



2019 Performance Report

Philippine Nuclear Research Institute
Department of Science and Technology



**ABOUT
US**

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

VISION

The PNRI is an institution of excellence - a provider of innovative and effective nuclear and radiation science and technology for national prosperity.

MISSION

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

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Department of Science and Technology

Nuclear science and technology has been getting more and more exciting lately. Our nuclear scientists at the DOST Philippine Nuclear Institute have successfully woven nuclear science in the daily lives of common people-in food, environment, and most especially in their health.

In 2019, nuclear-related initiatives caught the attention of the award-giving bodies, as well as the media and the public. PNRI itself was recognized as having the most number of published research papers among all of the DOST agencies. This means that PNRI researchers have produced quite a number of research papers that are cited by other researchers because of the research papers' validity and sound science.

In households, nuclear science also became visible because of its researches that determined authentic food and ingredients helping ensure food safety among us Filipinos.

Nuclear technology is also helpful in developing materials that can help make the environment cleaner and safer, such as the radiation-grafted abaca-based fabric that can filter toxic pollutants. The exciting potential applications of this study is very evident such that DOST-PNRI chemists who developed this technology bagged the Utility Model award in the 2019 Regional Invention Contest and Exhibits.

Meanwhile, DOST-PNRI has also made remarkable accomplishments in providing nuclear services to its clientele. One evidence of its exceptional service is when the Institute's Irradiation Services Team bagged the 2019 Presidential Lingkod Bayan Award by the Civil Service Commission. This team operates PNRI's irradiation facilities, which are mainly used for radiation processing of various products such as food, medical equipment and raw materials, as well as for advanced research and development applications.

The Institute has also consistently demonstrated efficient enforcement of nuclear safeguard and security policies.

The year 2019 has seen DOST-PNRI consistently and fervently demonstrating nuclear science for the people. With the more aggressive nuclear S&T promotion campaign and building of networks and linkages, DOST-PNRI has broadened its reach within the country and in the international scene.

Congratulations to DOST-PNRI for its very significant increase in visibility and productivity in 2019. Cheers for more success in the coming years!



FORTUNATO T. DE LA PEÑA

Secretary



Philippine Nuclear Research Institute

I am proud to present the Institute's accomplishments and milestones for the year 2019.

Major developments in our R&D and service capabilities are currently laying the groundwork for huge leaps in terms of what PNRI can deliver for the following years.

We are looking forward in the near future to the establishment of a the Center for Nuclear Medicine Research and Development, complete with cyclotron and Positron Emission Tomography/Computed Tomography (PET/CT) facilities, which will maximize the use of valuable radiopharmaceuticals to make the early diagnosis of cancer more available and affordable to Filipinos. Our special thanks to our Balik Scientist, Dr. Thomas Neil Pascual, whose efforts are instrumental to the fruition of this endeavor.

Much closer to the horizon is the ongoing upgrade of our Cobalt-60 Multipurpose Irradiation Facility. Its well-proven contributions to the industry through radiation processing of various products will be expanded further thanks to its full automation with support from the International Atomic Energy Agency and cost-sharing by the government.

Speaking of radiation applications, the Institute takes pride in our radiation-grafted abaca fabric designed to deal with toxic pollutants such as heavy metals, for bagging the Outstanding Utility Model Award at the recently concluded 2019 Regional Invention Contest and Exhibits. Congratulations!

With regards to the development of our country's legal and regulatory framework, the challenge continues as the Comprehensive Nuclear Regulations Act is once again refiled in the 18th Congress. We are optimistic that our lawmakers will see the need for an independent regulatory body for ionizing radiation. PNRI will also do its part in addressing the recommendations of the IAEA in Integrated Nuclear Infrastructure Review (INIR) Mission Report to build the adequate national infrastructure should we engage in a nuclear power program.

Beyond research, services and regulations, PNRI also ensures that the benefits of the Atom can be felt by our countrymen. Our successful example is the commercialization and launching of the Carrageenan Plant Growth Promoter, which can increase the yield of rice, and its recent label expansion to other crops such as mungbean and peanut.

PNRI also had the opportunity to represent the country in several international events, most notably the 63rd IAEA General Conference, complete with an exhibit showcasing our latest nuclear and radiation applications. Nuclear science is also gaining ground among our Filipino students through our Nuclearization campaign in universities and colleges, as well as the Nuclear Science and Technology Education Program (nSTEp+) for secondary education.

Congratulations are also in order for our very own Irradiation Services Team for receiving the Presidential Lingkod Bayan Award, as well as our scientists and researchers for once again leading the pack at the DOST International Publication Awards, with 21 papers published in internationally recognized journals – the highest among DOST agencies once again.

These accomplishments and more are featured in this 2019 Annual Report. Indeed, there is more work to be done, and we intend to keep the nuclear flame burning brightly to help light the way for national development.

Again, thank you very much, and Mabuhay!

C.A.L.

CARLO A. ARCILLA

Director



2019 HIGHLIGHTS OF ACCOMPLISHMENTS

Organizational Outcome		
Outcome indicators	Target	Accomplishment
Number of partnerships with public and private stakeholders and international organizations	15	17 = 2 above target
Amount of revenue generated from partnerships	P100,000,000	P155,156,437 = P55,156,437 above target
Output indicators	Target	Accomplishment
Percentage of technologies transferred within the expected timeframe	100%	100%
Percentage of projects implemented within the expected timeframe	100%	100%
Percentage of projects completed and published, presented or IP filed or approved	100%	100%

Nuclear Science and Technology and Advisory Program		
Outcome indicators	Target	Accomplishment
Percentage of clients that rated technology transfer as satisfactory or better	100%	100%
Percentage of clients that rated technical services as satisfactory or better	100%	100%
Output indicators	Target	Accomplishment
Number of knowledge/ technologies diffused	24	34 = 10 above target
Number of technologies transferred/commercialized	1	1
Number of technical services rendered per sector	68,000	69,854 = 1,854 above target



18,000 bags, boxes, and samples irradiated for **120** clients/customers



167,400 liters of PGP irradiated at the E-beam facility



70,000 radiation protection services for **12,000** clients/customers



25 conditioned disused sealed radioactive sources
+7 received for waste management



912 samples from **423** customers of nuclear-based analytical services



394 samples from **91** customers of cytogenetic and microbiological services



Provided gamma column scanning services for analysis and maintenance of process vessels



41 training courses on nuclear S&T and non-destructive testing for **821** participants



40 tours for ~ **1700** clients



400 clients provided with library services

Nuclear Regulations, Safety and Safeguards Program		
Outcome indicators	Target	Accomplishment
Percent of benefit incidence of satisfactory implementation of safeguards agreement and physical security system	100%	100%
Percent of benefit incidence of satisfactory regulatory issuances	100%	100%
Percent of compliance to regulatory standards	100%	99%
Output indicators	Target	Accomplishment
Number of regulations, guides, notices, bulletins or associated documents issued	6	7 = 1 above target
Number of violation of regulations detected over the last 5 years as percentage of the average number of licenses and permits on issue over the last 5 years	15%	10% = 5% above compliance (percentage of violations is targeted as equal or lower than 15% as measure of the effectiveness of regulatory inspection and enforcement)
Number of security/safeguards and regulatory activities implemented	10	11 = 1 above target



Regulations and Standards Development

- Code of PNRI Regulations
- Administrative Orders
- Regulatory Issuances
- Coordination for enactment of Nuclear/Atomic Law before Congress



Inspection of Licensees and Facilities and Enforcement of Regulations



Radiological Impact Assessment Studies and Emergency Preparedness and Response

- Training of first responders and technical personnel
- Continued development of RADPLAN with NDRRMC and other agencies



Licensing, Review and Evaluation of Nuclear/Radioactive Materials and Facilities



Nuclear Security and Safeguards

- Installation of safeguards and physical protection systems
- Maintenance of international commitments to nuclear safety, security, and safeguards
- Deployment of PNRI Mobile Expert Support Team in national and local events

Nuclear Research and Development Program		
Outcome indicators	Target	Accomplishment
Number of partnerships with public and private stakeholders and international organizations	15	17 = 2 above target
Amount of revenue generated from partnerships		
Output indicators	Target	Accomplishment
Percentage of technologies transferred within the expected timeframe	100%	100%
Percentage of projects implemented within the expected timeframe	100%	100%
Percentage of projects completed and published, presented or IP filed or approved	100%	100%



Technology Transfer and Commercialization of products

- Ongoing efforts for establishment of commercial irradiation facility
- Commercial distribution of Technetium-99m generators and other pharmaceuticals
- Revenue generation from commercialization of Carrageenan PGP by 2 technology adopters



S&T Linkages and Networking

- Assistance and support from the IAEA
- 9 research contracts and 39 TC projects
- 43 expert missions/delegates and 5 IAEA fellows
- 12 PNRI hostings of regional meetings, seminars, and training courses
- 108 PNRI personnel and 106 non-PNRI personnel trained



Research and Development Applications in Food and Agriculture

- Development of mutant varieties of food and ornamental crops
- Expansion of applications of Carrageenan PGP
- Irradiation of food and agricultural products to prolong shelf-life
- Studies on detection of Ciguatera toxin fish poisoning
- Development of biodegradable super water adsorbents for agricultural use



Applications for Improving Industrial Competitiveness

- Development of radiation-grafted abaca fabric for adsorbing heavy metals
- Studies on radiation grafting for precious metals
- Studies using X-ray Absorption Spectrometry to analyze allanite minerals



Publications

- 21 DOST IPA awardees and 28 other scientific publications



Applications in Environmental Management

- Isotope techniques for air pollution and groundwater studies
- Studies on management of harmful algal blooms or red tide in mussels
- Environmental radioactivity monitoring and marine radiological assessment
- Establishment of System for Online Monitoring of Environmental Radiation in various regions
- Extraction of uranium and rare earth elements in phosphates
- Studies on mercury contamination in mined-out areas



GENERATION OF NEW KNOWLEDGE

PNRI features its latest research and development on nuclear and radiation applications in the Philippines which benefit various sectors such as agriculture, medicine, industry, and the environment.

NUCLEAR APPLICATIONS IN FOOD AND AGRICULTURE

Mutation Breeding of Sugarcane

Researchers use mutations caused by radiation in plant breeding for producing varieties not derived from traditional means such as producing hybrids from two different plants. The ongoing research at PNRI utilizes an integrated breeding platform coupling mutation breeding with biotechnology. This has promising applications in inducing mutation for developing sugarcane varieties with increased sugar and biomass content as well as improved agronomic traits.



Initial selections of irradiated sugarcanes

Mutation Breeding of Alocasia

Mutation breeding is also being used to develop new varieties of ornamental plants. Alocasia is one of our native plants with high ornamental value. Alocasia samples grown in the laboratory (through tissue culture) were exposed to ionizing radiation and are currently being observed for desirable traits.




Tissue cultures of Alocasia

Enhancing Productivity of Selected Cereal Crops

RICE:


Seeds of traditional rice varieties Licoy, Native Borie, and Umangan were harvested from irradiated and control plants. The effect of irradiation on plant height differed per variety but flowering time was the same between irradiated and control plants.



LICOY:
Irradiated group was 6.1 cm shorter than the unirradiated or control counterpart

UMANGAN:
Almost the same height for irradiated (99.1 cm) and control (99.3 cm)

NATIVE BORIE:
Control group was 10.5 cm shorter than irradiated group



FLOWERING TIME:
No difference between irradiated and control plants.

ADLAI:

PNRI continues the development of improved varieties of adlai, or Job's Tears, which is a viable alternative to staple food crops, such as rice and corn. For this year, the top two mutant lines Guinampay 100-3-1 and Guinampay 100-3-2 were sown in the field together with the control for further testing of stability and increase of yield. Researchers also conducted a radiosensitivity study on adlai.



A researcher inspecting young samples of adlai at the PNRI compound



Guinampay variety of adlai irradiated at various doses

Carrageenan Plant Growth Promoter for Mungbean and Peanut

PNRI's award-winning Carrageenan Plant Growth Promoter (PGP) formula has also recently completed its field tests for use in mungbean and peanut. The final results showed an increase in yield by around 35% for mungbean and around 40% for peanut.

The Fertilizer and Pesticide Authority has also approved the label expansion of Carrageenan PGP to include both crops.

Carrageenan PGP Field Testing for Enhanced Growth and Induced Pest and Disease Resistance

PNRI researchers continue to study the formula's efficacy in enhancing growth and resistance to pests and diseases for staple food crops such as rice and corn.

For this year, the team produced and shipped 45,000 liters of Carrageenan PGP to Iligan City in Lanao del Norte for a two-season testing in 5,000 hectares of rice field. Continuous monitoring showed that the formula remains stable even after 39 months based on its chromatogram profiles.



The Carrageenan PGP is already in the market, with two technology adoptors to date



Improving Nutrient Use Efficiency towards Precision Agriculture

Isotope tracers prove useful in developing smart-farming methods for food crops by using the right amount and proper timing of fertilizer application and irrigation, among other factors.

Preliminary results of field experiments for corn fields in Malingin, Bogo, Cebu showed that corn planted in soil with low organic matter content responded vigorously to fertilizer application, particularly nitrogen, compared with those planted in soil with medium to high organic matter contents.

After finding that soil organic matter is important to overall soil fertility and crop response to added fertilizer, the research team suggests to undertake soil analysis to generate best nutrient recommendations for profitable and sustainable corn production.



Researchers use an isotope ratio mass spectrometer to analyze the samples with isotope tracers, which are keys in studying nutrient use efficiency among crops.

Development of Biodegradable Super Water Absorbents for Agriculture

Using radiation technique, the study optimized the formulation of super water absorbent (SWA) based on polyacrylic acid/cassava starch (SWA-cassava starch).

Biodegradable SWAs are crosslinked polymers that can absorb and retain large amount of water. They can increase water holding capacity of soil, minimize water use, and enhance plant growth, thus increasing agricultural productivity.

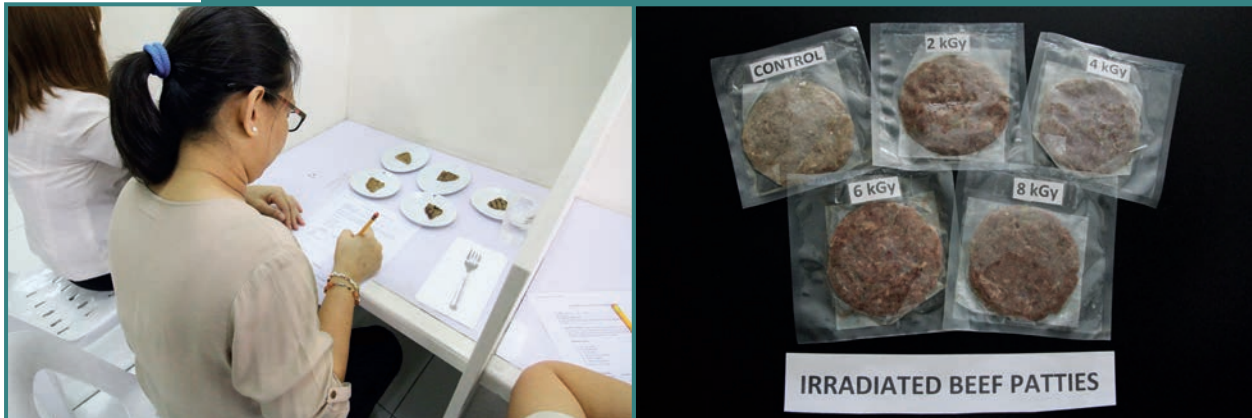
Application of Food Irradiation Technologies for Enhancing Food Safety, Quality, and Agricultural Trade

Radiation processing is already being used across the globe to decontaminate and extend the shelf-life of food. PNRI researchers continue to expand these applications to ensure food safety and improve the industrial and commercial competitiveness of various products.

This year, the Institute looked at the effect of irradiation on in-house burger patties compared with commercial burger patties. It also had a preliminary analysis on the use of acetic acid as sanitizer to reduce microorganisms on the fruit surface of high-value crops such as strawberry and lanzones.

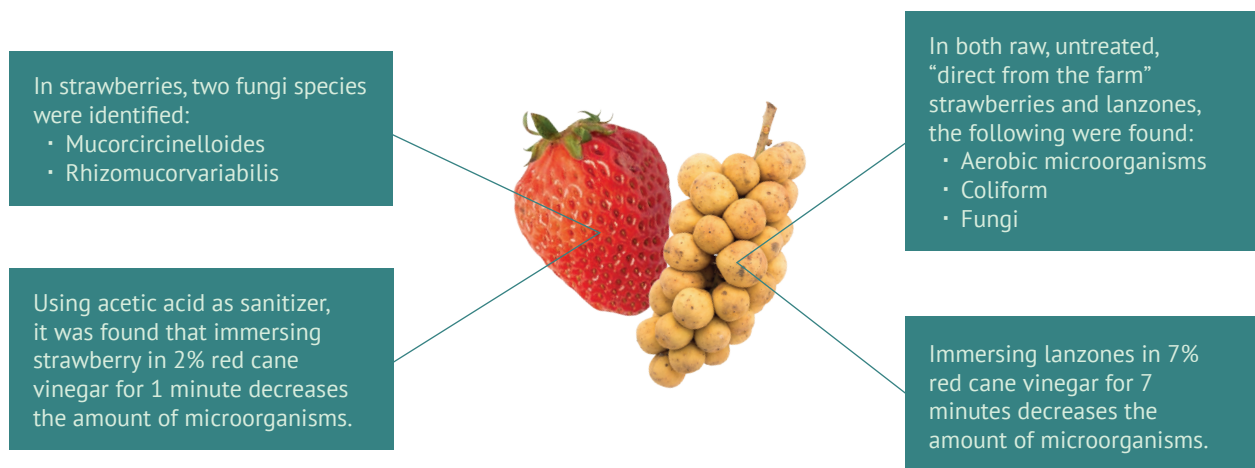
Electron Beam Irradiation for Improving the Microbiological Quality of Raw, Frozen Burger Patties

To further demonstrate the application of electron beam irradiation in food quality preservation, the Institute studied the microbiological quality of different commercially available beef burger patties. Studies showed that electron beam irradiation reduced the microbial count in beef patties.



Synergistic Effect of Postharvest Treatment and Radiation Technology on the Shelf-life of Strawberry and Lanzones

Prior to irradiation, vinegar can be used to reduce the amount of microorganisms on fruit surface. Further studies are ongoing.



Detection and Quantification of Ciguatera Fish Poisoning Toxin in Philippine Reef Fishes

The study used a radioligand receptor binding assay (RBA) developed in a project involving the International Atomic Energy Agency (IAEA), World Health Organization, and the National Oceanic and Atmospheric Administration. The study followed the format in quantifying saxitoxins, the best-known paralytic shellfish toxin.

Having verified that the RBA method is applicable in the Philippine setting, the study will help reduce public health risks caused by harmful algal blooms, specifically ciguatera fish poisoning.

NUCLEAR APPLICATIONS IN HEALTH AND MEDICINE

Development of Local Production of Technetium-99m Radiopharmaceuticals

PNRI consistently develops the local production of Technetium-99m (Tc-99m), an isotope used in radiopharmaceuticals for most nuclear medicine procedures.



Researchers continued to work on establishing a Radiopharmaceutical Kit Laboratory and ensuring its compliance with good manufacturing practices, as well as developing PNRI's capability to perform unit dosing for Tc-99m, which could further help lower the cost of radiopharmaceutical to be supplied to hospitals.



Balik Scientist for Nuclear Medicine

Through the DOST Balik Scientist Program, PNRI received the invaluable assistance of Dr. Thomas Neil Pascual, formerly of the IAEA. A nuclear medicine expert, Dr. Pascual collaborated with PNRI under the national health R&D agenda.



Director Arcilla of PNRI signs the memorandum of agreement for the Balik Scientist Program with Dr. Thomas Neil Pascual along with officials and researchers from PNRI and DOST.

CRADLE Project for Detection of Early-Stage Prostate Cancer

Prostate cancer is among the top causes of morbidity and mortality in the country among males. PNRI is currently engaged in a Collaborative Research and Development to Leverage Philippine Economy (CRADLE) project funded by the DOST-Philippine Council for Health Research and Development (PCHRD) and in collaboration with Rocket Health to develop the use of radiotracers as imaging biomarkers for early detection of prostate cancer, particularly the Prostate Specific Membrane Antigen (PSMA).

