Global networking for improved radiological and nuclear emergency preparedness and response in food and agriculture

THE CHALLENGE

Radioactive release during a radiological or nuclear emergency can affect agriculture and food production. Response involves the timely identification of areas where produce grown cannot reach the consumer due to safety reasons. It is critical that the most up-to-date information on spatial and temporal distribution of radionuclides is available to decision-makers.

IAEA RESPONSE

Establishing a global network enhancing worldwide capabilities of competent authorities responsible for monitoring radionuclides in food, soil, water and agriculture is key to swift global and national response in an emergency. The network will encourage and facilitate collaborative operations, including the development of online data management and geo-visualization platforms; improve the effectiveness of sampling, analysis and mapping; develop optimised remediation planning, monitoring and evaluation strategies; and ensure proper and ongoing training of staff.

PROJECT ACTIVITIES

- **Develop modules** for training and train competent authorities in managing data on radionuclides in food and agriculture, including monitoring and use of monitoring data for remediation planning.
- **Exchange information** between Member States on sampling techniques and analytical measurements, data management and visualization and real-time monitoring.
- **Develop, expand or customize** data management and visualization strategies and tools.
- **Prepare guidelines** on participatory monitoring of data on radionuclides in food and agriculture for food producers and consumers.
- **Perform simulation exercises** covering different aspects of nuclear emergency response in food and agriculture.

DURATION

Three years

BENEFICIARY COUNTRIES

All IAEA and FAO Member States

EXPECTED RESULTS

Enhanced capabilities in Member States in addressing contamination of food producing areas during radiological and nuclear emergencies, and improved infrastructure and support to address challenges concerning contamination in these areas.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1:	133 750
Year 2:	304 950
Year 3:	283 550
Total:	**722 250**

Generating high quality data to improve clinical practice and public health policies

THE CHALLENGE

Patients worldwide are benefiting from continuous improvements in outcomes and quality of life thanks to clinical research. The results of IAEA coordinated research activities in selected fields of radiation medicine and nutrition influence clinical diagnostic and treatment practices, programmes combating malnutrition in all its forms, and public health policies and strategies. As coordinated research projects (CRPs) become progressively more complex and sophisticated, the need for robust research quality assurance increases.

IAEA RESPONSE

This project will focus on capacity building activities to support Member States in improving the quality of data collected in technically advanced clinical trials in dosimetry, radiotherapy, nuclear medicine and diagnostic imaging. It includes using isotope techniques in nutrition to obtain quality information on the underlying factors of malnutrition and the effect of specific nutrition interventions. It also aims to strengthen research capacity in radiation medicine and nutrition.

PROJECT ACTIVITIES

- **Support quality assurance** of a liver cancer radiotherapy trial conducted under a coordinated research project. This will be achieved through coordination of dosimetry measurements on anthropomorphic phantoms. These phantoms can be used for future studies.
- **Training event** on specific isotope techniques in nutrition conducted under a CRP.
- **Training event** on standardization of study procedures for the assessment of nutritional status conducted under a CRP.
- **Support proficiency** tests among participating centres.
- **Training event** focusing on contouring for target volumes and organs at risk in radiotherapy treatment planning to ensure compliance with clinical trial protocols.
- **Support for phantom studies** in nuclear medicine and radiology imaging.
- **Development of training material** and training course. This will focus on research principles (e.g. protocols, ethics, research writing, data analysis) as part of initiating CRP.

DURATION

Five years

BENEFICIARY COUNTRIES

IAEA Member States participating in coordinated research

EXPECTED RESULTS

Improved quality of trial data and conclusions will provide clinically vital information regarding appropriate diagnostic and treatment practices. Better results of interventional studies and conclusions will help inform public health nutrition policymakers and programme planners about effective nutritional interventions. Material developed under the project will support future quality assurance activities and training for coordinated research projects.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	186 000
Year 2	86 000
Year 3	106 000
Year 4	81 000
Year 5	81 000
Total	**540 000**

