	17 – 21 Oct	DOST-FNRI
IAEA/RCA Regional Training Course on the Development and Clinical Application of Radiosynovectomy Agents	Ivy Angelica Nuñez, Joanna Michelle Chua	14 – 18 Nov	Eastwood Richmond Hotel
Training on the Updates on the 2016 IRR of RA 9184	Luzviminda Muyco	24 – 25 Nov	DOST-NAST, Bicutan
Commission on Audit Course on Implementation of Government Accounting Manual (GAM) for National Government Agencies (NGAs)	Marife Roa	12 – 16 Dec	Commission on Audit, Quezon City
PhilGeps Training Phase I	Joanrose Villanueva	13 – 14 Dec	AM Zone Internet Café, Pasig City
SEMINAR/WORKSHOP			
Seminar Workshop for the Development of the IRR of the STMA	Teresita De Jesus	25 – 26 Jan	Malacañang, Manila
Grievance Handling and Conflict Management Seminar	Soledad Castañeda	20 – 21 April	BMA Training Center, Pasig City
National Workshop on Radiological Crime Scene Management	Julieta Seguis, Sylvia Busine, Maria Teresa Salabit, Raymund Beredo, Joseph Tugo	25 – 29 April	PNRI
Basic Customer Service Skills	Glaiza Espina, Aristotle Micalat, Desiree Ayo, Mark Anthony Baal, Dante Bajet, Camille Grace Beredo, Aileen Cezar, Israel Vinoya, Gina Abrera, Veriza Rita Cruz, Rosario Encabo, Frederick Hila, Socorro Intoy, Jennifer Sagum, Allan Gregor Bulos, Felix Anthony Dela Cruz, Mary Gold Dela Cruz, Gloria Jimenez, Gonzalo Madera Jr, Layla Tal Medina, Julieta Mendoza, Ivy Angelica Nuñez, Eugene Gregorio, Ailil Marie Semana, Ma. Allis Uriarte, Maria Norma Aliman, Hans Joshua Dantes, Christine Singayan, Arminda Espineda, Miriam Rejas	30 – 31 May	PNRI
Association of Government Internal Auditors, Inc. (AGIA) Seminar	Soledad S. Castañeda Bryan Villoria Hershey Lou Santos and Mark Anthony Baal Ricky Gabinete and Joanrose Villanueva Susan Pascual Vangelina Parami	5 – 7 June 13 – 15 June 20 – 22 July 27 – 29 July 3 – 5 Aug 7 – 9 Dec	Hotel Kimberly
Lecture Workshop Series by the Daniel K. Inouye Asia-Pacific Center for Security Studies (DKI-APCSS)	Soledad S. Castañeda	8 – 9 June	Department of Foreign Affairs
National Workshop on ANSN Self-Assessment Process	Estrella Caseria, Luvimina Lanuza, Rhodora Leonin, Rolando Reyes, John Marquez, Thelma Artificio, Alfonso Singayan, Thelma Artificio, Lynette Cayabo, Editha Marcelo, Edmundo Vargas, Justina Cerbolles, Ronald Piquero, Ma. Elina Salvacion Kristina Ramo, Jeana Lee Sablay, Joan Tugo, Rissa Jane Amper, Reymar Diwa, Dan Benneth Mangulabnan, Hans Joshua Dantes	14 – 16 June	PNRI
Social Media Engagement Workshop	Justina Cerbolles and Joan Tugo	22 – 23 June	Richville Hotel
Regional Workshop on Identifying Transboundary Air Pollution Events Across Asia-Pacific	Preciosa Corazon Pabroa and Joseph Michael Racho	27 June – 1 July	Novotel Manila
Association of Government Internal Auditors, Inc. (AGIA) Seminar	Soledad Castañeda, Johnylen Melendez, and Miriam Rejas	29 June – 1 July	Hotel Kimberly
Seminar on Technology Transfer Procedure for Researchers	Paolo Tristan P. Cruz, Jorge R. Sahagun, Bin Jeremiah D. Barba, Botvinnik L. Palattao	25 July	DOST-TAPI
DOST-STII Two-day Journal Writing Workshop	Unico A. Bautista, Jennyvi D. Ramirez, Cheri Anne M. Dingle, Charles Darwin T. Racadio and Botvinnik L. Palattao	26 – 27 July	DOST-STII
Seminar on Understanding International and Philippine Organic Standard and Certification Requirements	Celia Asaad, Maria Lucia Cobar	12 Aug	Eagle Court Condominium, QC
Week-Long Echo Seminar and Workshop	Gregory Ciocson	15 – 19 & 22 Aug	Crimson Hotel
Workshop on Insights regarding SocioEconomic, Ethical and Cultural Considerations (SECC) in the Context of GM Regulations	Preciosa Corazon Pabroa	8 – 9 Sept	Acacia Hotel
OneLab Strategic Planning Workshop	Ana Elena Conjares	19 Sept	DOST-FNRI
Participation to the Second Seminar on Project 47-EU Partner to Partner EU P2P: Export Control Program for Dual Use of Goods	Teresita De Jesus Alan Borrás	19, 20 & 22 Sept	Bayleaf Hotel
EU Workshop on Task 1: Technical Assistance for Improving the Legal Framework for Nuclear Safety and Strengthening the Capabilities of the Regulatory Authorities of the Philippines and its Support Organization (TSO)	Teofilo Leonin, Jr, Edgardo Racho, Julieta Seguis, Vangelina Parami, Cecilia de Vera, Teresita de Jesus, Alfonso Singayan, Sylvia Busine, Luzviminda Venida, Thelma Artificio, Alan Borrás, Nelson Badinas, Mary Rose Mundo, Maria Teresa Salabit, Romelda Azores, Albert Llagas, Jeana Lee Sablay, Raymund Beredo, Ma. Allis Uriarte, Eugene Gregorio, John Richard. Fernandez, Jayson Godoy, Norman Jay Barro, Johnylen Melendez	26 – 30 Sept	Richville Hotel
Seminar/Workshop on Strategic Trade Management for Government Officials, Licensing Officers and Other Relevant Stakeholders	Julieta Seguis, Luvimina Lanuza, Teresita De Jesus, Alan Borrás, Gregory Ciocson	28 - 29 Sept	The Peninsula Manila