Preparations for new ligands in PSMA imaging are already underway, along with the development of a new model to design the ligands for computer simulations, which will serve as the basis for selecting the ligands before proceeding to synthesis.

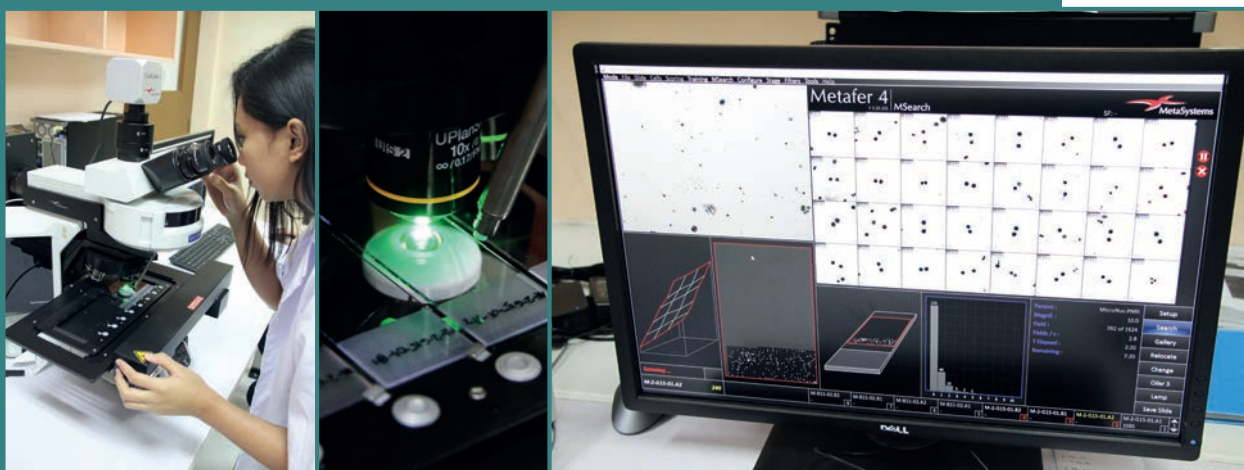
UPGRADING OF PNRI CYTOGENETIC BIOLOGICAL DOSIMETRY CAPABILITY FOR NUCLEAR INCIDENT AND OTHER HEALTH-RELATED SERVICES

Researchers continue to study binucleated cells (or those with two nuclei) commonly found in cancer cells to enable researchers to determine the absorbed radiation dose in individuals possibly exposed to radiation, either accidentally or chronically.

In case of an accident or incident, the absorbed dose assists physicians in categorizing victims and managing their individual treatment. Developing this capability among the research team is important in the establishment of a biodosimetry laboratory.

Another study focuses on the health-related application of cytogenetic assays, particularly in determining radiation sensitivity of healthy and cancer patients.

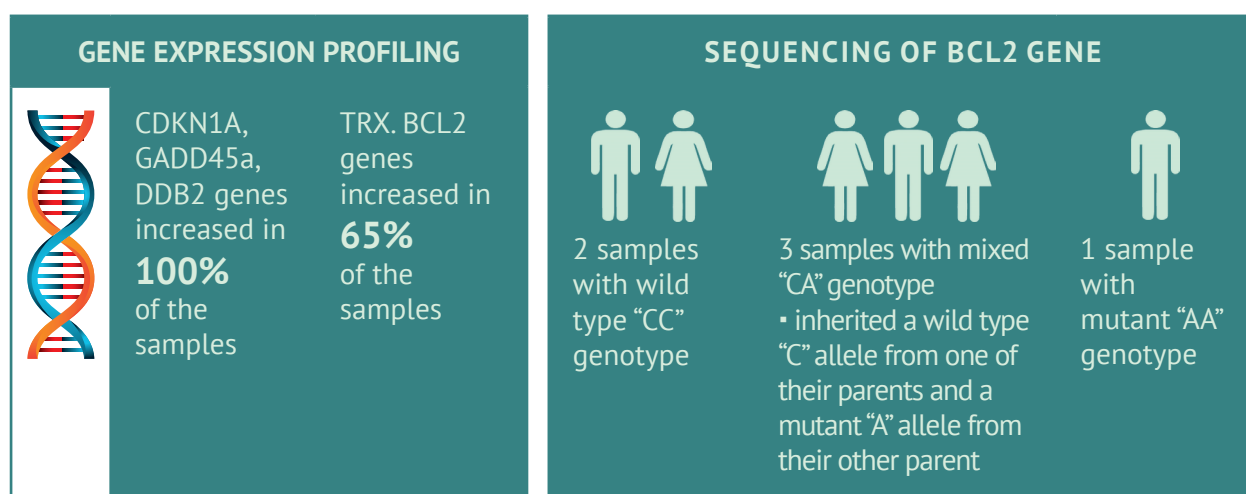
Finding out variations in inter-individual radiation sensitivity will pave the way to personalized radiotherapy of cancer patients.



Gene Expression Profiling and Mutational Analysis of Radiation-response Genes in Radiotherapy Patients

This study aims to determine whether differences in gene expression profile of radiation response genes can be associated with the radiotherapy response of a cancer patient and use this technique to predict radiotherapy responses.

For gene expression profiling, research results showed that there was an increase in gene expression among both volunteers of healthy and cancer patients before and after in vitro exposure to 2 Gy radiation through the PNRI gammacell-220. To further examine possible genotypic differences, some of the samples from healthy volunteers were sequenced for the BCL2 gene at the Philippine Genome Center.



Sterile Insect Technique Against Dengue Mosquito

PNRI continues the development of the Sterile Insect Technique where sterilized mosquitoes will be released in the wild to control the population of the dengue vector *Aedes aegypti*.

The study focuses on food materials and feeding methods that affect growth and development of *Aedes aegypti* that are grown in the laboratory.

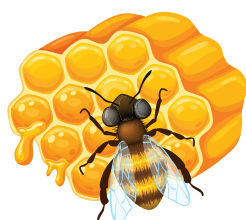
Further, the team also considered one new location in Navotas City, in addition to two locations in Quezon City, as study sites for mosquito sterile insect technique releases.



DEVELOPMENT OF NOVEL BIO-BASED MATERIALS USING GAMMA AND ELECTRON BEAM FACILITY FOR MEDICAL AND AGRICULTURAL APPLICATIONS

This project aims to develop bio-based materials processed by irradiation for medical and agricultural purposes

Effect of irradiation on the physico-chemical properties and antibacterial activity of stingless bee honey against the common wound bacterium, *Staphylococcus Aureus*.



Stingless bee honey:

- Total soluble solid and total flavonoid content not affected by irradiation up to 30 KGy
- Minimum Inhibitory Concentration (8%) against *Staphylococcus Aureus* was not affected by irradiation up to 30 KGy.

Non irradiated honey:

- Decrease in pH due to presence of fermenting microorganisms

Effect of Irradiation on the Physico-Chemical Properties of Alcoholic Extract of Propolis

Propolis, also called “bee glue”, refers to the resinous substance gathered by bees from different types of plants.

Irradiation

- Did not affect the non-volatile components in ethanolic extract of propolis (EEP)
- Increased the non-volatile components of the propanolic extract of propolis (PEP)
- Increase in dose decreases total flavonoid content in the EEP, indicating degradation
- Total flavonoids did not change in the PEP, indicating that propanol is effective in preserving flavonoids in the extract.
- Did not affect total phenolic contents in EEP
- Total phenolic in the irradiated PEP are significantly higher compared with non-irradiated group
- The effects of irradiation on PEP is similar to that of the irradiated stingless bee honey

Alcoholic extracts from propolis after irradiation



Shabu Profile Mapping using Nuclear Techniques

PNRI is collaborating with the Philippine Drug Enforcement Agency in the use of nuclear analytical techniques to conduct profile mapping of the notorious prohibited drug metamphetamine, commonly known as shabu. Researchers are currently fast-tracking the analysis of 100 samples via a plethora of isotope-based techniques such as x-ray fluorescence spectrometry, isotope ratio-mass spectrometry and x-ray diffraction.

NUCLEAR APPLICATIONS TO BOOST INDUSTRIAL COMPETITIVENESS

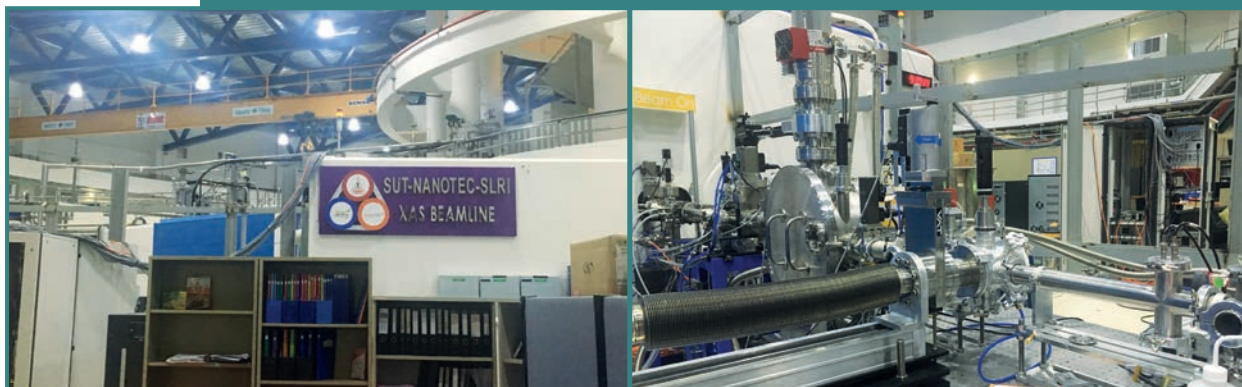
Radionuclides such as uranium, as well as rare earth elements (REEs) and industrial materials used in many advanced electronics and other export products. PNRI researchers are characterizing local deposits of various minerals to see if a significant amount of these resources can be extracted.

Through a technique called X-ray Absorption Spectroscopy or XAS, PNRI researchers investigated the correlation of radiation damage with the oxidation states of iron present in allanite minerals from Palawan, Philippines.

Results showed that the iron ratio in allanite rises as the absorbed alpha-dose increases. The researchers found that the allanite samples had relatively lower iron (ferrous ion) component, validating earlier local findings that the allanite in Palawan, Philippines has not accumulated radiation damage.

Allanite, one of the most common rare earth minerals, contains rare earth metals such as thorium and uranium that emit alpha-particles as they undergo radioactive decay. Due to the incorporated radioactive minerals, allanite can serve as a natural analogue for the immobilization or storage of high-level nuclear waste.

Characterization of Radiation Damage and Applications of Uranium/Thorium Bearing Heavy Minerals Using Nuclear and Other Related Techniques-Phase II

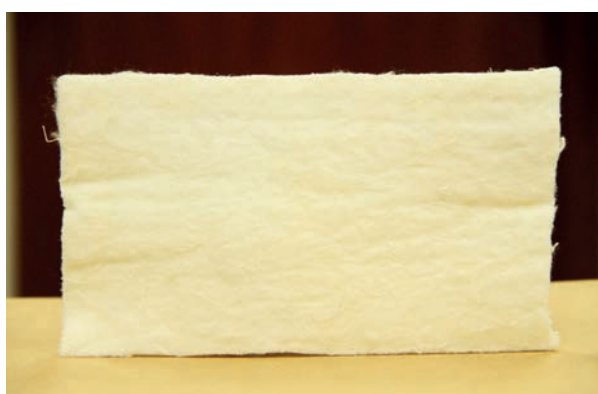


PNRI researchers analyze data using the SUT-NANOTEC Joint Research Facilities for Synchrotron Utilization in collaboration with the Synchrotron Light Research Institute in Thailand.

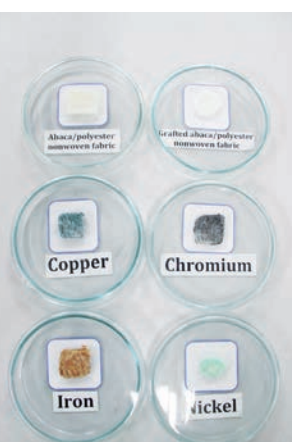
Radiation-Grafted Abaca Non-Woven Fabric as Heavy Metal Adsorbent

Radiation can modify materials and graft various polymers with advanced properties. Abaca was activated using radiation from the Electron Beam Irradiation Facility to allow the grafting of the polymers. PNRI chemists grafted a fabric based on the native product abaca with synthetic polymers to develop a nonwoven fabric that can filter toxic heavy metals such as lead, cadmium, nickel, chromium, mercury, and arsenic which can be harmful to human health and the environment.

The resulting abaca/polyester nonwoven fabric is reusable, cheaper to use and on par with, if not better than, commercial resins in filtering waste. The research project was funded by PCAARRD in collaboration with Philippine Textile Research Institute which provided the abaca/polyester nonwoven fabric. PNRI was granted a utility model for the technology, which later won at the Regional Invention Contest and Exhibits for the National Capital Region (RICE) in November 2019.



The radiation-grafted abaca/polyester non-woven fabric developed by PNRI



Samples of the fabric were tested on various heavy metals, such as copper, chromium, iron and nickel, among others

Radiation grafted materials are expected to prove useful for various industries, particularly those requiring waste water treatment. IAEA has engaged in a project with the Philippines and other countries for the increasing use of these technologies to minimize hazardous pollutants in various bodies of water in the Asia-Pacific region. PNRI is also looking forward to the development of other applications of radiation grafting such as producing biodiesel and recovering precious metals.



During an IAEA training course, PNRI researchers demonstrated radiation grafting procedures at the Chemistry Research Section laboratory (left) and at the Electron Beam Irradiation Facility (right)

Competitive Adsorption and Fixed Bed Column Adsorption Studies (Phase 2)

This continuing study from 2018 showed that the radiation-grafted adsorbent had higher selectivity to scandium. Thus the researchers were able to establish its applicability in a fixed-bed column adsorption mode.

The findings revealed the high potential of the radiation-grafted adsorbent in the metal processing industry, particularly for scandium recovery.

The element scandium is used in high-end applications such as in fuel cell, electronics, aerospace and lighting, etc which makes it a very important resource.

NUCLEAR APPLICATIONS IN ENVIRONMENTAL PROTECTION AND MANAGEMENT

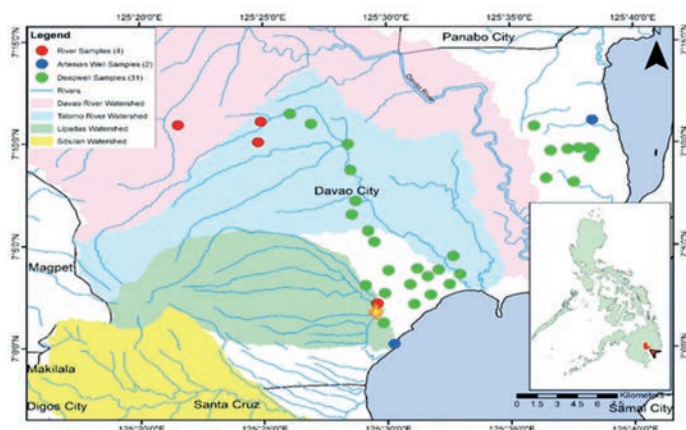
Assessing Soil Erosion in a Mango Orchard through Conventional and Isotope Techniques

Stable carbon and nitrogen isotope signatures were used as soil erosion indicators in the study area in Villa Boado, Talugtog, Nueva Ecija. Since these isotope signatures are unique (with specific origin and history), these were used to explain the observed measurement variations and possible sources of pollution in the site. Measured soil loss was 0.6 ton/ha and 0.4 ton/ha for October and November respectively.

Isotope Techniques for Groundwater Resource Studies in Davao City

Nuclear and isotope-based analytical techniques proved invaluable in characterizing the groundwater sources of Davao City, particularly its origin, rate of recharge, and its vulnerability to pollution in the face of rapid urbanization.

Results showed rare drastic changes in the groundwater within the past two decades, with the age of water ranging from less than 10 to 27 years inland and more than 50 years near the coast. Hence, any effects of climate change, land use change, population growth, and industrialization in the groundwater system is delayed.



Map of the study area showing the sampling sites (identified separately by symbols) and the rainwater collection stations (marked by yellow-orange star).

Capacity Building in Production of Marine Reference Materials for Harmful Algal Bloom Management

The study was able to improve the procedure used in measuring the toxin content of mussels by modifying the separation process for at least two potent form of the paralytic shellfish toxins (PSTs), namely neo-saxitoxin and saxitoxin. Using hydrochloric acid as extracting solvent, the researchers were able to give a conservative estimate of toxicity level that provides better safety-net for human consumptions of mussels.



The Receptor Binding Assay laboratory used by PNRI researchers for harmful algal bloom studies. PNRI currently serves as an IAEA Collaborating Center for Harmful Algal Blooms.

Assessing the Impact of Mining and Industrial Activities on Air Quality



PNRI researchers meet with collaborators for air pollution studies at the Surigao del Sur State University (SDSSU).



An air sampling station at SDSSU

PNRI expands its air pollution studies to compare the impact of mining activities in Surigao in northeastern Mindanao with the long-term data gathered in the industrial heartland of Valenzuela City.

Sampling sites were installed in May 2019 at Surigao. Results showed that both areas exceeded the WHO guidelines for particulate matter (PM 10 and PM 2.5), although there is lower vehicular impact and sulfur traces, and no lead pollution in Surigao compared with Valenzuela. However, high levels of mined minerals such as iron, chromium, and nickel were detected in Surigao, which may impact its air quality.

Radiological Assessment of Selected Marine Areas in the West Philippine Sea

The project focuses on monitoring the marine environment of the West Philippine Sea which has become an important body of water because of increased activities related to energy explorations, mining activities, wastes dumping, and nuclear energy production in neighboring countries. The project team collected specific types of marine samples such as seaweeds and snapper (*Lutjanidae*) whose natural and anthropogenic radionuclides were determined through gamma spectrometry.

Generated data will be included in the baseline database, and serve as country inputs to the regional database and to the ongoing comprehensive global assessment of marine radioactivity organized by the IAEA.



Assessment of Public Radiation Exposure in Tanay, Philippines

Based on analysis of air particulates collected at the CTBTO Radionuclide Monitoring Station PHP52, the following were detected: naturally-occurring radionuclides Beryllium-7 and the Lead-212 Family of radionuclides. Other radionuclides detected in air particulates include Cobalt-60, Sodium-24, and Iodine-131.

The concentrations were too small to be attributed to nuclear weapon activities or nuclear facility accidents. These may have come from previously deposited material in the environment through various processes such as wind or fire.

The data and findings of the study will serve as basis for further studies on local and regional atmospheric transport and radiological impact assessment for the implementation of an effective nuclear and radiological emergency preparedness and response system in the Philippines.

Assessing NORMs in Rice Field Soils in Nueva Ecija

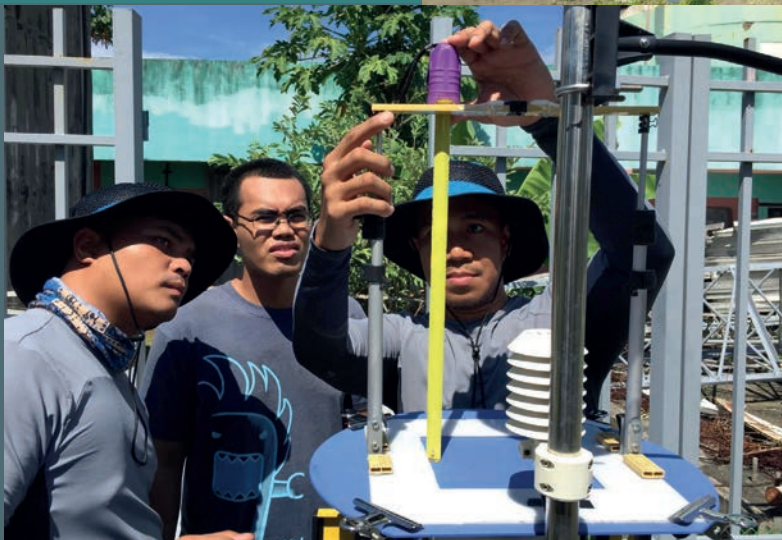
Researchers studied the presence of naturally-occurring radioactive materials (NORMs) in Nueva Ecija ricefields, including possible contribution of fertilizers to soil radioactivity.