Clinical applications of biological dosimetry in low and middle income countries

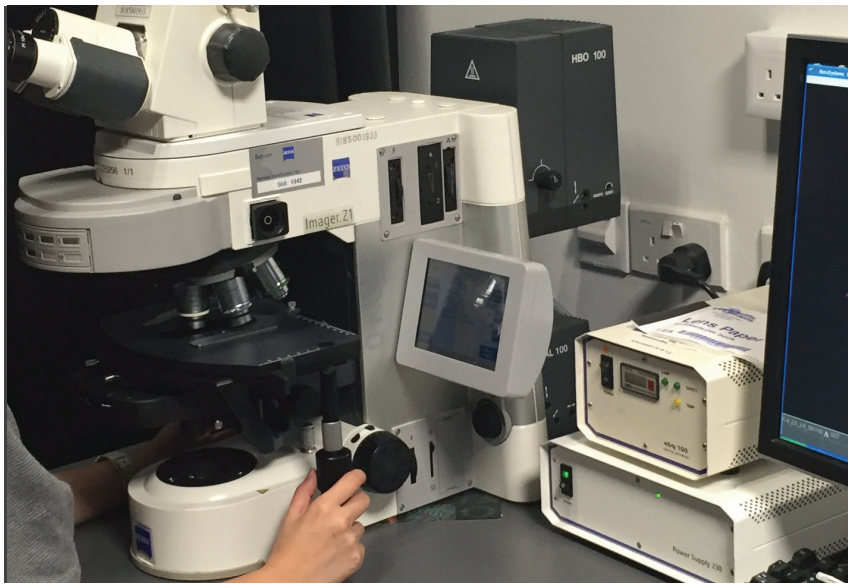
THE CHALLENGE

Biological dosimetry is a powerful tool that uses markers of biological damage induced by ionising radiation to estimate the radiation dose absorbed by an individual. It is especially useful when physical dosimetry measurements are absent or need to be verified, such as following partial body exposure or internal contamination. A national biodosimetric capability ready for large-scale accidents is not available in many low and middle income countries due to limited resources and lack of trained personnel.

IAEA RESPONSE

This project will complement and reinforce efforts undertaken by the IAEA within the framework of the Technical Cooperation Programme and Coordinated Research Projects (CRPs) related to biodosimetry. It aims at developing clinical applications of biodosimetric methods tailored for low and middle income countries, so that they may benefit from a better, personalized medical service. Specifically, biological markers in radiation oncology can help in many areas, such as predicting tumour and normal tissue radiotherapy response. The project will also help countries to maintain and strengthen expertise in accident biodosimetry.

It is proposed to establish a network of ten participating institutions, with each participant having shared tasks related to the harmonization, strengthening and development of biodosimetric capability, and a specific CRP on the clinical application of biodosimetry.



PROJECT ACTIVITIES

- **Consultant meeting.** This will be held to formulate the work programme and select participating institutions.
- **Network of ten partner institutions.** The project will be implemented as ten contracts with participating institutions, subject to evaluation and renewal on a yearly basis.
- **Four annual meetings.** These will focus on reporting results and planning future activities.

DURATION

Five years

BENEFICIARY COUNTRIES

Low and middle income Member States in Asia and the Pacific

EXPECTED RESULTS

Participating low and middle income countries will improve their ability to use biodosimetry techniques, resulting in a greater capacity to determine radiation exposure based on biological measures. This will enhance quantification and understanding of radiation exposure, thereby improving medical services and contributing towards improved preparedness in the case of large scale accidents

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	12 000
Year 2	77 000
Year 3	77 000
Year 4	77 000
Year 5	77 000
Total	**320 000**

Environmental monitoring – representative sampling for terrestrial radionuclide measurements

THE CHALLENGE

Environmental monitoring is carried out in many countries worldwide to control and measure radionuclide activities across different environmental compartments. But a systematic approach is needed to improve and harmonize methodologies for the determination and monitoring of radioactivity in the terrestrial environment.

IAEA RESPONSE

The IAEA is currently working on a technical document to discuss in detail the preconditions and steps required to ensure proper environmental sampling of soil and vegetation for radiation monitoring.