TABLE 5. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2016 (continuation)

FIELD	NAME	DATE	VENUE
SEMINAR/WORKSHOP			
Seminar on Best Practices and Challenges Toward Sustainability in Laboratory Management	Christopher Mendoza	29 – 30 Sept	St. Paul University, Quezon City
Seminar on IECEP (Institute of Electronics Engineers of the Philippines, Inc.) 2016: 66th Annual Membership Meeting	Felix Anthony Dela Cruz Mary Gold Dela Cruz	27 – 29 Oct	Philippine Trade and Training Center, Pasay City
Seminar-Workshop on Negotiation Skills	Ana Elena Conjares, Grace Carlos, Gregory Ciocson, Aristotle Miclat	3 Nov	DOST-PCIEERD
Radioactive Source Security Inspectors Transition Workshop Course	Julietta Seguis, Sylvia Busine, Lynette Cayabo, Luzviminda Venida, Nelson Badinas, Maria Teresa Salabit, Raymund Beredo	7 – 10 Nov	PNRI
Regional Workshop on Radiation Monitoring and Information Sharing in an Emergency	Rosario Encabo, Ryan Joseph Aniago, Cecilia de Vera	12 – 16 Dec	Novotel Manila
Association of Government Internal Auditors, Inc (AGIA) Seminar	Israel Vinoya	13 -15 Dec	Hotel Kimberly
MEETING			
Meeting on Umbrella Program Development	Glenda Obra	14 Jan	UP, Manila
1st CBRN CoE Regional Experts Round Table Meeting for South East Asia	Julietta Seguis, Cecilia De Vera	27 – 29 April	The Peninsula Manila
11th ANSN IT Support Group Meeting	Ana Elena Conjares, Christopher Halnin, Marlon Dave Regoso, Christine Singayan, Arminda Espineda	20 – 24 June	B Hotel, Quezon City
2016 NAST Scientific Meeting	Preciosa Corazon Pabroa, Raymond Suggang, Gloriamaris Caraos, Gilbert Diano	13 – 14 July	Manila Hotel
62nd Executive Council Meeting and Conference	Graceta Cuevas	10 – 14 Oct	Manila Hotel
Revalidation Meeting on the Use of the Enhanced Gender Mainstreaming Evaluation Framework	Emma Cancino	19 Oct	DOST
Consultation Meeting on Country Program Framework (CPF)	Soledad Castañeda, Graceta Cuevas, Luvimina Lanuza, Teofilo Leonin, Ana Elena Conjares, Glenda Obra, Adelina Bulos, Teofilo Garcia, Preciosa Corazon Pabroa, Rolando Reyes, Renato Bañaga, Nydia Medina, Kristine Marie Romallosa, Alfonso Singayan, Raymond Suggang, Emma Cancino, Roland Rallos, Ma. Llorina Rañada	10 Nov	PNRI
Annual Scientists Meeting & Oath Taking of Newly Conferred Scientists	Glenda Obra	28 – 29 Nov	Acacia Hotel
CSC - Field Office 4th Cluster Meeting	Michael Hernandez, Aileen Cezar	7 Dec	MWSS, Quezon City
CONVENTIONS/CONFERENCE/SUMMIT/SYMPOSIUM			
2016 Annual Convention of the Philippine Society of Nuclear Medicine	Adelina Bulos, Maria Teresa Borrás, Rizalina Osorio, Gregory Ciocson	5 – 7 Feb	EDSA Shangri-La Hotel