Partial analysis of traces of U-238, Th-232, K-40, and Ra-226 in soil samples in Aliaga and Bongabon showed that the radioactivity and dose values are well below the world average, and the dose for fertilizers sampled are also negligible. Further collection and analysis of samples are ongoing.

Establishment of Real-Time Radiation Monitoring System in the Philippines

This project “System for On-line Monitoring of Environmental Radiation” or SOMER aims to provide continuous real-time gamma radiation level measurements from different parts of the country. SOMER will strengthen nuclear emergency preparedness and response through real-time monitoring and early detection of radiation emergencies in the Philippines.

Installed Radiation Monitoring Station in PAGASA Jaro, Iloilo City



SOMER facilities are also installed in other areas, such as:

- Sinaít, Ilocos Sur
- Puerto Princesa, Palawan
- Lapu-Lapu City, Cebu
- Guiuan, Eastern Samar
- El Salvador City, Misamis Oriental

Extraction of Valuable Elements from Phosphate Fertilizer Byproducts

Current studies show that local stockpiles show enhanced concentrations of uranium and radium up to 145 parts per million (ppm), with radioactivity measured at 1.13 Bq/g. Meanwhile, rare earth element concentrations range from 112 to 756 ppm, composed primarily of yttrium (26%), cerium (25%), lanthanum (16%), and neodymium (15%).

The Institute is also engaged in an IAEA technical cooperation project aiming to develop the first uranium extraction facility in the country for wet phosphoric acid. The project not only looks forward to a sustainable production of uranium from phosphate fertilizer byproducts, but also aims to reduce the negative environmental impact of radionuclides and other heavy metals on agricultural land.



Researchers collecting phosphogypsum samples from trenches in a phosphate fertilizer manufacturing plant

Characterization of Radionuclides and REEs in Coal and Feldspar Deposits

Coal and feldspar may also hold additional economic potential in the form of untapped radionuclides as well as REEs they may contain. PNRI embarked on a project to characterize and estimate the amount of these valuable resources, starting in late 2019 with stakeholder visits to local coal deposits in Semirara Island and Isabela, as well as feldspar deposits in Ilocos Norte and Northern Palawan.

Researchers are also developing a method to get that data on the spot using advanced techniques such as Laser-Induced Breakdown Spectroscopy and gamma-ray spectrometry.



Analysis of a feldspar rock sample using laser induced breakdown spectroscopy analyzer

Tracing Pathways of Mercury Concentrations in Palawan



Water sampling at a pit lake in Puerto Princesa, Palawan as part of an investigation into possible mercury pollution in the surrounding area using nuclear and isotope-based techniques

Using environmental isotopes and nuclear techniques, PNRI researchers tracked the pathways and sources of mercury pollution in an abandoned mining area in Palawan. The study involved a rapid assessment of environmental conditions in the air, surface water, groundwater, and soil sediments.

Results showed elevated mercury levels in soil sediments and air originating from two hotspots, one at a near-mine waste calcine deposit and another at the Honda Bay wharf. The pathway is connected to the Tagburos River which traverses close to the pit lake of the mine and draining to Honda Bay. Mercury levels both in the surface water and groundwater are insignificant, while isotope analysis showed that the age of the groundwater is that of a sub-modern water recharged by local precipitation and originating from meteoric water.

ESTABLISHMENT OF THE RADIATION RESEARCH CENTER



The project is co-funded by the DOST and the PCHRD.

In December 2019, the PNRI completed the establishment of the Radiation Research (RadRes) Center.

The RadRes Center aims to offer innovations for a wide range of radiation research including immediate and late effects of radiation; radiation oncology; drug discovery and development; DNA repair radiation dose-lethality and mitigation cellular radiobiology; tumor radiotherapy; normal tissue response to radiotherapy; low dose effects; dosimetry methods and instrumentation, and health physics.

The RadRes Center is expected to play a key role in further developing the Philippines' expertise in Radiation Research by training the new generation of researchers and young scientists.

ESTABLISHMENT OF A SUBCRITICAL ASSEMBLY FOR TRAINING, EDUCATION AND RESEARCH (SATER)

PNRI is preparing for the re-operation of the Philippine Research Reactor-1 (PRR-1) as a Subcritical Assembly for Training, Education and Research (SATER). SATER will serve as a research facility for advanced experiments and reactor operations and eventually support the country's manpower development should the country decide to engage in a nuclear power program.

The rehabilitation of the PRR-1's physical infrastructure is already underway and the structural and seismic evaluation as well as fabrication of additional structures for the subcritical assembly will commence in 2020. PNRI has also engaged in several research activities on neutron spectroscopy to help maximize SATER's applications, including academic research and industries requiring neutron sources.

Experts from Korea Atomic Energy Research Institute (KAERI) and TechnicAtome of France were invited to help review the preparations for the facility, while relevant safety and security-related documents are also currently under regulatory review.



ESTABLISHMENT OF A CYCLOTRON FACILITY AND CANCER STAGING CENTER

One of PNRI's flagship projects is the establishment of a cyclotron and Positron Emission Tomography/Computed Tomography (PET/CT) facility which will serve as a major center for diagnosing cancer. The facility is projected to drive down the cost of PET/CT scans by up to one-fifth of the average cost.



Artist's rendition of the PNRI Center for Nuclear Medicine Research and Development soon to rise along Central Avenue in Diliman, Quezon City

LIST OF SCIENTIFIC PUBLICATIONS

PUBLICATIONS WHICH GARNERED THE 2019 INTERNATIONAL PUBLICATION AWARDS

TITLE	AUTHORS	JOURNAL	PUBLISHED
Antioxidative Nanoparticles Significantly Enhance Therapeutic Efficacy of an Antibacterial Therapy against <i>Listeria monocytogenes</i> Infection	Chitho Feliciano, Yutaka Ikeda, Yukio Nagasaki, Kazuhiro Shoji, Shinji Saito	Molecular Pharmaceutics 15(2): 1126-1132	March 2018
Antioxidant Nanomedicine Protects against Ionizing Radiation-Induced Life-Shortening in C57BL/6J Mice	Chitho Feliciano, Yukio Nagasaki	Biomaterials Science and Engineering 5(11): 5631-5636	January 2019
Organogenic Potential of <i>Dendrobium</i> Floral Tissues for Stable Transformation Applications	Jorge Sahagun, Anupan Kongbangkerd, Kumrop Ratanasut	Philippine Journal of Science 147(4): 667-676	December 2018
Synthesis and Characterization of Mordenite-type Zeolites with Varying Si/Al Ratio	Mon Bryan Gili, Marlon Conato	Materials Science Express 6(4): 015515(1-10)	June 2019
Adsorption Uptake of Mordenite-type Zeolites with Varying Si/Al Ratio on Zn ²⁺ Ions in Aqueous Solution	Mon Bryan Gili, Marlon Conato	Materials Science Express 6(4): 045508(1-12)	June 2019
Documented Pupal Eye Color of Mediterranean Fruit Fly as a Tool for Radiation Sterilization	Sotero Resilva, Brian Barnes, Glenda Obra	Philippine Journal of Science 148(1): 27-93	March 2019
Radiation Sterilization of Mexican Fruit Fly <i>Anastrepha ludens</i> (Leow) Based on Pupal Eye Color	Sotero Resilva, Emilio Hernandez, Glenda Obra	Philippine Journal of Science 148(1): 45-50	March 2019
Development of Calculation Tool for Respiratory Tract Deposition Depending on Aerosols Particle Distribution	Eliza Enriquez, Lorna Jean Palad, Kazuki Iwaoka, Masahiro Hosoda, Shinji Tokonami, Reiko Kanda	Radiation Protection Dosimetry 184 (3-4): 388-390	October 2019
Absorbed Dose Rates in Air along the Roads in Quezon City, Philippines	Lorna Jean Palad, Christopher Mendoza, Eliza Enriquez, Chistian Dela Sada, Fe Dela Cruz, Juanario Olivares, Ryan Joseph Aniago, Kazuki Iwaoka, Masahiro Hosoda, Shinji Tokonami	Philippine Journal of Science 148(2): 395-399	June 2019
Preliminary Development of Thoron Exposure System in the Philippines	Lorna Jean Palad, Eliza Enriquez, Fe Dela Cruz, Christopher Mendoza, Juanario Olivares, Ryan Joseph Aniago, Chistian Dela Sada, Kazuki Iwaoka, Masahiro Hosoda, Shinji Tokonami	Science Diliman 30(2): 87-95	December 2018
Measurement of Ambient Gamma Dose Rates along Two Industrial Facilities in Leyte Island, Philippines	Lorna Jean Palad, Christopher Mendoza, Fe Dela Cruz, Juanario Olivares, Paolo Tristan Cruz, Kazuki Iwaoka	Radiation Protection Dosimetry 184 (3-4): 395-399	October 2019

LIST OF SCIENTIFIC PUBLICATIONS

PUBLICATIONS WHICH GARNERED THE 2019 INTERNATIONAL PUBLICATION AWARDS

(Continuation)

TITLE	AUTHORS	JOURNAL	PUBLISHED
Enhanced Amination and Adsorption Performance of Functional Copolymer Synthesized via RAFT-mediated Radiation Grafting in Emulsion	Jordan Madrid, Yuji Ueki, Lucille Abad, Takeshi Yamanobe, Naoriaki Seko	Journal of Polymer Research 25(9): 193	September 2018
Sustained DDB-2 and TRX transcriptional response of quercetin-treated lymphocytes exposed to Co-60 radiation	Gloriamaris Caraos, Mary Jayne Manrique, Chitho Feliciano, Neil Tan Gana, Maria Christina Ramos	Gene Reports 16	May 2019
Physico-chemical Characteristics of Wastewater from a Ball Mill Facility in Small-scale Gold Mining Area of Paracale, Camarines Norte, Philippines	Jessie Samaniego, Maria Antonia Tanchuling	Philippine Journal of Science 147 (3): 343-356	September 2018
Effect of Radiation-modified Kappa-carrageenan as Plant Growth Promoter on Peanut (<i>Arachis hypogaea</i> L.)	Lucille Abad, Fernando Aurigue, Djowel Recto Montefalcon, Proceso Manguiat, Florita Carandang, Sancho Mabborang, Gil Mark Hizon, Matt Ezekiel Abella	Radiation Physics and Chemistry 153: 239-244	December 2018
Triterpenes and Sterols from leaves of <i>Hoya meliflua</i> Merr	Fernando Aurigue, Vincent Antonio Ng, Raoumond Malabed, Consolacion Ragasa	Pharmacognosy Journal 11(1): 48-52	January 2019
Hoya of the Philippines, Part II: <i>Hoya pulchra</i> (Apocynaceae), a New Species from Southern Philippines	Fernando Aurigue, Jorge Sahagun, Derek Cabactulan, Reynold Pimentel, Miguel David De Leon, Michele Rodda	Annales Botanici Fennici 56: 49-53	February 2019
Preliminary Radiological Survey on High Rare-Earth Containing Area in San Vicente, Philippines	Lorna Jean Palad, Kazuki Iwaoka, Christopher Mendoza, Fe Dela Cruz, Masahiro Hosoda, Shinji Tokonami, Eliza Enriquez, Chitho Feliciano, Reiko Kanda	Philippine Journal of Science 143(2): 499-502	September 2019
Multimetal Resistant, Alkalitolerant Bacteria Isolated from Serpentinizing Fluid-Associated Sediments and Acid Mine Drainage in the Zambales Ophiolite, the Philippines	Carlo Arcilla, Bharathi Vallalar, D'Arcy Meyer-Dombard, Dawn Cardace	Geomicrobiology Journal 36(9): 792-809	June 2019
Geology, Alteration, and Mineralization of the Kay Tanda Epithermal Gold Deposit, Lobo, Batangas, Philippines	Carlo Arcilla, Sofia Marah Frias, Akira Imai, Ryohei Takahashi, Ma. Ines Balangue-Tarriela, Nigel Blamey	Resource Geology 69(4): 1-34	May 2019
A Radioligand Receptor Binding Assay for Ciguatoxin Monitoring in Environmental Samples: Method Development and Determination of Quality Control Criteria	Lisbet Díaz-Asencio, Rachel Clausen, Ma. Llorina Rañada Carlos Alonso-Hernández, Marie-Yasmine Dechraoui Bottein	Journal of Environmental Radioactivity 192:289-291	December 2018

LIST OF SCIENTIFIC PUBLICATIONS

OTHER SCIENTIFIC PUBLICATIONS

TITLE	AUTHORS	JOURNAL	PUBLISHED
The Role of Reactive Iron in Long-term Carbon Sequestration in Mangrove Sediments	Dicen, G.P., Navarrete, I.A., Rallos, R.V., Salmo, S.G., Garcia, M.C.A.	Journal of Soils and Sediments 19(1): 501-510	January 2019
Determination of the REE content, Geological Age, and Absorbed Alpha Dose of Allanite Mineral from Palawan, Philippines	Dingle, C.A.M., Jecong, J.F.M., Hila, F.C., Ramo, M.E.S.V., Guillermo, N.R.D., Vasquez Jr, M.R., Samson, V.A.I.	X-Ray Spectrometry 48(5): 513-521	March 2019
Insecticidal Activity of Crude Ethanolic Extracts of Selected Philippine Plants against Diamondback Moth, <i>Plutella xylostella</i> Linnaeus	Javier, A.M.V., Ocampo, V.R., Ceballo, F.A., Javier, P.A.	Philippine Journal of Science 148(1): 33-43	March 2019
Computational Design and Characterization of a Subcritical Reactor Assembly with TRIGA Fuel	Asuncion-Astronomo, A., Štancar, Ž., Goričanec, T., Snoj, L.	Nuclear Engineering and Technology 51(2): 337-344	April 2019
Synthesis and Characterization of Mordenite-type Zeolites via Hydrothermal Method using Silica Gel and Sodium Aluminate as Si and Al Sources at Varying Temperature	Gili, M., Conato, M.	Journal of Physics: Conference Series 1191: 012038	March 2019
Effects of Molarity Variation on the Optical Property and Topography of ZnO Thin Films Deposited Via Spray Pyrolysis	Gili, M.B., Chu, R., Balela, M.	Journal of Physics : Conference Series 1191(1): 012050	March 2019
Effects of Mechanical Activation of Precursors in the Synthesis of Ca-Doped BaTiO ₃ Via Conventional Solid State Reaction Method	Gili, M.B., Chu, R., Cervera, R.	Journal of Physics: Conference Series 1191(1): 012053	March 2019
Adsorption Uptake of Philippine Natural Zeolite for Zn ²⁺ ions in Aqueous Solution	Gili, M.B., Olegario-Sanchez, L., Conato, M.	Journal of Physics: Conference Series 1191(1): 012042	March 2019
Synthesis and Characterization of Mordenite-Type Zeolites via Hydrothermal Method Using Silica Gel and Sodium Aluminate as Si and Al Sources at Varying Temperature	Gili, M., Conato, M.	Journal of Physics Conference Series 1191 (1): 012038	March 2019
Assessment of Temporal Variations of Natural Radionuclides Beryllium-7 and Lead-212 in Surface Air in Tanay, Philippines	Cruz, P.T.F., Bonga, A.C., Dela Sada, C.L., Olivares, J.U., Dela Cruz, F.M., Palad, L.J.H., Jesuitas, A.J., Cabatbat, E.C., Omandam, V.J., Garcia, T.Y., Feliciano, C.P.	Journal of Environmental Radioactivity 208-209: 105989	June 2019
Towards Integrated Management of a Shallow Tropical Lake: Assessment of Water Quality, Sediment Geochemistry, and Phytoplankton Diversity in Lake Palakpakin, Philippines	Navarrete, I.A., Dicen, G.P., Perez, T.R., Mendoza, S.M., Rallos, R.V., Labides, J.L.R., Rivera, C.T., Hallare, A.V., Claveria, R.J.R.	Environmental Monitoring and Assessment 191(8)	July 2019

LIST OF SCIENTIFIC PUBLICATIONS

OTHER SCIENTIFIC PUBLICATIONS (*Continuation*)

TITLE	AUTHORS	JOURNAL	PUBLISHED
Gamma Irradiation for the Inactivation of <i>Aspergillus Niger</i> in Aged Cotton Fabric	Uldo, D.A., Feliciano, C., Cayetano, M., De Guzman, Z.	Radiation Physics and Chemistry 165:108399	July 2019
Size-resolved Composition and Morphology of Particulate Matter During the Southwest Monsoon in Metro Manila, Philippines	Cruz, M.T., Bañaga, P.A., Bañaga, P.A., Betito, G., Braun, R.A., Stahl, C., Aghdam, M.A., Obiminda Cambaliza, M., Dadashazar, H., Hilario, M.R., Lorenzo, G.R., Ma, L., MacDonald, A.B., Pabroa, P.C., Yee, J.R., Simpas, J.B., Sorooshian, A.	Atmospheric Chemistry and Physics 19(16): 10675-10696	August 2019
Treatment of Small Scale Gold Mining Wastewater Using Pilot-Scale Sedimentation and Cocopeat Filter Bed System	Samaniego, J.O., Tanchuling, M.A.N.	Global Journal of Environmental Science and Management 5(4)	August 2019
Enhancing Peanut Productivity through Application of Irradiated K- Carrageenan	Gatan, M.G.B., Gatan, M.T., Aurigue, F.B.	International Journal of Recent Technology and Engineering 8(3)	September 2019
Evaluation of the Spatial Distribution of Evacuation Centers in Metro Manila, Philippines	Cajucum, E.P., Chao, G.Y., Constantino, G.A., Ejares, J.A., Quillope, S.J.G., Solomon, H.M., Ringor, C.L.	International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archive 42(3)	September 2019
Surface Water Characteristics in the Vicinity of Abandoned Mercury Mine Site in Puerto Princesa City, Philippines	Samaniego, J.O., Gibaga, C.R.L., Tanciongco, A.M., Rastrullo, R.M., Costa, M.A.V.	Philippine Journal of Science 148(3): 493-499	September 2019
Predicting Useful Life of Cocopeat in a Filter Bed Treating Wastewater with Heavy Metals using HYDRUS-1D	Samaniego, J., Tanchuling, M.A.	ASEAN Engineering Journal 9(2):44-56	October 2019



PROVISION OF NUCLEAR S&T SERVICES

PNRI harnesses the unique advantages of nuclear and radiation applications to serve its customers from a wide range of sectors. These include the processing of commercial and industrial products, sample analysis, and radiation protection, among others.

IRRADIATION SERVICES

PNRI offers its irradiation facilities to clients for microbial decontamination of food products and other raw materials, sterilization of medical products, and other radiation processing services.

Cobalt-60 Multipurpose Irradiation Facility

Established in 1989, PNRI's Multipurpose Irradiation Facility (MIF) is the only facility of its kind in the country to date. Using gamma irradiation from its Cobalt-60 source, the facility serves clients from various industries for processing a wide variety of products for commercial and manufacturing purposes, among others.

Products Irradiated at the MIF



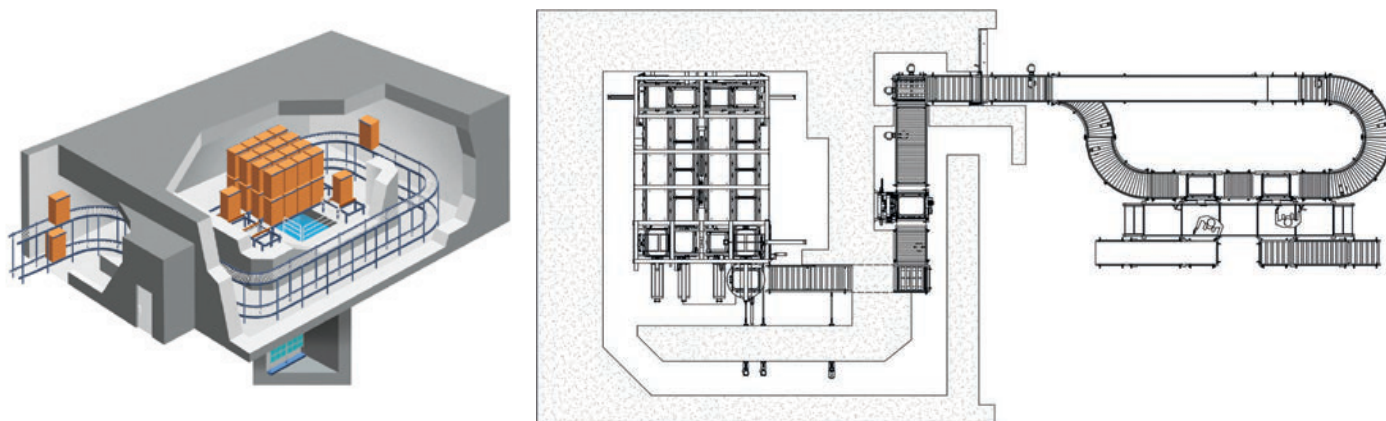
17,266
Bags/Boxes of Products

79
Clients



Full Automation Upgrade for the MIF

With support from the IAEA, PNRI is upgrading its MIF into a fully automated commercial-scale facility to meet the increasing demands of the industry.