This project aims at supplementing the forthcoming technical document and protocol with practical guidance on its implementation, in line with that provided by ISO standard 18589. The practical implementation of sampling will support existing monitoring networks and national institutions regularly involved in providing samples for analysis. There will be a practical phase involving field work and sampling, field measurements, laboratory analytical work and assessment of results, to provide a toolbox for further application in Member States.

PROJECT ACTIVITIES

- **Assessment of field sites.** Several field sites will be assessed for radionuclide distribution and to ensure their suitability for practical sampling courses.
- **Ensuring availability.** The availability of necessary sampling tools, teaching and laboratory infrastructure will be ensured.
- **Targeted workshops.** These will discuss the IAEA protocol in detail, provide practical examples for implementation under different environmental conditions, take representative samples, perform field measurements, analyse samples in a laboratory and interpret the results to confirm the suitability of the approach.
- **Prepare course and protocol contents** as complementary information to the ISO standard on soil sampling for radiation monitoring.
- **Develop assistance tools** for representative sampling.
- **Transfer of course content.** Preparation will be made for the possible transfer of the course content to regular lectures and training.

DURATION

Four years

BENEFICIARY COUNTRIES

All IAEA Member States

EXPECTED RESULTS

Both the IAEA technical document on soil and vegetation sampling for radionuclide analysis and the practical guidance on its implementation will be a valuable addendum to the generic guidance provided by ISO standard 18589, which lacks details for proper implementation in practice. As a result, this project will have a major positive impact on Member States' ability to conduct high quality representative sampling as the precondition for proper interpretation and use of data produced in environmental laboratories.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	120 000
Year 2	120 000
Year 3	120 000
Year 4	120 000
Total	**480 000**

Improving agricultural practices to enhance resource use efficiency and reduce greenhouse gas emissions in intensively managed agricultural systems

THE CHALLENGE

Increased greenhouse gas emissions, which contribute to climate change and global warming, are having a profound impact on the sustainability of agricultural production systems. Yet, at the same time, agriculture itself is contributing to greenhouse gas production through intensive farming methods, as countries struggle to meet the food demands of rapidly rising populations. It is therefore important to find an integrated solution to reduce greenhouse gas emissions, making soils more resilient to climate change and increasing crop productivity at the same time.

IAEA RESPONSE

Using both nuclear and conventional techniques, the IAEA, together with the Food and Agriculture Organization of the United Nations (FAO), assists Member States to find integrated solutions. The project is designed to enhance nutrient use efficiency on farms while reducing greenhouse gas emissions through adaptation and mitigation practices and technologies. A specific focus of the project will be to quantify nitrous oxide (N_2O) and identify its exact sources using the ^{15}N isotopic technique, and the use of ^{13}C isotope to assess sources of carbon (C) sequestered in the soil.

PROJECT ACTIVITIES

- **Development, evaluation and validation** of methodologies and guidelines to measure N_2O, NH_3 and C-sequestration. Stable isotopes of ^{15}N and ^{13}C as well as conventional techniques will be used for quantifying greenhouse gases, nitrogen use efficiency and C sequestration. This also includes the provision of standard operating procedures, guidance and technical support.
- **Outreach and promotion.** This includes producing pamphlets for farmers on climate smart agricultural practices, and the publication of research results in popular media and in peer-reviewed journals. The objective is to improve the exchange of ideas, knowledge and experience, and to facilitate interaction.
- **Technical workshops and technology packages.** These will focus on the results of greenhouse gas measurements and C-sequestration under different land uses, as well as developing packages for reducing N_2O and NH_3 emissions and improving soil fertility, crop productivity and resource-use efficiency in intensively managed agricultural production systems.