83rd NRCP General Membership Assembly and Scientific Conference	Soledad Castañeda, Graceta Cuevas, Lucille Abad, Preciosa Corazon Pabroa, Neil Raymund Guillermo, Fernando Aurigue, Adelaida Barrida, Raymund Suggang, Ana Marie Veluz, Gregory Ciocson, Jordan Madrid, Abigaile Mia Javier, Angelito Ramos	16 March	Philippine International Convention Center, Pasay City
Symposium on Predatory Journals and Conferences	Celia Asaad	28 March	Hotel Jen
2016 Civil Service Institute Learning and Development Plan	Soledad Castañeda, Graceta Cuevas, Preciosa Corazon Pabroa, Vangelina Parami, Ana Elena Conjares Michael Hernandez	29 – 30 Mar; 13 – 14 Apr; 8 – 10 Mar	Civil Service Commission
Capacity Building of Local Technology Transfer and Commercialization Ecosystem and its Stakeholders	Ana Elena Conjares, Gregory Ciocson	4 – 8 April	Acacia Hotel
Policy Forum on Research Findings on the Effects of Climate Change on Philippine Marine Resources	Soledad Castañeda, Efren Sta. Maria	5 April	Hotel Jen
Forum on Reconfiguring Primary Health Care Within the Context of Kalusugan Pangkalahatan/Universal Health Care	Emma Cancino, Celia Asaad	6 June	Hotel Jen
Back-to-back Summative Event of AMIA Project 1 - Strengthening Implementation of Adoption and Mitigation Initiative in Agriculture and Launch of AMIA Project 2 - Building Climate Resilient A&F Livelihoods and Communities	Zenaida De Guzman	9 – 10 June	Torre Venezia, Quezon City
2016 Civil Service Institute Learning and Development Plan	Luvimina Lanuza, Graceta Cuevas, Emma Cancino, Gerald Conise, Bryan Villoria	13 – 14 April; 9 – 10 June	Civil Service Commission
2016 CES Leadership Conclave	Soledad Castañeda	16 June	Bayleaf Hotel
55th PART Annual Convention	Zenaida De Guzman	27 – 29 July	SMX Convention Center, Taguig City
Disaster Summit	Cecilia de Vera, Mary Rose Mundo, Joseph Tugo, Fe Dela Cruz, Lorna Jean Palad	27 July	PHIVOLCS
Orientation for the Laboratories on Trade Facilitation and Role of Accreditation at the Department of Trade and Industry	Haydee Solomon	25 Aug	Dep't of Trade and Industry, Makati City
Forum on the Precautionary Principle: Implications for Public Policy	Zenaida De Guzman	8 Sept	Hotel Jen
Policy Forum on Gender Parity in Science and Technology (S&T)	Emma Cancino	8 Nov	Hotel Jen
2nd Balik Scientist Annual Convention	Zenaida de Guzman, Glenda Obra, Celia Asaad	18 Nov	Hotel Jen
2016 PSNT Convention	Renato Bañaga, Ana Elena Conjares, Roel Loteriña, Unico Baustista, Arturo Salih, Ramoncito Sulit, Andrew Barrida, Allan Bulos, Felix Dela Cruz	18 Nov	Richmonde Hotel