Advantages:

- Safer working environment for facility operators
- Continuous mode of operation
- Increased volume of products that can be irradiated
- Less shutdown time during operation
- Flexibility in irradiating products requiring low, medium, and high doses
- Higher income for industry partners

Gammacell-220

The Gammacell-220 self-shielded irradiator also uses gamma radiation from Cobalt-60 source but is used for samples in small volume or that require low radiation. These include samples from researchers as well as students with radiation-related investigatory projects.

535
Bags/Boxes
of products
irradiated

32
Clients
served



Ob-ServoSanguis Self-Shielded Gamma Irradiator for SIT and Small Volume Services

A new self-shielded gamma irradiator for the same scale of services arrived in October 2019. Initially intended for irradiating mosquitoes as part of PNRI's Sterile Insect Technique project, the new irradiator will also be used for small-volume samples requiring high doses, complementing the services previously provided through the Gammacell-220 irradiator.



Operators of the Irradiation Services Section demonstrate the new self-shielded gamma irradiator to IAEA Project Management Officer Mr. Syahril Syahril during his visit at PNRI.

Electron Beam Irradiation Facility

Established in 2014, the 2.5 MeV Electron Beam Irradiation Facility (EBIF) opens the frontier for more advanced applications of radiation processing in the Philippines. It is used for research and development as well as semi-commercial services.

PNRI's award-winning Carrageenan Plant Growth Promoter is also currently being produced in the EBIF.

614
Samples
irradiated

9
Clients
served

167,400
Liters of PGP
produced



PNRI Director Dr. Carlo Arcilla and IAEA Director of the Technical Cooperation Division for Asia and the Pacific Dr. Jane Gerardo-Abaya visit the EBIF irradiation room.

RADIATION PROTECTION SERVICES

PNRI's radiation protection services involves the monitoring, assessment, and control of radiation exposure levels among occupationally exposed workers, helping to ensure the safety of professionals and the general public. These services include personnel dosimetry services, calibration of radiation instruments, and gross radioactivity measurements.

Following the establishment of a new building for radiation protection services, PNRI operates a new Secondary Standards Dosimetry Laboratory which will continue to serve as the reference for relevant standards of measurement for ionizing radiation, used primarily for calibration of radiation detection instruments.



70,546
Total services
rendered

12,455
Total clients/
customers served

68,325
Personnel
monitoring services

1,298
Instruments
calibrated

734
Swipe samples
analyzed

65
Sealed sources
leak-tested

2019 has also seen improvements and additions to the Institute's radiation protection services. These include the automation of the processing of Optically-Stimulated Luminescence dosimeters, and the addition of new services: the Philippine Dose Registry of Occupationally Exposed Workers or PhilDose, personnel monitoring for neutron exposures and calibration of neutron monitoring instruments.

Radioactive Waste Management Facility

The Institute also operates the only centralized Radioactive Waste Management Facility in the Philippines. The facility serves as a temporary storage and treatment site for low and intermediate –level radioactive wastes in the country generated from various nuclear and radiation applications.



NUCLEAR-BASED ANALYTICAL SERVICES

Isotope and other nuclear-based analytical services cover a wide range of applications from regulatory certification of products to research studies on the composition of various materials. Many nuclear analytical techniques have significant advantages compared with conventional methods, allowing researchers to obtain more precise information without risking the sample to damage.



Gamma Spectrometer



Liquid Scintillation Counter



X-Ray Fluorescence Spectrometer



Isotope Ratio Mass Spectrometer

Type of Analysis	No. of Samples Received	No. of Customer Served
Gammametric analysis	161	75
Liquid scintillation counting for alpha and beta analysis	364	179
Radon analysis	343	152
Carbon-14 Analysis	27	16
X-Ray Fluorescence Analysis	17	1
Total	912	423

CYTOGENETIC ANALYSIS AND MICROBIOLOGICAL TESTING

To ensure the safety of medical and industrial workers here and abroad, PNRI offers its cytogenetic biodosimetry services to monitor the level of their exposure to radiation.

Researchers also conduct bioburden and sterility testing, moisture analysis, and other microbiological services.



Researchers upgraded their cytogenetics services with an automated microscope for analysis of dicentric chromosomes (inset)

	No. of samples received	No. of customers served
Cytogenetic analysis	14	14
Aerobic plate count	104	22
Mold and yeast count	102	21
Total coliform	98	19
Sterility tests	42	11
Moisture analysis	4	2
Bioburden test	30	2
Total	394	91

GAMMA COLUMN SCANNING SERVICES

Clients from refineries and petrochemical industries also availed of PNRI's services to scan for defects in internal components and structures such as process vessels. Gamma radiation gives researchers the advantage of quickly identifying these problems without interrupting normal plant operations.

This year, PNRI rendered its gamma column scanning service for four distillation columns of Pilipinas Shell. Cobalt-60 sources were also rented out for gamma column scanning at the Malampaya Offshore Installation.



Engineering Services

PNRI engineers regularly provide assistance for the design, fabrication, repair, and maintenance of various equipment for PNRI's various offices and laboratories. These include both conventional equipment as well as those specialized for nuclear and radiation-related applications such as survey meters, air samplers, and radiation source holders.

Aside from the preventive maintenance of several PNRI facilities, such as the Liquid Nitrogen Plant and maintenance of the CTBTO station equipment, PNRI engineers also supervise several infrastructure projects for the Institute, and inspect buildings to ensure fire safety and maintain its electrical systems.



Fabrication of steel mold



Fabrication of equipment for the Neutron Laboratory



Conduct of infrared thermographic inspection of panel boards to detect deficiencies or abnormalities to help prevent future electrical failure



Decommissioning of a Cobalt-60 teletherapy machine at the Western Visayas Medical Center in Mandurriao, Iloilo City



ENSURING THE SAFETY AND SECURITY OF RADIOACTIVE SOURCES

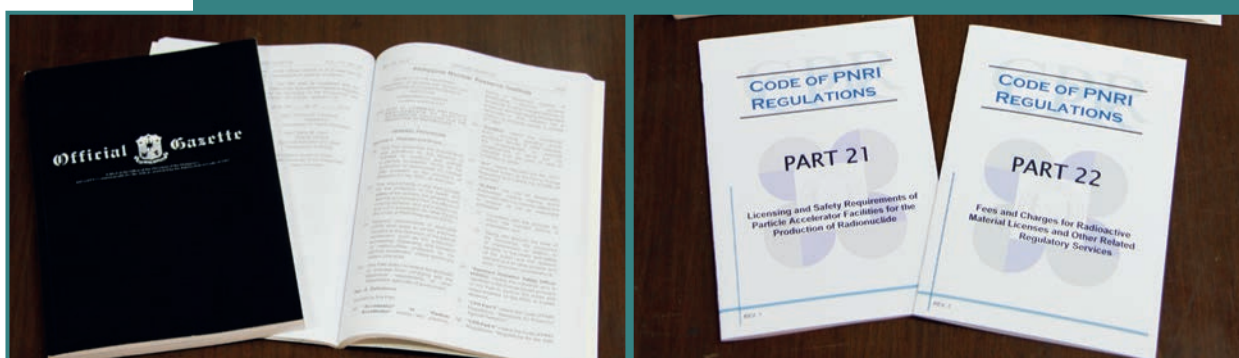
PNRI serves as the national regulatory body for nuclear and radioactive materials and facilities by virtue of Republic Act 5207 or the Atomic Energy Regulatory and Liability Act of 1968, as amended, and Executive Order 128 of 1987. The Institute accomplishes this mandate through its Nuclear Regulatory Division.

DEVELOPMENT OF NUCLEAR REGULATIONS AND STANDARDS

Under its regulatory mandate, PNRI promulgates regulations, administrative orders, and other requirements in line with international standards for nuclear and radioactive materials.

Code of PNRI Regulations (CPR)

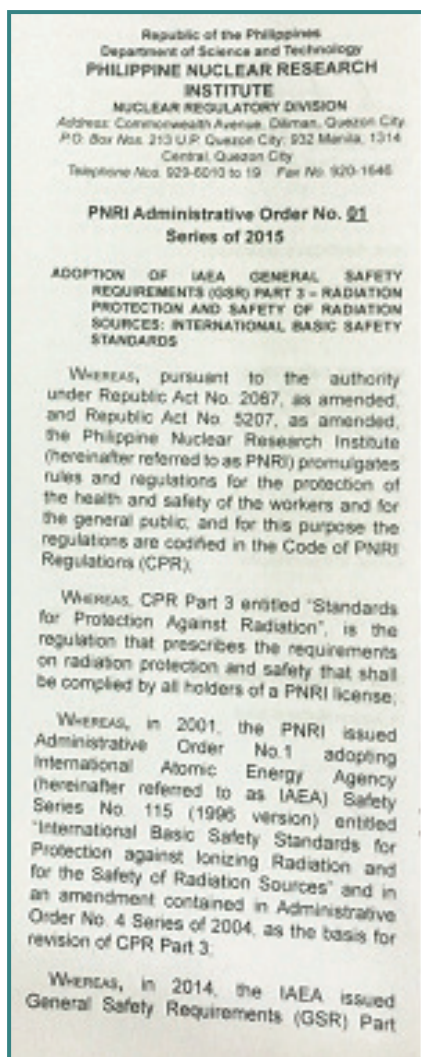
The CPR contains the requirements involving nuclear and radioactive materials, facilities, and related activities to ensure radiation protection, safety, and security of radioactive sources.



Part/Section	Title	Status
CPR Part 5	Requirements for Siting of Evaluation for Nuclear Installations	Published in Official Gazette (August 5, 2019)
CPR Part 7	Licensing of Nuclear Installations	Published in Official Gazette (September 16, 2019)
CPR Part 0	PNRI as the Regulatory Authority for Atomic Energy Facilities and Radioactive/ Nuclear Materials in the Philippines	Final draft for review
CPR Part 3	Standards for Radiation Protection and Safety of Radioactive Material	Final draft development ongoing
CPR Part 28	Licensing Requirements for Predisposal Management of Radioactive Waste Facilities and Activities	Final draft development ongoing
CPR Part 30	Safety Requirements for Research Reactors	Final draft development ongoing
CPR Part 29	Licensing and Safety Requirements for Borehole Disposal Facility of Radioactive Waste, Including Disused, Sealed Radioactive Source	For further comments

Administrative Orders and Other Issuances

PNRI also issues administrative orders, regulatory guides, information notices, and regulatory bulletins to inform the licensees on the recent developments regarding regulatory requirements and take appropriate actions, if necessary.



Order/Issuance	Title	Status
PNRI Administrative Order No. 2 s. 2018	Amendment of Administrative Order No. 1, S.2006, "Establishing the Code of PNRI Regulations"	Published in Official Gazette (February 4, 2019)
PNRI Administrative Order No. 1 s. 2019	Amendment to Section 6(a) of the Code of PNRI Regulations (CPRs): Application for New License and Renewal of License	Published in Official Gazette (December 16, 2019)
PNRI Regulatory Bulletin No. 19-01	Medical Event/ Medication Error: Improper Dose for the Administration of Iodine-131	Writing of final draft ongoing
PNRI Information Notice 2019-01	New Regulation: CPR Part 5 "Requirements for Siting of Nuclear Installations"	Approved by Dir. Arcilla on September 26, 2019
PNRI Information Notice 2019-02	Revised Regulation: CPR Part 7 "Licensing of Nuclear Installations, Rev. 01"	Writing of final draft ongoing

Legislative Support for the Nuclear Law

PNRI continues to push for the enactment of the bill on the Comprehensive Nuclear Regulation Act which will create an independent regulatory body for ionizing radiation consistent with international standards.



January

The bill for the Comprehensive Nuclear Regulations Act was approved on third and final reading at the House of Representatives on January 14, 2019.



February

Senator Benigno “Bam” Aquino IV, chairperson of the S&T Committee, delivers his sponsorship speech at the plenary on February 6, 2019.



May

In the Senate, the bill was subject to interpellation on May 20, 2019 but did not make it to the second reading by the end of the 17th Congress.



July-August

The bill was refiled during the 18th Congress by Senate President Vicente Sotto III as SBN 573 and by Congressman Erico Aristotle Aumentado in the House of Representatives as HB 2535.

Coordinated with legislative staff of Senator Francis Tolentino and Representatives Enrico Aristotle Aumentado, Ron Salo, and Virgilio Lacson.



September

In September, PNRI briefed Congressman Mario Vittorio Mariño, chairperson of the House Committee on Government Reorganization, on the salient features of the bill.



November

Held Bilateral meeting on the bill attended by representatives from the IAEA Office of Legal Affairs, Department of Energy and House Committees on Energy, S&T, Appropriations, and Government Reorganization.

Legislative Assistance Mission: National Workshop for Legislature of Nuclear Law held in Clark, Pampanga on 25-28 November 2019.

Turnover of the IAEA Integrated Nuclear Infrastructure Review (INIR) Mission Report

The International Atomic Energy Agency (IAEA) has formally turned over the Integrated Nuclear Infrastructure Review (INIR) Mission Report to the Philippine government on October 30, 2019.

Experts from the IAEA previously conducted the INIR mission on December 2018 to review the country's status in terms of the 19 milestones on nuclear infrastructure. It is a holistic peer review to assist member states in assessing the status of their national infrastructure required as the Philippines prepares to engage in a nuclear power program.

Among the recommendations of the INIR mission are the following:

- Government should implement the proposed expansion of the current Nuclear Energy Programme Implementing Organization (NEPIO) in order to enhance nuclear power program coordination
- The Philippines should further review some aspects of the current bills and ensure that its legislative plans include all necessary provisions of a comprehensive national nuclear law
- PNRI is encouraged to identify regulators and organizations that can provide external support to PNRI or the future independent regulatory body and pursue opportunities for cooperation
- NEPIO should develop/outline plans for human resource development for each key organization to be integrated at the national level



Department of Energy Secretary Alfonso Cusi (3rd from left) receives the INIR Mission Report from IAEA Deputy Director General Mikhail Chudakov (4th from left). They are joined by Ambassador Maria Cleofe Natividad, Permanent Representative of the Philippines to the IAEA and PNRI Director Dr. Carlo Arcilla (5th and 6th from left, respectively)

International Support for National Legal and Regulatory Infrastructure Development

PNRI continues to participate in several technical cooperation projects with the IAEA particularly the Asian Nuclear Safety Network to support the continued improvement and updating of the Philippines' national legal and regulatory framework.



Project RAS9089 on Strengthening Radiation Safety Infrastructure



Project PHI0015 on Capacity Building for Nuclear S&T by reviewing the TRIGA PPR Sub-Critical Assembly

Regulatory Conferences and Consultative Meetings

PNRI conducts regulatory conferences and consultative meetings to obtain feedback and consult with the various licensees and other stakeholders, which is necessary for the creation and updating of regulations.



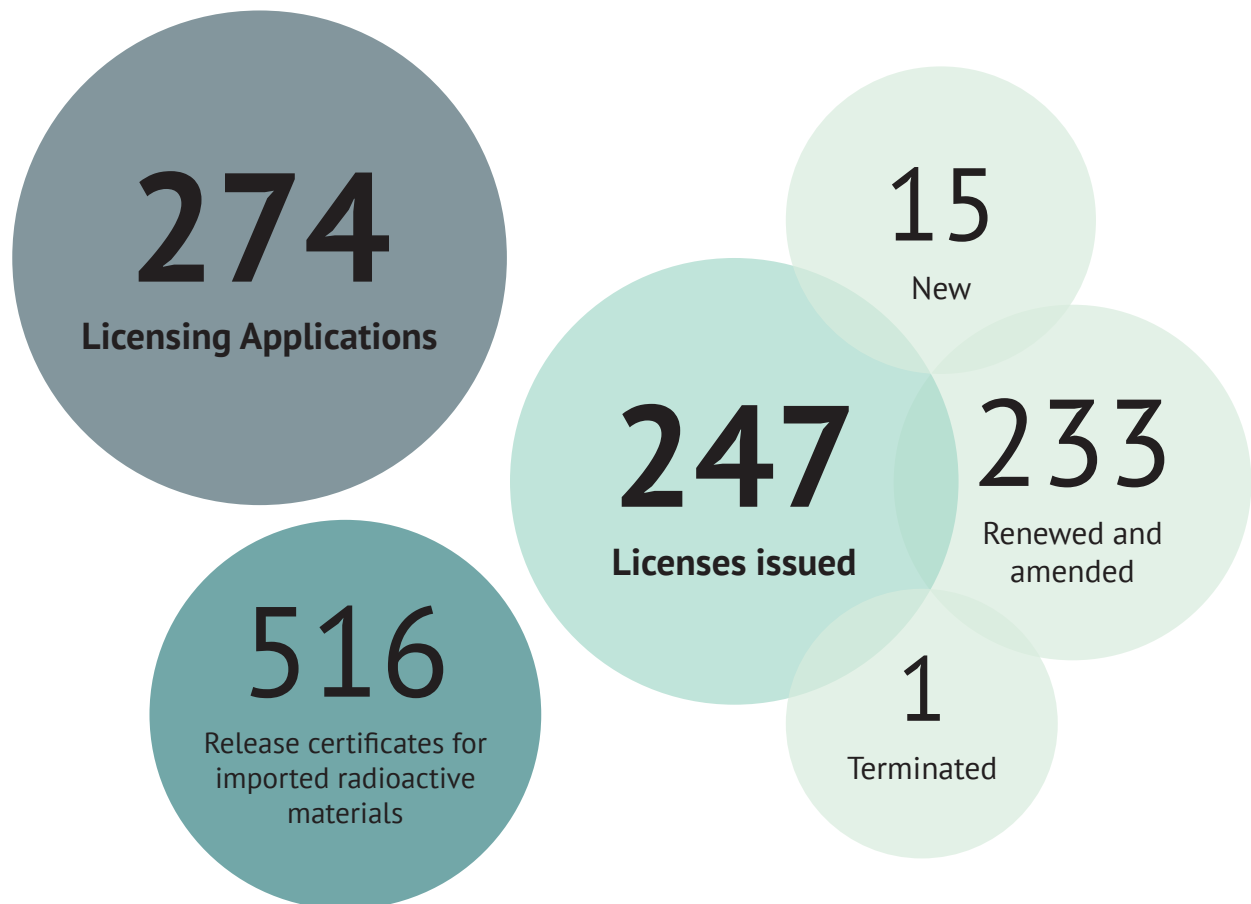
Regulatory Conference on February 28
for review of CPR Part 7, Licensing of
Nuclear Installations, Rev. 01