DURATION

Five years

BENEFICIARY COUNTRIES

IAEA Member States in Asia and the Pacific

EXPECTED RESULTS

It is expected that better management of nitrogen used in agricultural processes will result in reduced greenhouse gas emissions. Equally, more efficient use of nitrogen offers scope for increased farm production and profitability. An improved environmental footprint will help grow the market appeal and reputation of the produce.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	444 050
Year 2	96 300
Year 3	58 850
Year 4	64 200
Year 5	101 650
Total	**765 050**

Enhancing education and training programmes in human health through quality assurance in higher education

Phase II: Utilizing information and communications technology (ICT) in promoting lifelong learning for radiation medicine/nutrition professionals

THE CHALLENGE

Recent years have seen remarkable developments in the field of radiation medicine and nutrition. New diagnostic and treatment methods have been broadly adopted by medical facilities around the world. There is also a growing awareness that the safe management and use of radiation in medicine depends on well-trained professionals. IAEA Member States have made significant investments in this area, but gaps in expertise remain, especially in low and middle income countries.

IAEA RESPONSE

Phase I of this project was focused on ensuring that Member States had access to more effective education, training programmes and online learning materials, such as E-learning modules and recorded seminars. The objective of Phase II is to continue delivering high quality educational resources in radiation medicine and nutrition to Member States, utilizing streamlined and emerging information and communications technologies. In particular, the project will continue the development of critical online learning materials and webinars.

PROJECT ACTIVITIES

- **Integrating online learning and mobile learning in radiation medicine/ nutrition.** This will increase the use of networks to facilitate information sharing and delivery of on-line teaching and learning materials among Member States. Under strict internal quality assurance processes, these activities will be implemented for education and training activities in human health, including meetings, conferences and webinars.
- **Delivery of relevant guidelines and documents in radiation medicine and nutrition.** The material will also be translated into selected official UN languages.
- **Human Health Campus website.** Efforts will be made to transform the website into a more effective site for active learning.
- **Train the trainer.** Workshops and meetings will be initiated on topics such as e-learning tools, curriculum development and implementation, and evaluation methods for the IAEA to produce even more effective education and training materials for Member States.

DURATION

Three years

BENEFICIARY COUNTRIES

All IAEA Member States

EXPECTED RESULTS

More effective use of networks to facilitate information sharing and the delivery of teaching and learning materials among Member States is expected to result in opportunities to advance the training of medical professionals.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	132 000
Year 2	132 000
Year 3	132 000
Total	**397 000**

Assessment and communication of marine environmental radioactivity

THE CHALLENGE

In recent years, there has been a marked increase in scientific and public interest in radioactive contamination of the marine environment. Information such as the way in which radionuclides are transported by ocean currents, or how they are diluted and taken up by marine organisms, is vital to understanding the impact ocean radioactivity has on marine life and, consequently, on humans.

Data publications often rely on the work of a single institute and therefore present a fragmented view of world ocean radioactivity. Global integration of the data reported by Member States is needed to provide a reference for further marine radioactivity assessment and radiotracer studies.

IAEA RESPONSE

This project aims to build a comprehensive assessment of levels and trends of ocean radioactivity on regional and global scales in the years 2010-2015. Through the IAEA's MARiS (MARine information System) portal, it will increase the amount of data and information available to scientists, environmental managers and the public. Research will involve the collection and advanced analysis of a large volume of data, requiring the development and application of customized data processing and mapping tools.

PROJECT ACTIVITIES

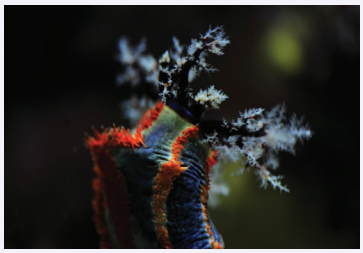
- **Assessment** of natural and man-made worldwide marine radioactivity. Data from 2010-2015 will be compared to reference levels from 1990 and 2000. A study of trends and environmental impacts will be carried out.
- **Development** of database content and enhancement of the MARiS database portal. New data and scientifically accurate and easy to understand information on marine radioactivity will be added and made available online. The aim is to include access to measurement/observation data and to information on marine radioactivity, presented in a manner that is accessible to a broader audience.
- **Involvement** of major marine radioactivity data producers with a geographically representative distribution. At least 25 scientists need to be involved in the project's workshops to sustain communication for bilateral and multilateral collaboration. The IAEA will support this scientific network through a collaboration platform, video-conferencing and workshops.
- **Production** of a scientific project report and a project eBrochure.