TABLE 5. PNRI HUMAN RESOURCES DEVELOPMENT (LOCAL) IN 2016 (continuation)

FIELD	NAME	DATE	VENUE
CONVENTIONS/CONFERENCE/SUMMIT/SYMPOSIUM			
Pre-Feasibility Study/Stakeholders' Involvement for a Nuclear Power Programme Workshop	Soledad Castañeda, Graceta Cuevas, Teofilo Leonin Jr., Vangeline Parami, Alfonso Singayan, Kristine Romalosa	5 – 9 Dec	El Cielito Hotel
GSIS General Assembly for Electronic Remittance File (ERF) Handlers	Susan Pascual	14 Dec	GSIS, Pasay City
GSIS General Assembly for Agency Authorized Officers (AAO)	Gerald Conise, Michael Hernandez	14 Dec	GSIS, Pasay City
OneLab Networking Forum	Preciosa Corazon Pabroa	20 Dec	Acacia Hotel

TABLE 6. LIST OF SCIENTIFIC PUBLICATIONS IN 2016

TITLE OF SCIENTIFIC PAPER	NAMES	PUBLICATION/NAME/ TYPE OF JOURNAL	DATE PUBLISHED
Publications which garnered the 2016 International Publication Awards and Incentives of P 60,000 per publication			
Size-dependent changes in toxicity of <i>Perna viridis</i> mussels exposed to natural populations of <i>Pyrodictum bahamense var. compressum</i>	Ma. Llorina O. Rañada, Rhett Simon dC. Tabbada, Aileen DL. Mendoza, Juan Relox Jr., Elvira Z. Sombrito	ISSN 2352-4855 Regional Studies in Marine Science 3:176-180	January 2016
Insecticidal Activity of Four Essential Oils against Diamondback Moth, <i>Plutella xylostella</i> Linnaeus (Lepidoptera: Pyralidae)	Abigaile Mia V. Javier, Virginia R. Ocampo, Flor A. Ceballos, Pio A. Javier	ISSN 0031-7454 Philippine Agricultural Scientist 99(2): 156-163 2016	June 2016
Pupal eye color of <i>Bactrocera philippinensis</i> (Drew & Hanock) as tool for radiation sterilization	Sotero S. Resilva, Glenda B. Obra	ISSN 0031-7683 Philippine Journal of Science 145(2): 139-151	June 2016
Triterpene and sterols from <i>Hoya diversifolia</i> Blume	Nelson M. Panajon, Fernando B. Aurigue, Chien-Chang Shen, Consolacion Y. Ragasa	ISSN 2231-3354 Journal of Applied Pharmaceutical Science 6(6):79-82	June 2016
Grafting of N,N-dimethylaminoethyl methacrylate from PE/PP nonwoven fabric via radiation-induced RAFT polymerization and quaternization of the grafts	Jordan F. Madrid, Mural Barsbay, Lucille V. Abad, Olgun Güven	ISSN 0969-806X Radiation Physics and Chemistry 124:145-154	July 2016
Hemostatic efficacy evaluation of radiation crosslinked carboxymethyl kappa-carrageenan and chitosan with varying degrees of substitution	Charito T. Aranilla, Bin Jeremiah D. Barba, Jeanina Richelle M. Vista, Lucille V. Abad	ISSN 0969-806X Radiation Physics and Chemistry 124:124-129	July 2016
Triterpene and sterols from <i>Hoya pubicalyx</i> Merr	Nelson M. Panahon, Fernando B. Aurigue, Ian van Altena, Consolacion Y. Ragasa	ISSN 0975-5071 Der Pharmacia Lettre 8(13):270-273	August 2016
Fish diversity and trophic interactions in Lake Sampaloc (Luzon Is., Philippines)	Jonathan Carlo A. Briones, Rey Donne S. Papa, Gil A. Cauyan, Norman Mendoza, Noboru Okuda	ISSN 0564-3295 Tropical Ecology 57(3):567-581	September 2016
Microbiological quality of brown rice, ready-to-eat pre-cut fresh fruits, and mixed vegetables irradiated for immuno-compromised patients	Chitho P. Feliciano, Zenaida M. De Guzman, Livelyn Mito M. Tolentino, Celia O. Asaad, Maria Lucia C. Cobar, Gina B. Abrera, Davison T. Baldos, Gilberto T. Diano	ISSN 0969-806X Radiation Physics and Chemistry 130(2017): 397-399	September 2016