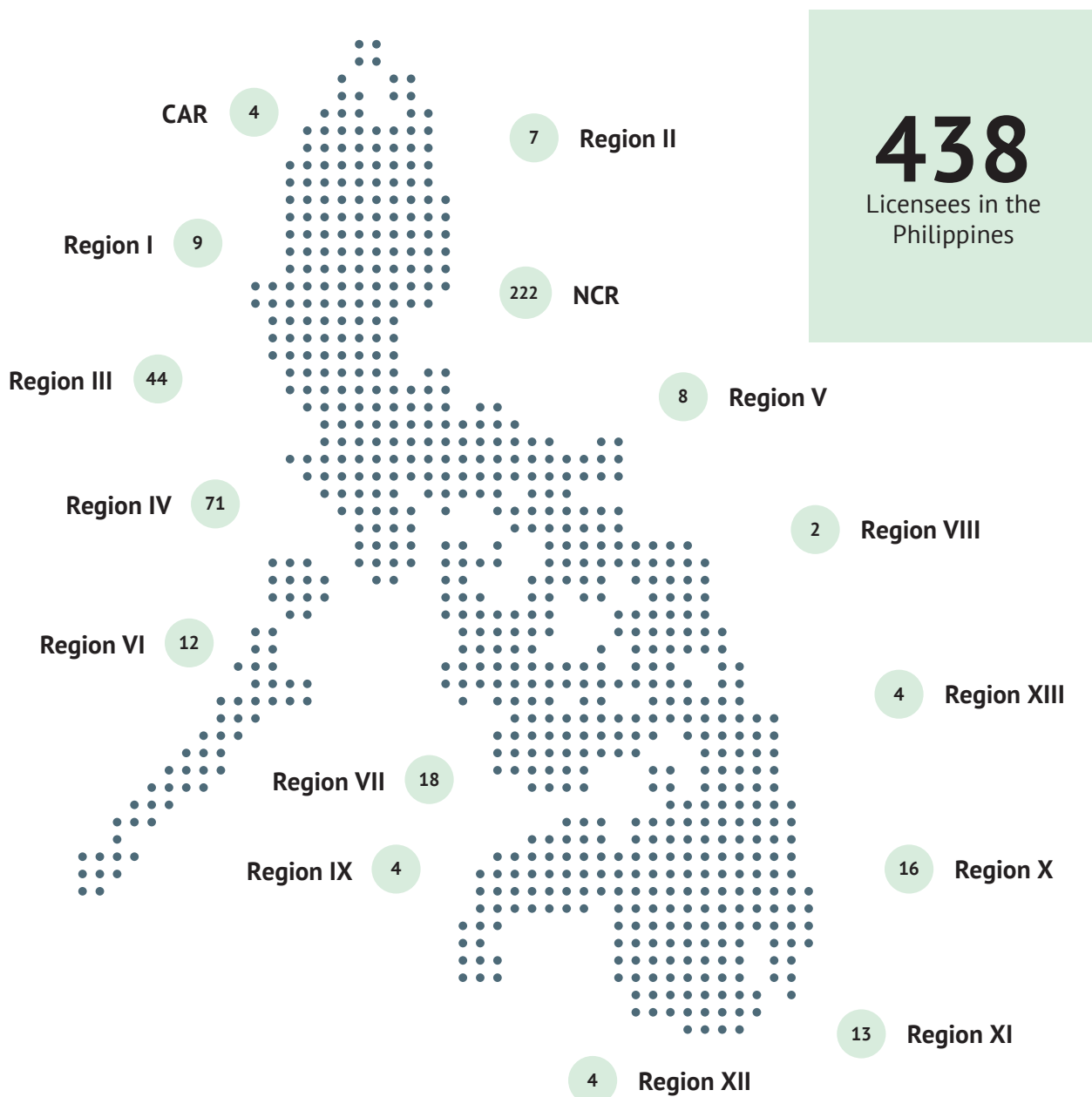
Regulatory Conference on September 18
for review of CPR Part 30, Safety Requirements of Research Reactors

LICENSING OF NUCLEAR AND RADIOACTIVE MATERIALS AND FACILITIES

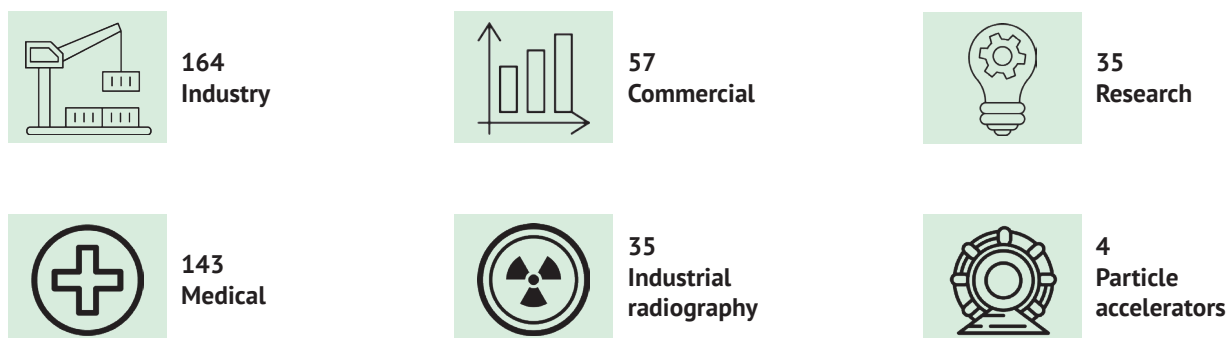
PNRI issues licenses for the use, possession, transportation, and other related activities involving nuclear and radioactive materials.



Distribution of Licensees by Region

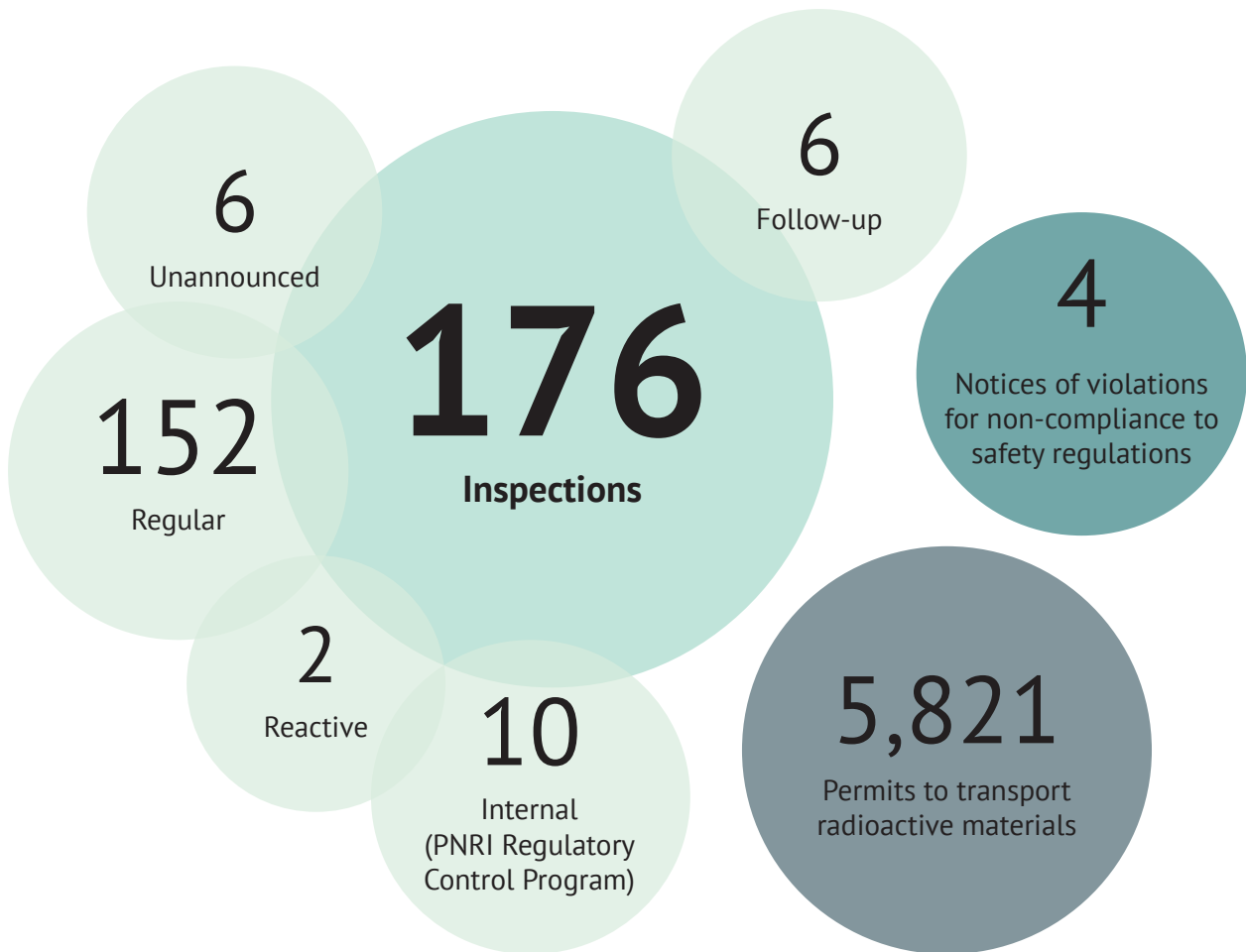


Distribution of Licensees by Use



INSPECTION AND ENFORCEMENT ACTIVITIES

To ensure the licensees' compliance with the law, regulations, and conditions of their license, PNRI regularly conducts inspections and audit of radioactive materials, facilities, and activities.



NUCLEAR SAFEGUARDS AND SECURITY

The Philippines remains steadfast in its commitments to various conventions and agreements that aim to prevent the diversion of nuclear materials to non-peaceful applications. PNRI implements these agreements with government agencies and international organizations.

Office of Radiological Security (Formerly the Global Threat Reduction Initiative of the US Department of Energy)

PNRI collaborates with the ORS team in inspecting and enhancing the security systems of medical and research facilities with radioactive materials.



Preventive maintenance and system checks were done to the security systems of the facilities of PNRI and the National Kidney and Transplant Institute in the first and last quarter of 2019.

Integrated Nuclear Security Support Plan

The Philippines continues to receive support from the IAEA in terms of reviewing and sustaining its nuclear security regime through the INSSP. The implementation of the INSSP involves the close coordination of PNRI with other government agencies and stakeholders.



INSSP Coordination meetings in May and June 2019 at the PNRI compound, with representatives from the National Security Council, the Armed Forces of the Philippines, Philippine National Police, and other national security agencies, particularly in the context of a prospective national nuclear energy program.

Radiation Portal Monitors in Major Philippine Ports

Operated under the Nuclear Smuggling Detection and Deterrence project, Radiation Portal Monitors (RPMs) in the ports of Manila and Cebu help prevent illicit trafficking of unauthorized nuclear and radioactive materials.



IAEA experts and PNRI representatives visited the port of Cebu in July 2019 to assess the status of the RPMs installed at the port



Cargo containers were monitored using handheld radiation equipment in the port of Cebu throughout 2019 as part of an IAEA research project on collecting radiation detection data for alarming containers

Nuclear and Radiation Training of Security Personnel

PNRI hosted several training courses and workshops for personnel in the military, police, and other government agencies not only to raise awareness about their role in nuclear security programs but also to improve their technical capabilities in dealing with nuclear and radioactive materials, radiation protection, and searching and securing radiation sources, among others.



Members of the PNP CBRNE team perform exercises during the Realistic Adaptive Interactive Learning System Training and Basic Search and Secure Workshop on 26-31 August 2019 at PNRI



PNRI experts train soldiers at the Nuclear Security Training Course for the 710th Special Operation Wing Unit of the Philippine Air Force from September 4-6, 2019 at Clark Airbase, Pampanga

Deployment of MEST in Major Events

To help ensure security during major national and local events, PNRI contributes its expertise and state-of-the-art vehicles and equipment for monitoring nuclear and radioactive materials through its Mobile Expert Support Team (MEST).



MEST teams were deployed in the following major events:

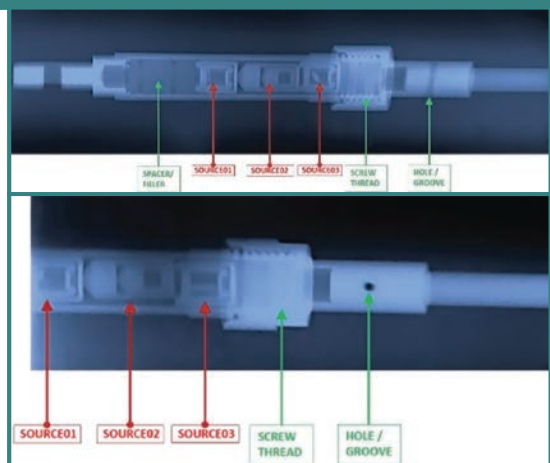
- Black Nazarene Traslacion 2019 in Quiapo, Manila on January 2-11
- The Declaration of the Mt. Carmel Church as a Minor Basilica in New Manila, Quezon City on March 25
- President Rodrigo Duterte's State of the Nation Address 2019 at the House of Representatives on July 19 to 22
- 30th Southeast Asian Games held in Manila, Clark, Subic and CALABARZON on November 29 to December 11

RADIOLOGICAL IMPACT ASSESSMENT STUDIES

To support the PNRI's regulatory mandate, researchers continue to study the impact of the use of radioactive materials in regulated facilities, activities, or practices for guidance and information of the radiation workers and the general public.



The validation results were published in the *Philippine Journal of Science* – Special Issue on Nuclear S&T



Radiographs showing the inside of the Californium-252 source rod

Technical report on the use of gamma radiography to validate radioactive sources

A technical report on the validation results was published in the Special Issue on Nuclear Science and Technology of the *Philippine Journal of Science* (PJS) on October 22, 2019.

Last June 2018, PNRI regulatory researchers successfully used gamma radiography to validate an unidentified number of disposed Californium-252 sources inside a rod from a cement plant, with very minimal external exposure.

Monitoring the Exposure of Medical Workers to Radioiodine

PNRI regulatory researchers continued to study the occupational exposure of medical workers who administer therapeutic dose of radioactive iodine, particularly the risk of inhaling Iodine-131 (I-131) which is commonly used for thyroid treatment in hospitals.

Occupational Hazards of using Nickel-63

In November, researchers started a study on the potential impact of Nickel-63 in case the radioactive source goes missing, including historical records of the regulated laboratories' use of the source or unregulated practice. Nickel-63 is used by laboratories in gas chromatography for analyzing compounds.

NUCLEAR AND RADIOLOGICAL EMERGENCY PREPAREDNESS AND RESPONSE

PNRI continues to build the capability of the country in preparing and responding to nuclear and radiological emergencies. The Institute cooperates with the National Disaster Risk Reduction and Management Council (NDRRMC) and other government agencies under the continually updated National Radiological Emergency Preparedness and Response Plan (RADPLAN).

Training of First Responders and Technical Personnel

The Institute conducted several training courses on nuclear or radiological emergency preparedness and response (EPR) for PNRI experts; medical doctors and hospital paramedics; and first responders from the police, military and other agencies representing the local disaster risk reduction and management offices personnel:

- Emergency Preparedness for PNRI Response Initiators
- Nuclear and Radiological EPR Training for the Philippine Army CBRN Platoon
- National Training Workshop on Medical Preparedness and Response for Radiological and Nuclear Emergency
- Follow-up Training Course on Nuclear and Radiological Emergency Preparedness and Response



European Commission Project on Decision Support System for Technical Support for Decision Making during Emergencies

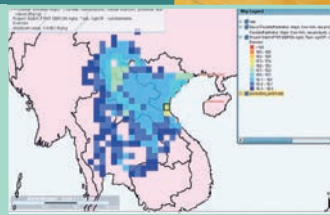
The European Commission, Instrument for Nuclear Safety Cooperation supports the PNRI Regulatory Authority on the activities of the ASEAN Network of Regulatory Bodies on Atomic Energy in enhancing regulatory activities and strengthening nuclear safety, security, and safeguard within the ASEAN Community.

PNRI regulatory researchers collected radio-ecological data from various government agencies for the customization of Decision Support System (DSS) at the national and regional level, to be used through appropriate food chain model for decision making in case of nuclear and radiological emergencies in the ASEAN Region.

Collection of data from the Sugar Regulatory Administration by PNRI researchers. PNRI also sources its data from agencies such as the Department of Agriculture, Department of Environment and Natural Resources - National Mapping and Resource Information Authority, Philippine Coconut Authority, and Philippine Statistics Authority.



Sample exercises of the JRODOS DSS tool



National Simultaneous Earthquake Drill

PNRI participated in the annual national earthquake drill where regular procedures for earthquakes were conducted with special considerations for nuclear and radioactive materials and facilities.



A black and white photograph of a statue of a man in a suit, holding a book and glasses, set against a cloudy sky. The statue is the central focus, with its head tilted upwards and to the left. It holds a pair of glasses in its right hand and a book in its left. The background shows a cloudy sky and some foliage at the bottom.

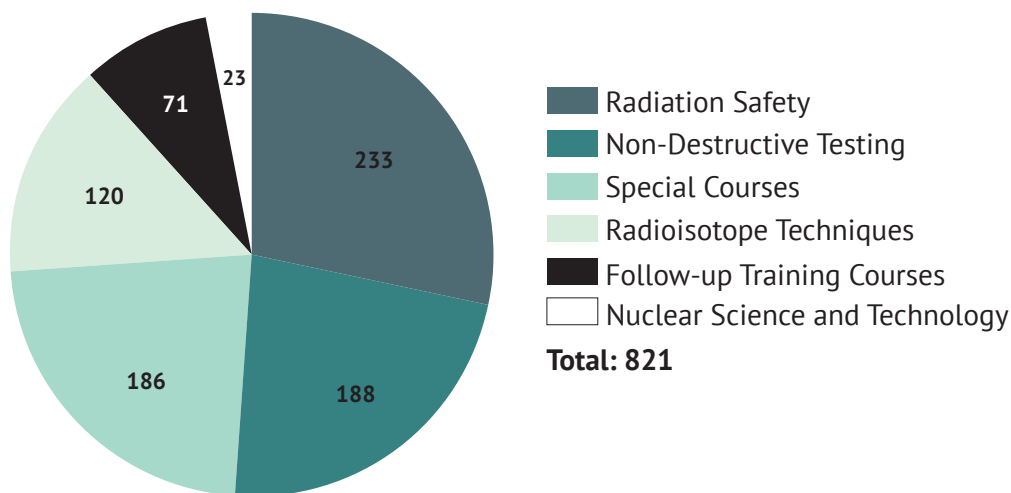
DIFFUSION OF KNOWLEDGE AND TECHNOLOGIES

The benefits of nuclear science and technology are being felt by more Filipinos than ever before. PNRI brings the benefits of the atom to its stakeholders through nuclear training courses; seminars and workshops; information, education and communication activities; the transfer of technologies to adopters for commercialization, and other vital efforts.

CAPACITY BUILDING ON NUCLEAR SCIENCE AND TECHNOLOGY

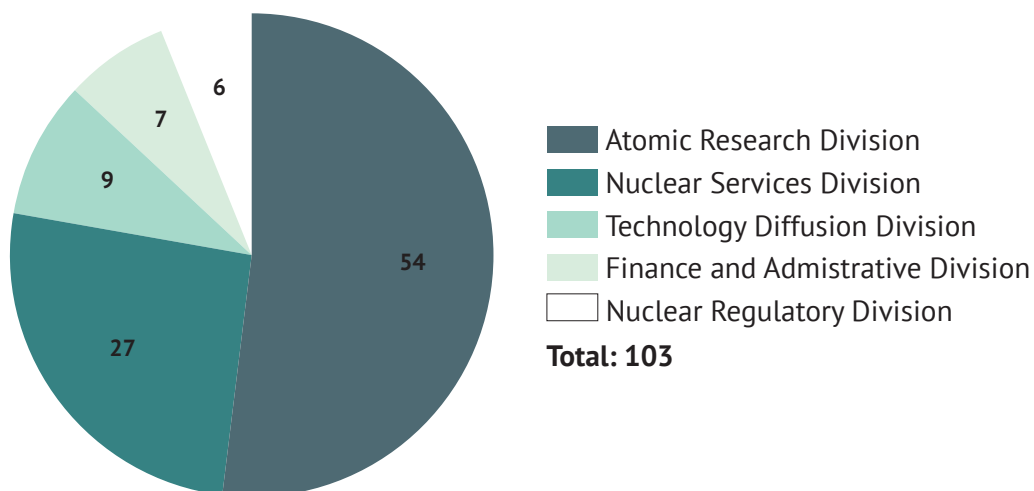
Nuclear Training and Other Specialized Courses

To strengthen the capacity building on nuclear science and technology, the PNRI offers regular and specialized training courses for various sectors. This year, a total of 41 courses were conducted with 821 participants. Among the areas covered by the courses are radioisotope techniques, nuclear science and technology, radiation safety, nondestructive testing, and other special courses. In cooperation with Japan Atomic Energy Agency (JAEA), follow-up training courses in reactor engineering, emergency preparedness and response, and environmental monitoring were also conducted.



Internship / On-the-Job Training Program

In 2019, 103 senior high school in the STEM academic track and college students had their on-the-job training and deployed to different sections at PNRI. On the other hand, nine students were engaged in research/thesis advisorship with PNRI research specialists.