DURATION

Four years

BENEFICIARY COUNTRIES

All IAEA Member States



EXPECTED RESULTS

Member States will have access to a database and an IAEA publication on marine radioactivity updated with all data produced by the Member States' laboratories since the year 2000.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	120 000
Year 2	120 000
Year 3	10 000
Year 4	55 000
Total	**305 000**

Marine plastics: Tackling the challenge using nuclear applications

THE CHALLENGE

Marine debris usually enters the marine environment through a combination of litter, inadequate waste management, and accidental loss. It is estimated that a minimum of 5.25 trillion particles weighing 250,000 tons are floating in the world's oceans today. The role of microplastics as vectors of hazardous contaminants to marine life is an issue of concern for all coastal states, especially developing countries and Small Island developing states whose economies rely on marine ecosystem services.

IAEA RESPONSE

This project will use nuclear techniques to better understand how microplastics become contaminated by persistent organic pollutants and how they act as a vector in the transfer of such contaminants to marine organisms. By studying the transfer mechanism, the project will help assess the threat that microplastics pose to Member States relying on fisheries as a source of food and income. It will also evaluate the preparation of bio-based plastics using radiation technologies.

PROJECT ACTIVITIES

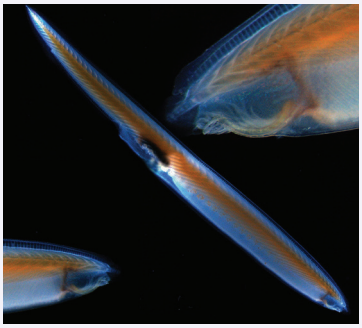
- **The dynamic** of sorption of organic pollutants on microplastics. This activity mainly consists of studying the sorption of two organic pollutant molecules on microplastics (plastic resin pellets) and their retention by microplastics in non-contaminating conditions, using nuclear and complementary techniques.
- **The role** of microplastics as a vector of organic pollutants to marine organisms. Using nuclear and complementary techniques, this activity will assess the risk of contamination of marine organisms through the ingestion of microplastics bearing organic pollutants.
- **Communication** and dissemination of information.
- **Technical meeting.** A meeting will be organized to evaluate the current worldwide status of the preparation of products made from bio-based plastic materials.

DURATION

Four years

BENEFICIARY COUNTRIES

Developing IAEA Member States



EXPECTED RESULTS

The use of nuclear techniques will help fine-tune existing monitoring programmes of persistent organic pollutants using microplastics. Another expected long-term impact will be the reduced amount of non-degradable plastics in the oceans due to the use of bioplastic-based materials.

The results of the project will be published in scientific journals and presented at international conferences.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	90 000
Year 2	90 000
Year 3	115 000
Year 4	15 000
Total	**310 000**

Ocean Acidification International Coordination Centre (OA-ICC) - Phase II

THE CHALLENGE

Ocean acidification has emerged as one of the major global threats to marine organisms, ecosystems and resources of the 21st century. If ocean pH continues to decrease at present rates, dramatic social-economic consequences can be expected, particularly for countries depending on marine resources.

The 2012 launch of the Ocean Acidification International Coordination Centre placed the IAEA in a leadership position on this sustainable development issue. Despite the Centre's substantial accomplishments over the last three years, the need for international collaboration and coordination continues to grow.

IAEA RESPONSE

The IAEA has carried out ocean acidification studies since 2008 and pioneered research on key indicators of ocean acidification, for which nuclear and isotopic techniques provide a unique tool.

Since its launch, the Centre has established a set of successful activities that have benefited many IAEA Member States. These include strengthening scientific capability to establish a global ocean acidification observing network, supporting international data management, promoting the use of best practices, and communicating the science to non-scientists. This project aims to build on the momentum and networks created over the first three years and further develop the wide portfolio of activities put into place.

PROJECT ACTIVITIES

- **Advancing ocean acidification science.** The Centre will continue to promote a series of international activities to accelerate advances in ocean acidification research, including in a multiple stressors context. Activities include improving global ocean acidification observation and access to data and literature, promoting international dialogue linking science with solutions, and facilitating intercomparison exercises.
- **Expanding understanding** of ocean acidification in vulnerable affected areas. The Centre will continue to organize technical meetings aimed at advancing scientific understanding of ocean acidification and enhancing capability in the most vulnerable regions of the world.
- **Communication.** The Centre's website and its news stream will be continued and developed as needed.