Historical record of nuclear activities from 129I in corals from the northern hemisphere (Philippines)	Angel T. Bautista VII, Hiroyuki Matsuzaki, Fernando P. Siringan	ISSN 0265-931X Journal of Environmental Radioactivity 164:174-181	November 2016
Microstructured boron foil scintillating G-GEM detector for neutron imaging	Takeshi Fujiwara, Unico Bautista, Yuki Mitsuya, Hiroyuki Takahashi, Norifumi L. Yamada, Yoshie Otake, Atsushi Taketani, Mitsuru Uesaka, Hiroyuki Toyokawa	ISSN 0168-9002 Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 838:124-128	December 2016
Other Publications			
Development of an Alternative Sample Preparation Procedure for the Confirmatory Analysis of the Biogenic Origin of Acetic Acid in Vinegar	Raymond J. Sucgang	31st Philippine Chemistry Congress : Book of Abstracts, p. 79	April 2016
Distribution of Water Stable Isotopes in Groundwater System on Isabela Province, Region II	Norman DS. Mendoza, Soledad S. Castañeda, Charles Darwin C. Racadio, Raymond J. Sucgang, Ferdie I. Billones and Allen Francis M. Lowe	31st Philippine Chemistry Congress : Book of Abstracts, p. 80	April 2016
Raft-Mediated Grafting of Poly(Glycidyl Methacrylate) in Emulsion State from Polyethylene/Polypropylene Nonwoven Fabric via Electron Beam Pre-Irradiation	Jordan F. Madrid, Lucille V. Abad, Takeshi Yamanobe, Noriaki Seko	31st Philippine Chemistry Congress : Book of Abstracts, p. 82	April 2016
Reformulation of Paraben-Free Body Creams with Self Preserving Actives	Raymond J. Sucgang, Luzviminda Cruz and Asella S. Cruz	31st Philippine Chemistry Congress : Book of Abstracts, p. 242	April 2016
Modified IMPROVE_A Protocol as the Optimal Thermal-Optical Protocol for Philippines OC/EC Samples	Preciosa Corazon B. Pabroa, Angel T. Bautista VII, Flora L. Santos, Leni L. Quirit, Joannes Luke B. Asis, Marie Alexandra K. Dy and Jason Patrick G. Martinez	31st Philippine Chemistry Congress : Book of Abstracts, p. 266	April 2016
Geochemical Studies on the Natural Attenuation Processes in Tacloban City's Ground Water Basin and the Intertidal Marine Environment	Jeff Darren G. Valdez, Wilfrén Clutario, Fe T. Piedad, Adorne Y. Madera and Grechelle Niemes	31st Philippine Chemistry Congress : Book of Abstracts, p. 267	Apr 2016
Synthesis of Amine and Carboxylic Adsorbents from Abaca-Polyester Fabric via Electron Beam Pre-Irradiation Technique	Patrick Jay E. Cabalar, Lucille V. Abad and Jordan F. Madrid	31st Philippine Chemistry Congress : Book of Abstracts, p. 276	Apr 2016
Application of Full-Factorial Design for Modeling Electron-Beam-Induced Graft Polymerization of Glycidyl Methacrylate on Polypropylene	Girlie Eunice P. Lopez, Lucille V. Abad and Jordan F. Madrid	31st Philippine Chemistry Congress : Book of Abstracts, p. 294	Apr 2016
Increasing Grain Yield and Nitrogen Use Efficiency in Rice Through Multiple-Split Fertilizer Application	Roland V. Rallos, Edna D. Samar and Faye G. Rivera	19th Philippine Society of Soil Science and Technology, Inc. Annual Meeting and Scientific Conference : Proceedings, p. 32-36	May 2016
Enhancing cytogenetic biological dosimetry capabilities of the Philippines for nuclear incident preparedness	Celia O.Asaad, Gloriamaris L. Caraos Gerardo Jose M. Robles, Anie Day D. C. Asa Maria Lucia C. Cobar. Al-Ahmadgaid Asaad	Genome Integrity Vol. 7 No. 4	December 2016