PNRI NUCLEAR TRAINING COURSES • 2019

TITLE OF TRAINING	NO. OF PARTICIPANTS
RADIOISOTOPE TECHNIQUES	
Course on Medical Use of Radioisotopes – Four Sessions	113
Course on Radioisotope Technology	7
NUCLEAR SCIENCE AND TECHNOLOGY	
Seminar on Nuclear Science for Teachers	23
RADIATION SAFETY	
Radiation Safety Course- Sealed Sources in Industrial Devices – Four Sessions	81
Radiation Safety Course -Commercial Sale Involving Radioactive Materials and Low Activity Sources – Two Sessions	30
Radiation Safety Refresher Course – Eight Sessions	122
SPECIAL COURSES	
OJT Orientation and Radiation Safety Seminar (Four Sessions)	95
RSC for Administrative and Support Staff	19
Course on Basic Nuclear Science	12
Refresher Course for PNRI Personnel	32
Train the Trainers for Course on Basic Nuclear Science	28

FOLLOW-UP TRAINING COURSES*Conducted in cooperation with the Japan Atomic Energy Agency (IAEA)*

Reactor Engineering Level 1	28
Nuclear and Radiation Emergency Preparedness and Response	30
Environmental Radioactivity Monitoring	13

NON-DESTRUCTIVE TESTING (NDT)*Conducted in cooperation with the Philippine Society for Nondestructive Testing, Inc.*

Surface Methods (Level 2/Level 3) – Three Sessions	63
Radiographic Testing (Level 2) – Two Sessions	33
Ultrasonic Testing (Level 2/Level 3) – Two Sessions	52
Infrared Thermographic Testing	14
Eddy Current Testing (Level 2/Level 3) – Two Sessions	26

Total No. of Courses: 41**Total No. of Participants: 821**

INFORMATION, EDUCATION AND COMMUNICATION OF NUCLEAR S&T

The PNRI's Nuclear Information and Documentation Section (NIDS) spearheaded the conduct of the following information, education, and communication activities in increasing knowledge and awareness of different stakeholders in nuclear science and technology.

Special Events and Nuclear Awareness Seminars



3 nuclear awareness seminars
250 participants



5 lecture sessions
300 clients



2 international events
5 national and regional S&T events
1 PNRI-organized annual Atomic Energy Week

Media Publicity



28 news releases published in quad media
24 media interviews
1 press conference (AEW)

Development of Information Materials on Nuclear S&T



56 IEC materials on nuclear technologies developed

Educational Tours



40 guided educational tours
1,700 clients

Website and Social Media



11,000 new Facebook page likes
43,300 page likes

Library Services



400 on-site library clients



S&T EVENTS • 2019

EVENTS PARTICIPATED IN	VENUE
National S&T Events	
DOST-PAGASA 154 th National / 69 th World Meteorological Day	PAGASA, Science Garden, Quezon City
DOST National Science & Technology Week Celebration	World Trade Center, Pasay City
DOST-XIII Regional Science & Technology Week Celebration	Lope Asis Gym, Bayugan City, Agusan del Sur
DOST-NCR Regional Science & Technology Week Celebration	Rizal High School, Pasig City
14 th National Biotechnology Week Celebration	National Kidney and Transplant Institute, Quezon City
47 th Atomic Energy Week	PNRI, Diliman, Quezon City
International S&T Events	
63 rd IAEA General Conference	Vienna International Centre, Vienna, Austria
Rural Development and Food Security Forum 2019	Asian Development Bank, Mandaluyong City



Rural Development and Food Security Forum 2019
Asian Development Bank, Mandaluyong City



DOST National Science & Technology Week Celebration
World Trade Center, Pasay City



DOST-NCR Regional Science & Technology Week Celebration
Rizal High School, Pasig City

S&T EVENTS • 2019

EVENTS ORGANIZED	VENUE
Nuclear Science and Technology Exhibit	House of Representatives, Quezon City
1 st Nuclear Youth Forum	PNRI, Diliman, Quezon City
Nuclear 101 Awareness Seminar in Mindanao	Grand Regal Hotel, Lanang, Davao City
Meeting cum Writeshop for the DOE-funded project “Development of Educational Resource Materials on Nuclear Science and Technology for Secondary Students and Science Teachers”	PNRI, Diliman, Quezon City
Nuclear 101 Awareness Seminar for Media	B Hotel, Scout Rallos, Quezon City



Nuclear Science and Technology Exhibit
House of Representatives, Quezon City



1st Nuclear Youth Forum
PNRI, Diliman, Quezon City

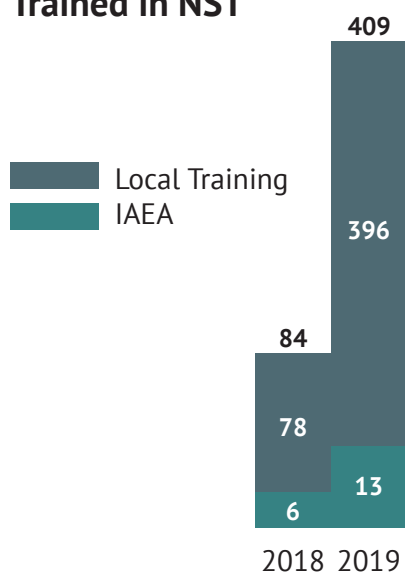


Nuclear 101 Awareness Seminar for Media
B Hotel, Scout Rallos, Quezon City

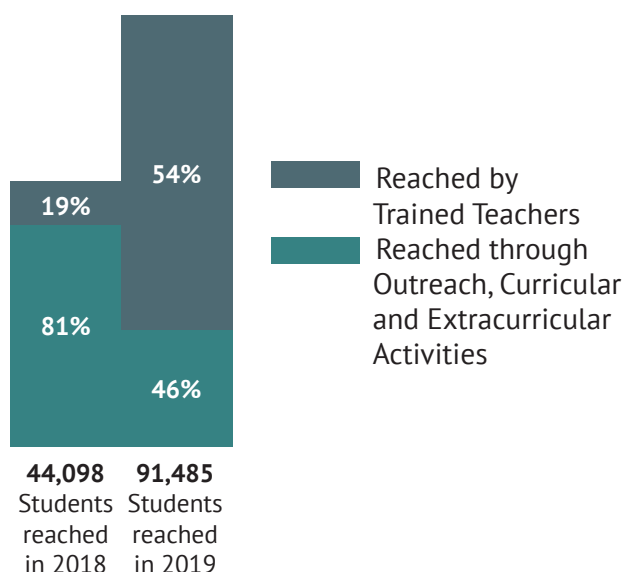
EDUCATING SECONDARY STUDENTS AND SCIENCE TEACHERS ON NUCLEAR S&T

A total of 135,569 students reached under the Nuclear Science and Technology Education Program in 2019. Together with its three partner institutions– the Department of Education, the Philippine Science High School, and the DOST-Science Education Institute– a total of 396 teachers were trained in nuclear science and technology locally while 13 teachers were sent to IAEA trainings abroad.

Number of Teachers Trained in NST



Impact



3
Partner
Institutions



4
Teachers' kits with
lesson instruction
survey meter cloud chambers naturally
occurring radioactive materials



33
Lesson exemplars
developed by teachers



4
NST modules in DOST-SEI mobile
learning facility (NuLab Bus)

NUCLEARIZATION OF PHILIPPINE EDUCATION

By actively building its networks among members of the academe, PNRI has also succeeded in breaking ground for nuclear S&T in tertiary education. The Institute partnered with several colleges and universities for initiating scientific visits abroad and the establishment of graduate programs or the integration of nuclear related subjects and electives in existing programs.

Nuclear S&T in Universities and Colleges



University of the Philippines Diliman

- Graduate Program in Energy Engineering EGY 225 (Nuclear Energy)
- Undergraduate Program in Chemical Engineering
- ChE 197 (Nuclear Technology for Engineers - elective)



Other universities that signified interest were:

- ADMU - Ateneo de Manila University
- CLSU - Central Luzon State University
- MSU-IIT - Mindanao State University - Iligan Institute of Technology
- Mapua University



A PNRI researcher conducts classes under EGY 225 - Nuclear Energy, one of the core subjects leading to MS/PhD in Energy Engineering under the UPD College of Engineering. 17 students passed the subject this 2019.

PNRI facilitated the scientific visit of officials from several universities in the Philippines to the Texas A&M University in the United States for a nuclear facility experience in a research university setting.



TECHNOLOGY TRANSFER AND COMMERCIALIZATION OF PRODUCTS AND TECHNOLOGIES



Technical Meeting on Commercialization Valuation of Tc-99m Technology, with PNRI Balik Scientist Dr. Thomas Pascual, teams from SVBB Law Office, Isotopes Techniques Section Head Adelina Bulos and Technology Transfer and Business Development Officer Gregory Ciocon.

Technology Transfer

The PNRI, through the Business Development Section:

- provided technical advisories to two companies in its effort to transfer radiation technologies and knowledge for use in trade and by industries.
- closed a commercial deal with a private firm for the transfer of isotope technology particularly in the commercial distribution of Technetium-99m generators and other radiopharmaceuticals. The signing of licensing and commercial distribution agreements will be after a favorable Fairness Opinion Report from independent experts, and written recommendation by DOST



Grand Launch in Davao City of the seaweed-based Plant Growth Promoter Technology, attended by representatives from PNRI, HL Trading Company, UPLB NCPC, DA and local business partners and guests.

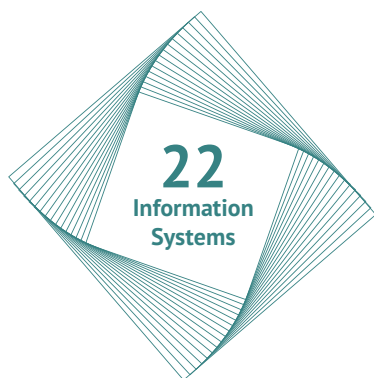
Intellectual Property Management

Nine potential intellectual properties (IP) were generated from R&D outputs of PNRI, and corresponding applications for IP protection were filed at the Intellectual Property Office of the Philippines.

Technology Promotion

The Carrageenan PGP was launched by the two adopters in over 20 cities and municipalities in the country, with PNRI participating in the product launches in over ten of the locations, as well as in broadcast media.

INFORMATION TECHNOLOGY AND NETWORK SYSTEMS DEVELOPMENT OF INFORMATION SYSTEMS AND SOFTWARE



PNRI Online Services Portal

A portal that serves as the gateway of clients to access all services being offered by the PNRI

Nuclear Training Center Online Application

A module in the PNRI Online Services Portal which supports the NTC staff in ensuring faster processing of applications for training courses and management of records

Integrated Library System

A system that integrates several modules of library services and databases of information resources for efficient management of library operations

Payment Information System

A web application that manages the issuance of official receipts for clients of PNRI services



Radioactive Waste Management Registry

This software tool is developed by IAEA for managing information on waste inventory. In 2019, major customization and migration were performed by MISS on the system to fit operational requirements

IT HelpDesk

A web application that helps manage requests of PNRI clients for software and network-related concerns

Management of ICT Resources

Aside from providing technical assistance in troubleshooting software, local area network, and internet connection problems, the MISS also embarked on a series of activities to augment the provision of network services for the continuous improvement of ICT resources and facilities:

- Deployment of PNRI's OwnCloud service for safekeeping the Institute's records to ensure that files are readily available for use anytime and anywhere
- Migration of the PNRI's FTP server backup files to a new machine with an upgraded storage capacity
- Migration of PNRI mail and collaboration services from Zimbra Collaboration Suite to Microsoft Office 365 in response to the increase in technological challenges and user requirements
- Upgrading of the Institute's firewall for a more secured network and internet connectivity



S&T LINKING AND NETWORKING

PNRI cultivates a strong network of nuclear partnerships, linkages, and cooperation with international organizations, government agencies, non-governmental organizations, the academe, and the private sector. These networks helped fuel the skyrocketing increase in capacity building activities in nuclear S&T in the Philippines.

LOCAL AND INTERNATIONAL S&T NETWORKING

The Institute continues to expand and strengthen its linkages and networks among local and international organizations. PNRI benefits from the steadfast support of the IAEA through research contracts, technical cooperation projects, expert missions, fellowships, hostings, and training courses. Also notable is the continued increase of IAEA trainees and fellowship grantees from more partner institutions and agencies, serving as a milestone in expanding Atoms for Peace and Development through a stronger network of sectors.

PNRI also forged new partnerships and sustained its linkages with other government agencies, medical institutions, scientific organizations, the academe, and the private sector. Such partnerships facilitated R&D projects and improved services and regulatory activities.

Among the highlights for the year is the visit to PNRI in October of Director for the International Atomic Energy Agency (IAEA) Technical Cooperation Division for Asia and the Pacific Dr. Jane Gerardo-Abaya, and IAEA Project Management Officer Mr. Syahril Syahril. Their visit is part of the strong partnership between the Philippines and the IAEA.



9

IAEA research contracts

39

IAEA technical cooperation projects

43

IAEA expert/mission delegates

5

IAEA fellows

12

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

108

PNRI personnel &

106

non-PNRI personnel

received training/fellowship grants from foreign institutions/agencies

IAEA RESEARCH CONTRACTS IMPLEMENTED IN 2019

TITLE/DESCRIPTION OF RESEARCH	NAME OF RESPONSIBLE AGENCY STAFF
Philippine Nuclear Research Institute	
Uranium/Thorium Fuelled High Temperature Gas Cooled Reactor Applications for Energy Neutral and Sustainable Comprehensive Extraction and Mineral Product Development Processes	Rolando Reyes
Development of Handling, Transport, Release and Trapping Methods of Dengue Mosquito Vector <i>Aedes aegypti</i> in the Philippines	Sotero Resilva
Collection and Analysis of Radiation Detection Data for Alarming Containers	Julietta Seguis
Assessment of the Levels, Distribution and Effects of Natural and Anthropogenic Radionuclides in the Philippine Marine Environment	Eliza Enriquez
Application of Cytogenetic Biodosimetry in Determining Radiosensitivity of Cancer Patients	Celia Asaad
Assessing the Impact of Industrial Activities on Air Quality and Its Surrounding Environment in Mining and Industrial Areas in the Philippine Using Nuclear and Related Analytical Techniques	Preciosa Corazon Pabroa
Radiation-Induced Synthesis of Nanostructured Materials for Analytical Application	Jordan Madrid
Synthesis of Heterogeneous Catalyst from Radiation-Synthesized Graft Copolymer for Cocomethyl Ester Production	Lucille Abad
Food and Nutrition Research Institute (FNRI)	
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 TECHNICAL COOPERATION PROJECTS IMPLEMENTED IN 2019

TITLE/DESCRIPTION OF RESEARCH	NAME OF CONTACT PERSON
National Technical Cooperation Projects	
Building Capacity in Nuclear Science and Technology by Re-establishing the Research Reactor-I as a Triga Fuel Subcritical Assembly	Kristine Marie Romallosa PNRI
Strengthening National Capacity in the Manufacture of Radiopharmaceuticals for Health Care Applications	Adelina Bulos PNRI
Applying Nuclear Techniques in the Attenuation of Floods and Natural Disaster-Borne Contamination	Raymund Sucgang PNRI
Enhancing Bench-scale Simulation for the Development of Continuous Extraction Technology of Uranium and Other Valuable Elements from Phosphates - Phase II	Rolando Reyes PNRI
Enhancing the Utilization of the Fully Automated Philippine Nuclear Research Institute Gamma Irradiation Facility	Luvimina Lanuza PNRI
Developing Nuclear Power Infrastructure in the Philippines - Phase II	Marietta Quejada Department of Energy
Regional Agreement Projects	
Facilitating Activities Implemented under the RCA Framework	Carlo Arcilla PNRI
Strengthening Regional Capacity in Non-destructive Testing and Examination using Nuclear and Related Techniques for Safer, Reliable, More Efficient and Sustainable Industries Including Civil Engineering	Renato Bañaga PNRI
Developing Bioenergy Crops to Optimize Marginal Land Productivity through Mutation Breeding and Related Techniques and Related Biotechnologies for the Development of Green Crop Varieties	Jorge Sahagun PNRI
Promoting the Application of Mutation Technique and Related Biotechnologies for the Development of Green Crop Varieties	Ana Maria Veluz PNRI
Enhancing Food Safety and Supporting Regional Authentication of Foodstuffs through Implementation of Nuclear Techniques	Raymund Sucgang PNRI
Assessing and Improving Soil and Water Quality to Minimize Land Crop Productivity using Nuclear Techniques	Efren Sta. Maria PNRI
Enhancing Stereotactic Body Radiation Therapy for Frequent Cancers in the RCA Region	Nonette Cupino St. Luke's Medical Center
Strengthening Cancer Management Programmes in RCA States Parties through Collaboration with National and Regional	Miriam Calaguas Jose Reyes Memorial Medical Center
Enhancing Medical Physics Services in Developing Standards, Education and Training through Regional Cooperation	Jonathan Corpuz Southern Philippines Medical Center
Enhancing Regional Capabilities for Marine Radioactivity Monitoring and Assessment of the Potential Impact of Radioactive Releases from Nuclear Facilities in Asia-Pacific Marine Ecosystems	Eliza Enriquez PNRI
Assessing the Impact of Urban Air Particulate Matter On Air Quality	Preciosa Corazon Pabroa PNRI
Assessing Deep Groundwater Resources for Sustainable Management through the Utilization of Isotopic Techniques	Norman Mendoza PNRI
Strengthening Capacity to Manage Non-Communicable Diseases Using Imaging Modalities in Radiology and Nuclear Medicine	Dr. Asela Barosso Dela Salle Medical and Health Sciences Institute

IAEA TECHNICAL COOPERATION PROJECTS IMPLEMENTED IN 2019

Regional Non-Agreement Projects	
Networking for Nuclear Education, Training, and Outreach Programmes in Nuclear Science and Technology in the Framework of Asian Network for Education in Nuclear Technology (ANENT)	Ana Elena Conjares PNRI
Educating Secondary Students and Science Teachers on Nuclear Science and Technology	Jasmine Angelie Albelda PNRI
Promoting Self-reliance and Sustainability of National Nuclear Institutions	Soledad Castañeda PNRI
Supporting Decision Making for Nuclear Power Planning and Development -Phase III	Mauro Marcelo Department of Energy
Conducting the Comprehensive Management and Recovery of Radioactive and Associated Mineral Resources	Rolando Reyes PNRI
Supporting Climate-Proofing Rice Production Systems (CRiPS) Based on Nuclear Applications-Phase II	Roland Rallos PNRI
Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants	Danica Dimaya National Meat Inspection
Managing and Controlling Aedes Vector Population Using the Sterile Insect Technique	Glenda Obra PNRI
Preventing Overweight and Obesity, and Promoting Physical Activity among Children and Adolescents	Mario Capanzana FNRI
Supporting the Applications of Emerging Targeted Therapeutic Radiopharmaceuticals for Radionuclide Therapy	Adelina Bulos PNRI
Enhancing the Management of Non-Communicable and Communicable Diseases through Capacity Building under the IAEA Curricula for Nuclear Medicine Professionals	Eduardo Ongkeko St. Luke's Medical Center
Using Stable Isotope Techniques to Monitor Situations and Interventions for Promoting Infant and Young Child Nutrition - Phase II	Mario Capanzana FNRI
Supporting Regional Nuclear Emergency Preparedness and Response in the Member States of ASEAN Region	Cecilia De Vera PNRI
Strengthening Public and Environmental Radiological Protection in the Asia Pacific Region	Lorna Jean Palad PNRI
Enhancing National Capabilities on Occupational Radiation Protection in Compliance with Requirements of the New International Basic Safety Standards	Kristine Marie Romallosa PNRI
Enhancing the Radioactive Waste Management Infrastructure in the Asia Pacific	Daisy Badilla PNRI
Enhancing the Radioactive Waste Management Infrastructure in the Asia Pacific Region	Ronald Piquero PNRI
Strengthening Regulatory Infrastructure and Promoting Safety Culture in Regulatory Authorities	Alan Borrás PNRI
Strengthening Radiation Safety Infrastructure	Vangelina Parami PNRI
Sustaining Cradle to Grave Control of Radioactive Materials	Carl Nohay PNRI