DURATION

Five years

BENEFICIARY COUNTRIES

All IAEA Member States

EXPECTED RESULTS

The second phase of this project is expected to build on the Centre's achievements of the last three years. It will continue to accelerate advances in international ocean acidification research and inspire tomorrow's experts, in particular in developing IAEA Member States. And it will further promote the efficient exchange of information between stakeholders and raise global awareness of this little known problem through its communication and outreach activities.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	560 000
Year 2	560 000
Year 3	560 000
Year 4	560 000
Year 5	560 000
Total	**2 800 000**

Creating Veterinary Laboratory preparedness among Member States in line with the global strategy for the control and eradication of peste des petits ruminants (PPR) using Nuclear and Nuclear-derived techniques

THE CHALLENGE

Peste des petits ruminants is a highly infectious transboundary animal disease that primarily affects sheep, goats and small wild ruminants in almost 70 countries in Africa, the Middle East and parts of Asia. With mortality and morbidity rates as high as 80%, the disease causes an estimated loss of US $1.5 to 2 billion annually. As sheep and goats contribute significantly to the cash income and nutrition of small farmers in many countries, control of the disease is an essential element in the fight for global food security and poverty alleviation.

IAEA RESPONSE

The 2015 Global Control and Eradication Strategy for peste des petits ruminants and other small ruminant diseases lays out the general principles, strategies and tools to be used, including nuclear and nuclear-derived diagnostic and monitoring techniques. The IAEA, together with the Food and Agriculture Organization of the United Nations, and national veterinary extension services, will collaborate under this strategy to help eliminate the disease. In particular, it will draw on the IAEA's laboratory experience in this area and its strong network of Member State laboratories. It is important to note that peste des petits ruminants is earmarked as an eradicable disease, the second after rinderpest.

PROJECT ACTIVITIES

- **Develop and refine** techniques for early and rapid diagnosis.
  The project will focus on the early and rapid immunological and molecular nuclear and nuclear derived diagnoses and control of peste des petits ruminants.
- **Optimization, validation, transfer, implementation and harmonization.**
  Appropriate nuclear and nuclear derived peste des petits ruminants diagnostic platforms will help Member States to survey infected or susceptible domestic animals and wildlife.
- **Development and evaluation** of peste des petits ruminants irradiated vaccines.
  Also, the standardization and harmonization of associated control reagents.

DURATION

Three years

BENEFICIARY COUNTRIES

IAEA Member States in Africa, Asia and the Middle East

EXPECTED RESULTS

Quality assured detection of the peste des petits ruminants virus and other small ruminant respiratory pathogens will be strengthened. Also, disease diagnostics and surveillance, post vaccination monitoring and confirmation of freedom from disease will be significantly improved.
Ultimately, peste des petits ruminants and respiratory disease burden will be reduced in the targeted countries through enhanced surveillance and early detection.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	508 250
Year 2	572 450
Year 3	476 150
Total	**1 556 850**

Seafood safety: Developing tools for improved monitoring and assessment of regulated and emerging contaminants and biotoxins

THE CHALLENGE

Seafood provides up to 16% of animal protein consumed worldwide, with annual sales estimated at US $400 million. More than one billion people rely on seafood as their primary source of protein. But it can also be the vector of harmful contaminants, posing a serious risk to human health. Monitoring for the presence of these contaminants in seafood commodities using reliable, widely applicable and fast methodologies is therefore imperative. There is also an increasing need for sensitive and reliable methods of analysis for organic and inorganic contaminants and marine toxins.

IAEA RESPONSE

The project aims at establishing or strengthening the detection of regulated and emerging contaminants and marine toxins in Member States by developing and improving analytical methodologies for key marine contaminants and biotoxins in finfish and shellfish products. Experimental research activities and protocols will also be developed to better understand the dynamics of contaminants' transfer from the environment to seafood and assess the contamination risk to consumers.