PNRI Officials 2016



Soledad S. Castañeda, PhD
Officer-in-Charge
Office of the Deputy Director and
Chief, Atomic Research Division



Teofilo V. Leonin, Jr., MSc
Chief
Nuclear Regulatory Division



Graceta DL. Cuevas, DPA
Chief
Finance and Administrative Division



Ana Elena L. Conjares, MSc
Officer-in-Charge
Technology Diffusion Division



Renato T. Bañaga, MSc
Officer-in-Charge
Nuclear Services Division
(March 1 to August 31, 2016)

Lucille V. Abad, PhD
Officer-in-Charge
Atomic Research Division
(August 1 to December 21, 2016)

Carlos Primo C. David, PhD
Officer-in-Charge, PNRI
(Starting July 1, 2016)



Alumanda M. Dela Rosa, PhD
Director, PNRI
(Until June 30, 2016)

Preciosa Corazon B. Pabroa, PhD
Officer-in-Charge
Nuclear Services Division
(January 1 to February 29, 2016)

Luvimina G. Lanuza, MNSA
Officer-in-Charge
Nuclear Services Division
(September 1 to December 31, 2016)



PNRI Organizational Chart



Office of the Director

Office of the Deputy Director

- Planning Section

Atomic Research Division

- Agriculture Research Section
- Biomedical Research Section
- Health Physics Research Section
- Applied Physics Research Section
- Chemistry Research Section
- Nuclear Materials Research Section

Nuclear Services Division

- Nuclear Reactor Operation Section
- Engineering Services Section
- Irradiation Services Section
- Radiation Protection Services Section
- Nuclear Analytical Techniques Application Section
- Isotope Techniques Section

Technology Diffusion Division

- International Cooperation Section
- Nuclear Training Center
- Nuclear Information and Documentation Section
- Business Development Section
- Management Information System Section

Nuclear Regulatory Division

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

Finance and Administrative Division

- Human Resource Management and Records and Communication Section
- Budget Section
- Accounting Section
- Property and Procurement Section
- Cash Section
- General Services Section

2016 PNRI ANNUAL REPORT PRODUCTION TEAM

EDITORS

Rhodora R. Leonin
 Justina S. Cerbolles
 Joan L. Tugo
 Hans Joshua V. Dantes

PRODUCTION and SUPPORT STAFF

Rissa Jane V. Amper
 Grace M. Carlos