PNRI HOSTING EVENTS IN 2019

FIELD	PHILIPPINE PARTICIPANT	AGENCY/ INSTITUTE	ORGANIZER/ VENUE/DATE
Regional Training Course on SBRT for Spine and Prostate Carcinomas	Rober John Ramos Raquel Louise Espiritu	Chong Hua Hospital, Mandaue	IAEA Novotel Cubao, Quezon City 12–16 March
	Ma. Lourdes Lacanilao Ricci Pilar Sugui	Southern Philippine Medical Center, Davao	
	Elrick Inocencio	UP-Philippine General Hospital	
Regional Network Meeting on Legal and Regulatory Framework for Safety and Regulatory Independence	Sheela Villano-Millera Donald Caballero	Senate of the Philippines House of Representatives PNRI	ANSN Novotel Cubao, Quezon City 25-29 March
	Romelda Azores		
Regional Workshop on Non-Destructive Testing Examination Qualification and Certification Scheme Requirements in Accordance with the Latest Edition ISO 9712 and ISO 17024	Edgardo Aguilar	Lufthansa Technik Philippines, Inc.	IAEA Crowne Plaza Galleria 6-10 May
	Estrella Relunia	Philippine National Certifying Body for Non-Destructive Testing PNRI	
	Andrew Barrida Ramoncito Sulit		
Regional Training Course on the Principles for Managing High-Activity (Category 1-2) Disused Sealed Radioactive Sources	Michael Kenneth Cruz Ronald Daryll Gachalian	PNRI	IAEA Crowne Plaza Galleria 13-17 May
RAS0079 Group Scientific Visit “Train the Training of Trainers”	Roxane Villanueva	Department of Education	IAEA Rizal Park Hotel, Ermita, Manila 20-24 May
	Abigail Clemente	PNRI	
Regional Training Course on Methodology and Mechanisms for Screening of Photosynthetic Efficiency in Crops	Wilhelmina Barroga	PhilRice	IAEA Novotel Araneta Center, Cubao 17-21 June
	Rimmon Armones	Sugar Regulatory Department	
	Arvin Dimaano Vivian Maguide Jahmel Sarem	PNRI	
Regional Training Course for Teachers to Introduce Nuclear Sciences in Secondary Schools through Innovative Approaches	Mariale Enecio Michael Lugtu	DOST-Philippine Science High School	IAEA Rizal Park Hotel, Ermita, Manila 17-28 June
Regional Training Course on RAS1023 “Developing and Upscaling of Radiation Grafted Materials for Water Treatment”	Bin Jeremiah Barba Patrick Jay Cabalar Alvin Kier Gallardo John Andrew Luna Janronel Pomicpic	PNRI	IAEA Novotel Cubao, Quezon City 22-26 July
Regional Meeting on the Development of Basic Regulations on Emergency Planning and Sharing of Related Experience	Vinz Michael Calija Teresita de Jesus Ma. Elina Salvacion Kristina Ramo	PNRI	ANSN PNRI, Diliman, Quezon City 14-18 October

PNRI HOSTING EVENTS IN 2019

FIELD	PHILIPPINE PARTICIPANT	AGENCY/ INSTITUTE	ORGANIZER/ VENUE/DATE
Workshop for Nuclear Safeguards and Security	Celia Asaad Jennyvi Ramirez Botvinnik Palattao	PNRI	FNCA PNRI, Diliman, Quezon City 26-28 November
	Johnny Capalos Marck Alain Ballesteros Eric Bacuyag Adonis Leo Jumaquio Eleazar Macaraeg Marc Francis Dela Cruz	Philippine National Police	
Final Coordination Meeting of RAS0075 "Asian Network for Education in Nuclear Technology"	Roel Loterina Faye Rivera	PNRI	IAEA Tryp Hotel, Pasay City 18-22 November
Regional Meeting for Central Government and Regulatory Bodies on the Development of Communication Strategy	Cecilia Baldos Rowena Villanueva Victoria Capito	Department of Energy	ANSN PNRI, Diliman, Quezon City 9-13 December
	Manuel Luis Plofino, Sr. Dante Caraos Lucila Fuentes	NAPOCOR	
	Fidel Thaddeus Borja	DOST	
	Framelia Anonas Allan Mauro Marfal	DOST-Science and Technology Information Institute	
	Alfonso Singayan Mary Rose Mundo Hans Joshua Dantes	PNRI	



*RAS0079 Group Scientific Visit
"Training the Trainers"*



FNCA Workshop on Nuclear Security



IAEA Project RAS1023 on Developing and Upscaling of Radiation Grafted Materials for Water Treatment



IAEA Regional Training Course for Teachers to Introduce Nuclear Science in Secondary Schools



IAEA Regional Workshop on Non-Destructive Testing



IAEA-ANSN Regional Meeting for Central Government and Regulatory Bodies on the Development of Communication Strategy



IAEA-RCA Regional Training Course on Methodology and Mechanisms for Screening of Photosynthetic Efficiency in Crops



PNRI SPECIAL S&T EVENTS

The Insititute actively participates in numerous conventions, conferences, and other special S&T events, both national and international in scope. PNRI officials, researchers, and regulators have had the opportunity to join delegations that represent the country's advances in nuclear science and technology.

IAEA GENERAL CONFERENCE

63rd International Atomic Energy Agency General Conference

PNRI delegates represented the country in technical meetings and forums on global developments and issues in nuclear applications at the 63rd IAEA General Conference on 16-20 September 2019 at Vienna International Centre in Vienna, Austria.





Atomic Energy Week **aeW47**

As mandated under Presidential Proclamation No. 1211 in 1973, the DOST-PNRI celebrated the 47th AEW to help generate awareness of the Filipinos on the beneficial uses of nuclear science and technology in food, agriculture, industry, medicine, and the environment.



Opening Ceremonies



Opening of Exhibits



Guided Tour at PNRI Facilities



**Press Conference****Technical Sessions****Philippine Nuclear Science Quiz****Closing Ceremonies**

PHILIPPINE NUCLEAR SCIENCE QUIZ (PNSQ)

The 2019 Philippine Nuclear Science Quiz (PNSQ) was conducted as part of the 47th Atomic Energy Week celebration. PNSQ aims to provide an avenue to develop Filipino students' awareness and appreciation of nuclear science and technology and its potential role in uplifting the quality of living in the country. It also aims to sustain awareness and understanding of the participants on nuclear science and technology and its beneficial applications.

A total of 29 schools all over the country participated in the competition on December 12 at the PNRI Compound.



2019 PNSQ Winners (National Level Competition)

1st Place | ₱50,00.00 + medals + plaque

Philippine Science High School - Main Campus

Couch: Kendrick A. Agapito

Students: Deric Miguel C. Gullon, Enrico Rolando G. Martinez

2nd Place | ₱40,00.00 + medals + plaque

Philippine Science High School – SOCCSKSARGEN Campus

Couch: Edman H. Gallamaso

Students: Nyrell L. Martinez, Bernard M. Arcenas

3rd Place | ₱30,00.00 + medals + plaque

Caloocan National Science and Technology High School

Couch: Michael Jayson D. Mallari

Students: Johnaxxel Mark T. Bonjoc, Giancarlo B. Albeos

Consolation | ₱15,00.00

Philippine Science High School – Central Visayas Campus

Couch: Joseph P. Hortezuela

Students: Johnaxxel Mark T. Bonjoc, Giancarlo B. Albeos

Consolation | ₱15,00.00

Philippine Science High School – Southern Mindanao Campus

Couch: Cromwell M. Castillo

Students: David Joseph G. Mendoza, Paul Ivan N. Enclonar

TOTAL NUMBER OF PARTICIPATING SCHOOLS: 29

PNRI JINGLE AND MTV MAKING CONTEST

The PNRI implemented a Jingle and MTV Making Contest about the applications of nuclear science and technology. Twenty-nine teams composed of senior high school and college students from across the country participated in the contest. The event aims to provide awareness and understanding of participants on the peaceful and beneficial uses of nuclear S&T in agriculture, health and medicine, environment protection, industry and power generation.

2019 Jingle and MTV Making Contest Winners



1st Make A Difference

Prize: ₱20,000.00

Team: Lunar Rovers
(Saint Louis University Laboratory High School- CAR)



2nd Brighter Days

Prize: ₱15,000.00

Team: STRNGRS
(Mapua University, Polytechnic University of the Philippines, Technological University of the Philippines-Taguig, and Taguig City University)



3rd Newclear Breakthrough

Prize: ₱10,000.00

Team: The Palladian Breakthrough
(Luis Palad Integrated High School – Region IVA)

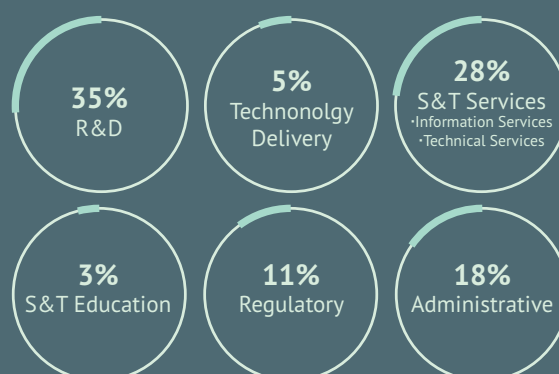
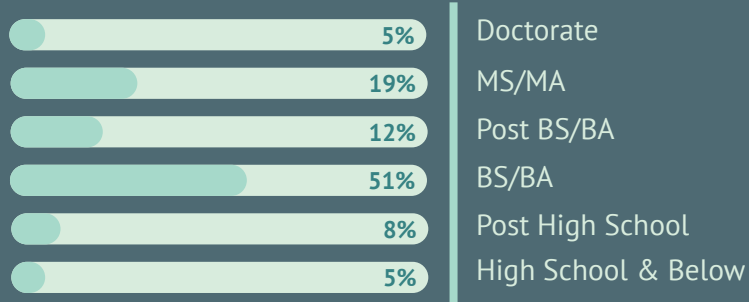
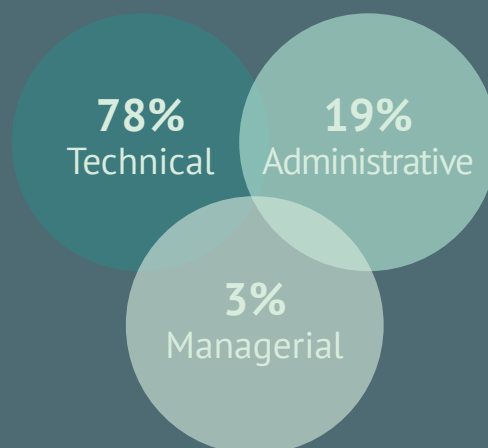
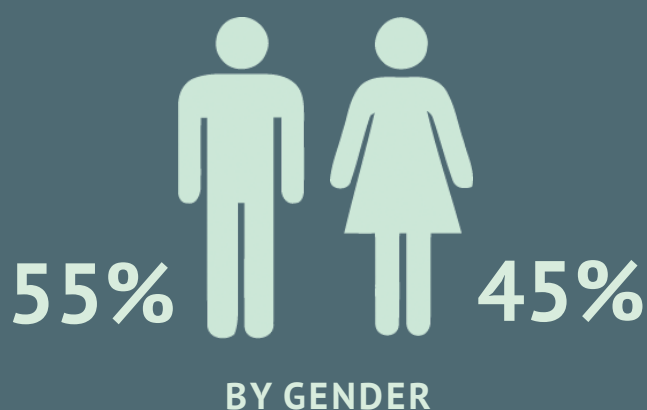


HUMAN RESOURCES DEVELOPMENT

PNRI is proud of its highly competent and diligent workforce who are behind the Institute's accolades and accomplishments. PNRI continually seeks opportunities for civil servants to improve their capabilities, and attracts new talents in the sciences as well as in other related fields, consistent with Civil Service regulations and guidelines.

DISTRIBUTION OF PERSONNEL

Human Resource Profile 2019



1 PNRI staff obtained her masteral degree in 2019

Cheri Anne M. Dingle
Science Research Specialist II
Applied Physics Research Section
Atomic Research Division
MS in Energy Engineering
University of the Philippines, Diliman

16

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

41

Nuclear training courses conducted by PNRI with 821 participants

9

Students from 4 schools were accepted for thesis/research advisorship at PNRI

103

Senior high school and college students from 26 schools were accommodated for work immersion/on-the-job training at PNRI

125

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

108

PNRI personnel & **106** non-PNRI personnel received training/fellowship grants from foreign institutions/agencies

NATIONAL AWARDS



Conferment of Scientist III Rank
Lucille V. Abad



Conferment of Scientist I Rank
Charito T. Aranilla & Sotero S. Resilva



Presidential Lingkod Bayan Award
Aurelio L. Maningas, Haydee M. Solomon, Giuseppe Filam O. Dean, Franklin A. Pares, and Geoffrey O. Tranquilan,
Among the recipients of the Presidential Lingkod Bayan Award as part of the 2019 Search for Outstanding Government Workers by the Civil Service Commission



DOST International Publication Awards
PNRI scientists garnered awards for 21 papers published in internationally recognized journals. The awards were given by the National Academy of Science and Technology during the 2019 DOST Intellectual Property Awards ceremonies held on December 10, 2019 at the Eastwood Richmond Hotel in Quezon City.



Gregorio Y. Zara Award for Basic Research **Carlo A. Arcilla**

Awarded the Gregorio Y. Zara Award for Basic Research by the Philippine Association for the Advancement of Science and Technology (PhilAAST) during the 68th PhilAAST Annual Convention on September 11 at the Hotel Jen Manila, Pasay City.



2019 Regional Invention Contest and Exhibits **Jordan F. Madrid, Patrick Jay Cabalar, and Lucille V. Abad**

Bagged the Outstanding Utility Model Award for the utility model for the project "Composite Nonwoven Fabric Heavy Metal Adsorbent and Method for Preparing the Same" at the 2019 Regional Invention Contest and Exhibits



DOST Woman Leader Award **Lucille V. Abad**

Recognized as DOST Woman Leader during the 2019 Women's Month Celebration, March 19, Hotel Jen Manila, Pasay City



PNRI Men's Table Tennis Team

Dante Q. Bajet, Davision T. Baldos, Rollie B. Ilao, Carl M. Nohay, Joseph R. Tugo, Sofronio B. Enriquez, Gerardo Jose M. Robles, Angel T. Bautista VII, Efrén J. Sta. Maria, Dan Benneth C. Mangulabnan, Raymund P. Beredo, Christopher O. Mendoza, and Brylle M. Gabinete

First Place in the Philippine Sports Commission Inter Government Agency Sports Festival as the Representative of the Department of Science and Technology



PNRI Women's Table Tennis Team

Kristine Marie D. Romallosa, Ivy Angelica A. Nuñez, Rizalina G. Osorio, and Lorna S. Relleve

Third Place in the Philippine Sports Commission Inter Government Agency Sports Festival as the Representative of the Department of Science and Technology

PNRI RECOGNITION AWARDS

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

2019 Gawad Kagalingan Award



Gawad Kagalingan Award

Nuclear Information and Documentation Section

(From L-R) Elijah Gecee Q. Cajipe (Contractual staff), Rissa Jane V. Amper, Joan L. Tugo, Michelle B. Arispe and Hans Joshua V. Dantes

In recognition of the team's innovative strategies and unflagging zeal in enhancing public awareness of nuclear S&T applications through various media, locally and internationally.

Gawad Kagalingan Award - 1st Runner Up

Health Physics Research Section

From L-R, top to bottom: Marilyn K. Castillo, Rosario R. Encabo, Vanessa J. Omandam, Loma Jean H. Palad, Chitho P. Feliciano, Eliza B. Enriquez, Merry Jaine T. Ortillo, Mary Joy V. Erojo, Shalaine S. Tatu, Jomar D. Pantua, Daniel L. Del Rosario, Juanario U. Olivares, Antonio C. Bonga, Christian L. Dela Sada, Ryan Joseph Aniago, Bernanrd Isaiah D. Lo, Gio Ferson M. Bautista, Judiel John M. Cortez

In Recognition of the team's remarkable improvement in scientific productivity and its efficient operation and implementation of the R&D projects



Gawad Kagalingan Award - 2nd Runner Up

Radiation Protection Services Section

(From L-R) Camille U. Pineda, Angelo A. Panlaqui, Ave Ann Nikolle M. Garalde, Abelardo A. Inovero, Marianna Lourdes Marie L. Grande, Ronald E. Piquero, Jhenize Carvina A. Fernandez

In recognition of the team's innovative R&D accomplishment, in addition to its efficient provision of radiation protection services

PNRI DIVISION AWARDEES



Atomic Research Division

Chitho P. Feliciano
Outstanding Senior
Technical Staff

Juanario U. Olivares
Outstanding Junior
Technical Staff

Finance and Administrative Division

Joanrose N. Villanueva
Outstanding Senior
Administrative Staff

Herlene C. Yee
Outstanding Junior
Administrative Staff

HUMAN RESOURCES DEVELOPMENT ACTIVITIES

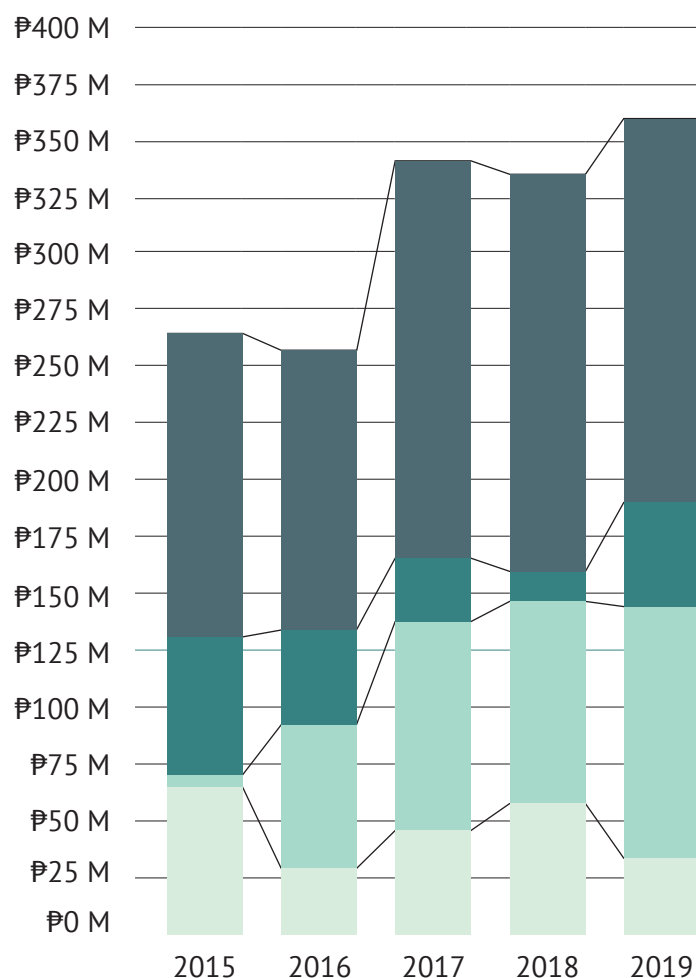




FINANCIAL RESOURCES

This year, PNRI had a budget allotment of Php 359,196,000.00 by class and Php 142,856,004.00 by organizational outcome. The Institute generated an annual income of Php 39,725,285.00 from licensing fees and from the Institute's nuclear and allied services, among others. Additional resources were also generated through local and foreign-funded projects on nuclear science and technology applications.

ANNUAL PNRI BUDGET



Legend:

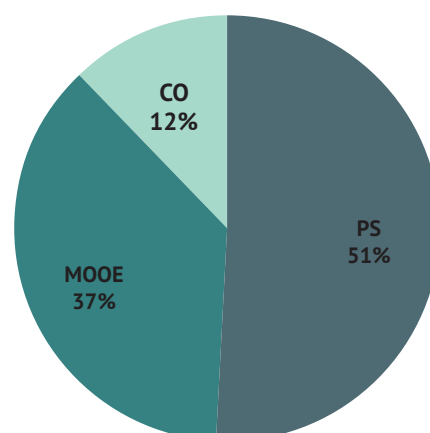
PS (Personnel Services)	CO (Capital Outlay)
MOOE (Maintenance & Other Operating Expenses)	Total

YEAR	PS	MOOE	CO
2015	₱129,813,000	₱65,194,000	₱63,000,000
2016	₱131,949,000	₱93,839,000	₱30,865,000
2017	₱163,348,000	₱132,858,000	₱49,872,000
2018	₱153,645,000	₱135,809,000	₱55,443,000
2019	₱182,185,000	₱133,576,000	₱43,435,000

ADDITIONAL RESOURCES GENERATED FROM EXTERNAL SOURCES 2019

TITTLE	AMOUNT
Local Grants-in-Aid	₱174,687,613.15
Foreign Grants	₱2,390,579.21
TOTAL	₱177,078,192.36

2019 ALLOTMENT BY EXPENSE CLASS

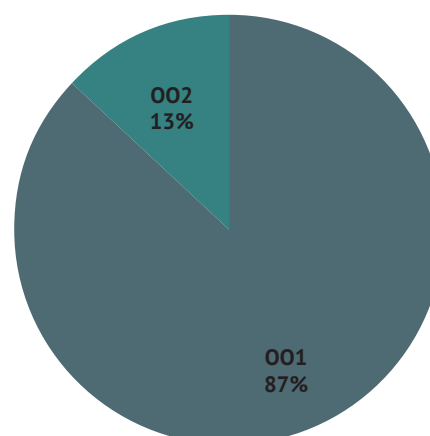


Legend:

PS	₱182,185,000.00
MOOE	₱133,576,000.00
CO	₱43,435,000.00

TOTAL ₱359,196,000.00

2019 EXPENDITURES BY ORGANIZATIONAL OUTCOME (OO)

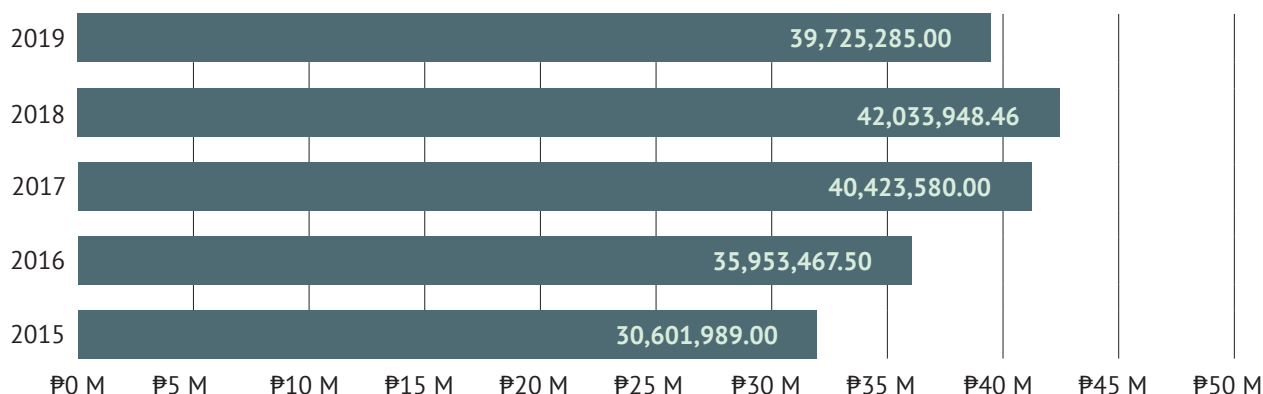


Legend:

OO1	₱124,155,152	Increased benefits to Filipinos from science-based R&D known-how and tools in cutting-edge nuclear and radiation technologies
OO2	₱18,700,852	Increased benefits to Filipinos from safe and secure utilization technologies and materials

TOTAL ₱142,856,004

2019 INCOME FROM PNRI SERVICES



SOURCE OF INCOME	INCOME GENERATED (IN PESOS)		
A. NUCLEAR PERMITS & LICENSES	5,709,187.50	Radioactivity Analysis	2,697,310.00
Licensing Fees	1,871,087.50	• Gammametric Analysis	317,760.00
Permit Fees	3,838,100.00	• Gross Alpha-beta Analysis	2,276,300.00
Transport Certificate	3,516,000.00	• Particulate Mass Determination	103,250.00
Release Certificate	309,100.00	Radioactive Waste Management (Radioactive Waste Storage/Disposal/Temporary Storage)	136,750.00
Certificate of Exemption	13,000.00		136,750.00
B. SERVICE INCOME	34,011,447.50	Biological Test	230,480.00
Inspection Fees	1,081,700.00	• Cytogenetic Analysis	24,500.00
Fines & Penalties - Service Income	281,470.00	• Sterility Test	27,000.00
Other Service Income	32,648,277.00	• Bioburden Test	30,000.00
Radiation Protection Services	23,985,809.50	• Aerobic Plate Count	146,880.00
• Monitoring films/OSL /TLD and Cassettes	20,217,324.50	• Mold and Yeast Count	600.00
• Calibration	2,160,585.00	• Chemical Analysis	1,500.00
• Leak Test/Spent-Sealed Sources	97,800.00	Radioanalytical and Related Tests	1,069,700.00
• Swipe Test	684,600.00	• Vinegar Adulteration	220,800.00
• Radiation Monitoring/ Hazards Evaluation	20,000.00	• Radon Analysis	799,500.00
• Rental of Survey Meter	396,900.00	• Elemental Analysis	49,400.00
• Rental of Moisture Density Gauge	384,600.00	Tracer Technique Services (Source Rental)	70,000.00
• Repair of Survey Meter	24,000.00	C. BUSINESS INCOME	4,650.00
Gamma Irradiation Services (Use of Cobalt-60 facility)	4,458,228.00	• Sale of CPR Compilation (Specific Part)/Infopac	800.00
		• Use of Dose Calibrator	350.00
		• Miscellaneous	3,500.00
		TOTAL INCOME	39,725,285.00

ADDITIONAL RESOURCES GENERATED FROM EXTERNAL SOURCES • 2019

PROJECT TITLE	PNRI PROJECT LEADER	AMOUNT		FUNDING AGENCY
		LOCAL	FOREIGN	
US DOE/Batelle and PNRI in Support of the Global Threat Reduction Initiative Project	Julietta Seguis		161,079.2	US-DOE
Collection and Analysis of Radiation Detection Data for Alarming Containers	Julietta Seguis		821,303.84	CRP-IAEA
Development of Handling, Transport, Release and Trapping Methods of Dengue Mosquito Vector <i>Aedes Aegypti</i> in the Philippines	Sotero Resilva		362,199.00	CRP-IAEA
Assessment of the Levels, Distribution and Effects of Natural and Anthropogenic Radionuclides in the Philippine Marine Environment	Eliza Enriquez		233,018.25	CRP-IAEA
Assessing the Impact of Mining and Industrial Activities on Air Quality and Surrounding Environment Areas in Mindanao and Luzon, Philippines	Preciosa Corazon Pabroa		413,099.35	KAERI
Radiation-Induced Synthesis of Nanostructured Materials for Analytical Application	Jordan Madrid		229,942.57	CRP-IAEA
Geochemical Radiometric Characterization of the cu-mo-u Occurrences in the Larap-Paracale Mineralized District, Camarines Norte, Philippines	Rolando Reyes		86,993.00	CRP-IAEA
Resource Evaluation and Characterization of Uranium, Thorium, and Rare Earth and Other Essential Elements from Commercial Phosphate Fertilizer Processing Industry in the Philippines	Rolando Reyes		82,944.00	CRP-IAEA
Development of Biodegradable Super Water Absorbents for Agricultural Application	Lucille Abad	12,603,947.40		PCAARRD
Single Laboratory Validation of Isotope-Based Toxicity Assay for the Detection and Quantification of Ciguatera Fish Poisoning (CFP) Toxin in Commercially Available Philippine Reef Fishes	Ma. Llorina Mestizo	5,500,178.00		PCAARRD
National Training Course on Enhancing Access & Affordability to Nuclear Medicine Theranostic: Procedures in Various Clinical Specialties	Nydia Medina	200,000.00		PCHRD
Promoting Innovative Philippine Nuclear Science and Technology Applications at the International Atomic Energy Agency (IAEA) General Conference Exhibition and IAEA General Conference Side Events/Symposiums	Ana Elena Conjares	1,793,712.00		PCAARRD

ADDITIONAL RESOURCES GENERATED FROM EXTERNAL SOURCES • 2019

(Continuation)

PROJECT TITLE	PNRI PROJECT LEADER	AMOUNT		FUNDING AGENCY
		LOCAL	FOREIGN	
Detection of Adulteration in Philippine Honey using Carbon-13 Isotope Analysis	Angel Bautista VII	1,826,153.00		PCAARRD
Air Particulate Matter: Char by Elemental and Isotopic Fingerprinting of Organic and Inorganic Pollution Sources and Possible Mitigation Measures by Electron Beam Technology	Preciosa Corazon Pabroa	651,518.39		NRCP
Shabu Profile Mapping Using Nuclear and Isotopic-based Analytical Techniques	Preciosa Corazon Pabroa	3,262,381.44		PCHRD
Tracing the Pathways of Mercury Concentration in Mined-Out Area	Jessie Samaniego	2,701,271.96		PCIEERD
Development of Unit Dose Dispensing Capability of 993TC Radiopharmaceutical Kit Facility	Adelina Bulos	1,041,551.24		PCHRD
Development of a GMP Compliant Lab for the Manufacture of Radiopharmaceutical Cold Kits	Maria Teresa Borras	1,608,378.32		PCHRD
Improvement of Recommended Sugarcane Varieties Using Nuclear Technology and Biotechnology	Jorge Sahagun	1,523,319.20		SRA
Development of an Animal Model for Use in Radiation Research and Establishment of the Radiation Biology Research Center: Core Facility for Radiobiological Research	Chitho Feliciano	49,592,251.40		PCHRD
Assessing the Naturally Occurring Radioactive Materials (NORM) of Soils in the Rice Fields of Allaga and Bongabon in Nueva Ecija	Arvin Jagonoy	3,057,076.00		PCAARRD
Upgrading of PNRI Cytogenetic Biological Dosimetry Capability for Nuclear Incident Preparedness and Other Related Services	Celia Asaad	23,817,307.00		PCHRD
Enhancing OneLab for Global Competitiveness - RDIs Component (PNRI) (Year 2)	Preciosa Corazon Pabroa	45,048,080.80		PCIEERD
Strategic Communication Approaches to Boost the Philippine Nuclear Research Institute Promotions	Rhodora Leonin	799,718.00		PCIEERD
Field Verification Testing of Carrageenan Plant Growth Promoter for Enhanced Growth and Induced Pest and Disease Resistance in Rice and Corn	Lucille Abad	3,907,963.00		PCAARRD
Detection of Adulteration in Philippine Honey Using Carbon-13 Isotope Analysis	Angel Bautista VII	2,243,567.00		PCIEERD

ADDITIONAL RESOURCES GENERATED FROM EXTERNAL SOURCES • 2019

(Continuation)

PROJECT TITLE	PNRI PROJECT LEADER	AMOUNT		FUNDING AGENCY
		LOCAL	FOREIGN	
Extraction of Radionuclides, Rare Earths and Other Valuable Industrial Elements from Philippine Phosphogypsum Tailings	Rolando Reyes	1,176,995.00		PCIEERD
Radiometric Characterization of Source and Treated Water Collected in Selected Areas in the Philippines	Arvin Jagonoy	519,660.00		Coca-Cola
Screening for Radionuclide Contamination from the Fukushima Accident by Iodine-129 Measurement in Corals from the Philippines	Angel Bautista VII	1,915,906.00		PCCAARD
Development of a Passive Neutron Spectrometry System	Alvie Astronomo	706,641.00		PCIEERD
Development of Instructional / Educational Resources Materials on Nuclear Science and Technology for Secondary Students and Science Teachers	Jasmine Angelie Albelda	2,000,000.00		DOE
Development of Novel Radiopharmaceuticals for Management and Detection of Early Stage Prostate Cancer	Joanna Michelle Chua	4,919,004.00		PCHRD
Radiological Assessment of Selected Marine Areas in the West Philippine Sea	Chitho Feliciano	500,000.00		NAST
Multi-location Trials of Oligo Carrageenan for Improved Productivity of Mungbean and Peanut in Regions II, III, VII and X	Fernando Aurigue	296,240.00		PCAARRD
The Use of Radon Technique in Mapping Geological Faults in the Philippines	Angelito Ramos	240,197.00		PCIEERD
Development of Novel Nanomedicine (Redox Nanoparticles) for the Protection of Radiotherapy Patients and Nuclear Workers	Chitho Feliciano	1,234,596.00		DOST
TOTAL		174,687,613.15	2,390,579.21	

Funding Agencies

US-DOE – United States Department of Energy

PCIEERD – Philippine Council for Industry, Energy, and Emerging Technology Research and Development

CRP-IAEA – Coordinated Research Project
– International Atomic Energy Agency

PCAARRD – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development

KAERI – Korea Atomic Energy Research Institute

NRCP – National Research Council of the Philippines

DOST – Department of Science and Technology

NAST – National Academy of Science and Technology

PCHRD – Philippine Council for Health Research and Development

SRA – Sugar Regulatory Administration

PNRI OFFICIALS



**Carlo A.
Arcilla, PhD**
Director



Lucille V. Abad, PhD
Chief, Atomic Research
Division



**Preciosa Corazon
B. Pabroa, PhD**
Chief, Nuclear
Services Division



**Soledad S.
Castañeda, PhD**
Deputy Director



**Ana Elena
L. Conjares, MSc**
Chief, Technology
Diffusion Division



**Maria Celerina
M. Ramiro, MEM**
Chief, Finance and
Administrative Division
(Starting July 1, 2019)



Teofilo V. Leonin, Jr., MSc
Chief, Nuclear
Regulatory Division
(Until Jan. 15, 2019)



Vangelina K. Parami, PhD
Officer-in-Charge, Nuclear
Regulatory Division
(Jan. 16 to April 30, 2019)



Alan M. Borrás, MPM
Officer-in-Charge, Nuclear
Regulatory Division
(May 1 to July 31, 2019)

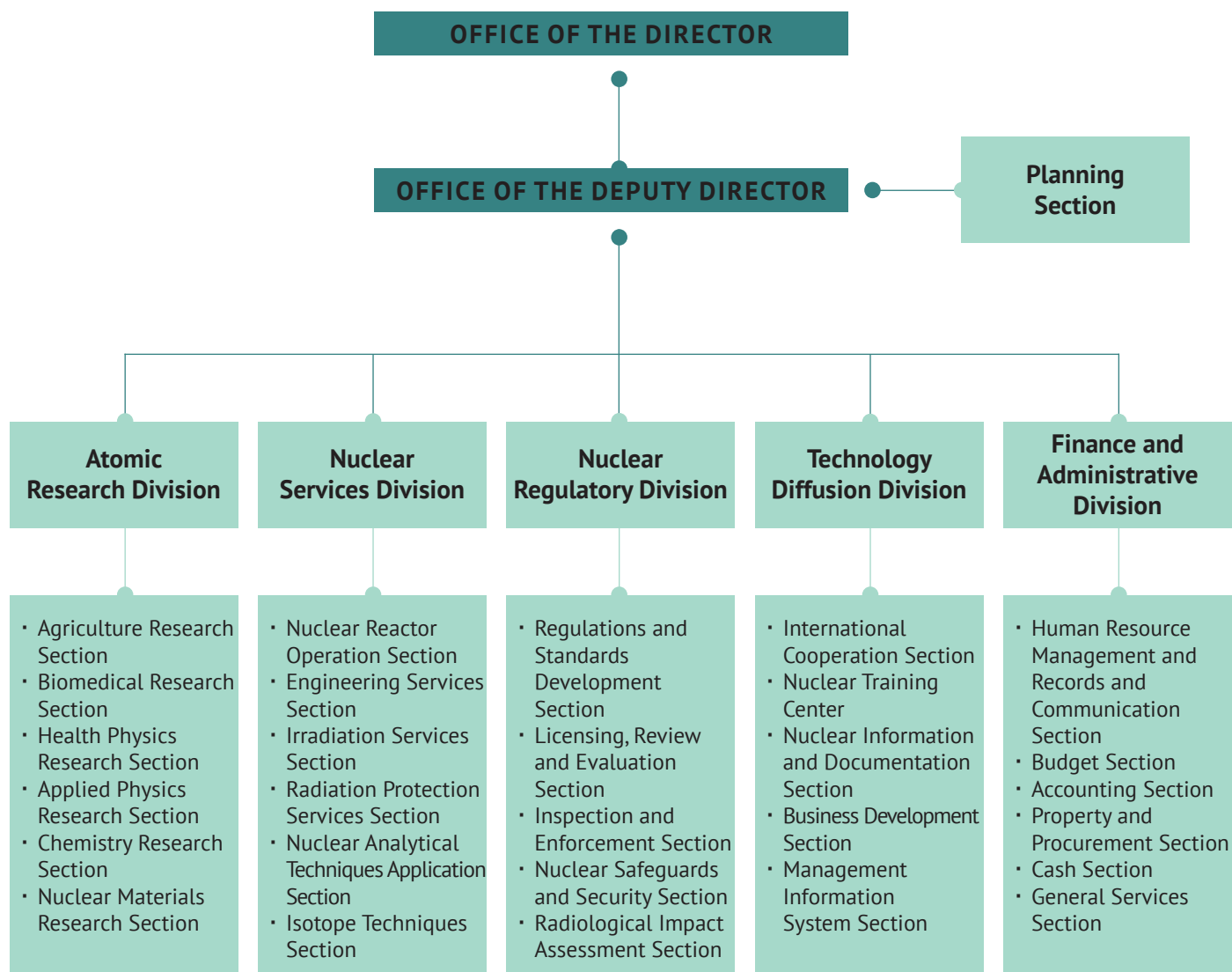


Edgard G. Racho
Officer-in-Charge, Nuclear
Regulatory Division
(Aug. 1 to Dec. 31, 2019)

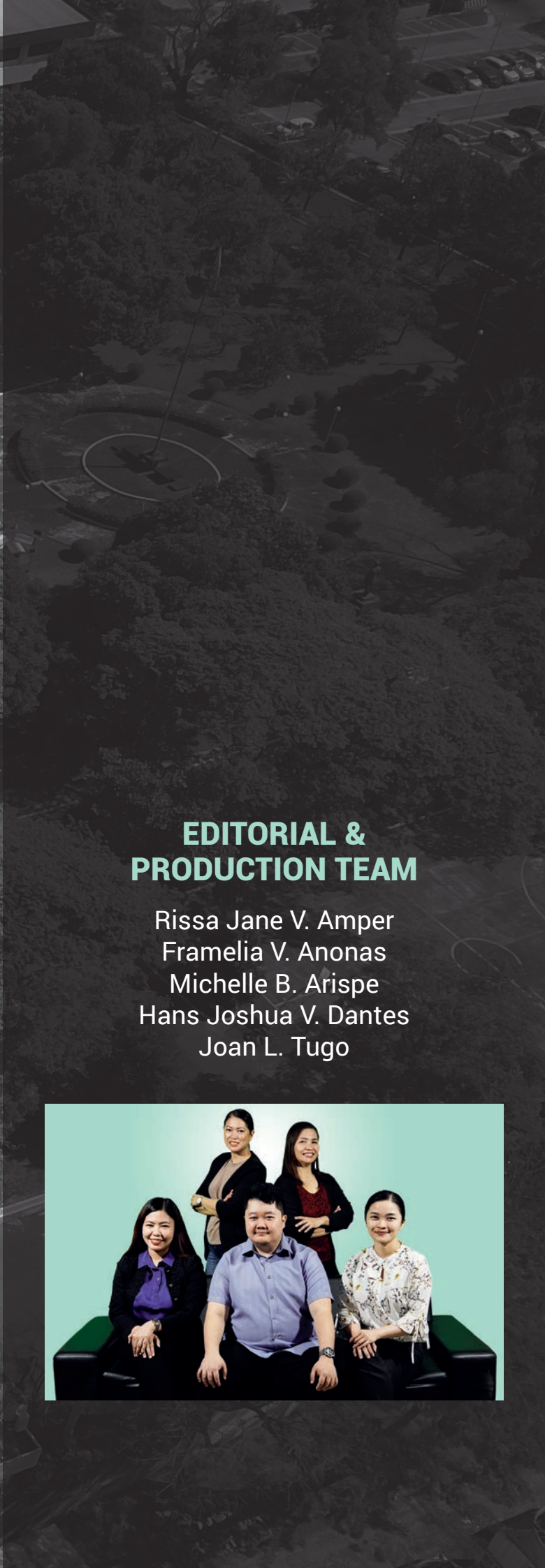


Gerald D. Conise, MPA
Officer-in-Charge, FAD
(Jan. 1 – June 30, 2019)

PNRI ORGANIZATIONAL CHART







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