An array of nuclear and isotopic techniques such as radiotracers, receptor binding assay, isotope dilution, mass spectrometry, atomic fluorescence spectrometry and atomic absorption spectrometry are available to monitor seafood for contaminants. These will be further developed.

PROJECT ACTIVITIES

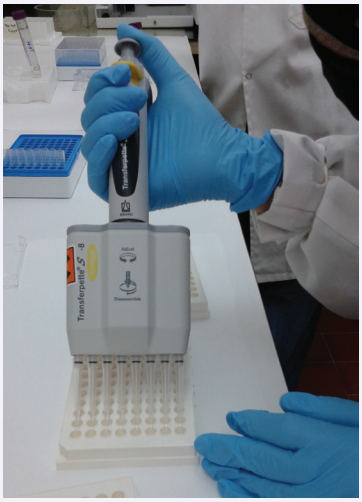
- **Nuclear analytical method development for harmful contaminants.** This will focus on harmful algal bloom biotoxins, mercury and methyl-mercury, and fluorinated and brominated persistent organic pollutants.
- **Nuclear applications for detecting seafood contamination.** This includes risk assessment through an experimental approach.
- **Dissemination of project results.** This will be achieved via e-learning material, technical workshops, distribution of reference material, communication to international conferences and publication of scientific manuscripts.

DURATION

Four years

BENEFICIARY COUNTRIES

All IAEA Member States



EXPECTED RESULTS

The analytical methods developed through this project will provide tools and methodologies to Member States to facilitate the monitoring of persistent organic contaminants, mercury and biotoxins in seafood. The experimental approaches will help to assess and mitigate the risk of these compounds for seafood safety. Dissemination of project results will assure the efficient transfer of knowledge among Member States and will allow the procurement of useful tools and methods to prevent jeopardizing the health benefits of seafood.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	155 000
Year 2	185 000
Year 3	185 000
Year 4	190 000
Total	**715 000**

Develop regional networks of isotope hydrology laboratories for groundwater age dating to improve water resources assessment and management

THE CHALLENGE

Adequate supplies of clean, fresh water are vital to human survival and, as such, are an important part of the Sustainable Development Agenda. Due to increasing demand, declining water quality and the impact of climate change, the availability of groundwater resources in underground aquifers is key to continued development and economic growth.

Isotope hydrology, and in particular the determination of groundwater age, enables scientists to quickly and accurately assess the origin, availability and renewability of groundwater stored in aquifers. But the wider application of isotope hydrology requires strong national and regional capacity, with well-equipped laboratories and trained staff.

IAEA RESPONSE

The IAEA has made advances in adapting and developing analytical methods and equipment for use in isotope hydrology that are easy to acquire and operate. It has also developed a set of training tools and courses to enable Member States to train their staff to be self-reliant in the operation of isotope hydrology laboratories.

This project aims to adapt methods for isotopic application related to groundwater age dating and to develop regional networks of well-equipped laboratories for the measurement of stable isotopes, tritium and related radioisotopes in water samples. It will identify the most appropriate applications and adapt methods to suit national and regional considerations, with the aim of strengthening Member States' capacity for water resources assessment and management.

PROJECT ACTIVITIES

- **National–regional technical workshops.** A series of workshops will be conducted to evaluate the suitability of specific isotope applications and to conduct feasibility studies. Technical support for undertaking the feasibility studies will be provided.
- **Phase II.** The results of these studies will be used to develop a plan for laboratory capacity and related training in a follow-up Phase II effort to be implemented in cooperation with, or by, the Department of Technical Cooperation.

DURATION

Four years

BENEFICIARY COUNTRIES

IAEA Member States in Latin America and the Caribbean, Africa and Asia and the Pacific

EXPECTED RESULTS

The project will help build regional networks of operational laboratories and trained personnel dedicated to groundwater age dating, thereby allowing Member States to make assessments of their national and shared water resources, as well as to use them in a sustainable way.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	70 000
Year 2	440 000
Year 3	290 000
Year 4	350 000
Total	**1 150 000**

Enhance Agency's capacity to provide support to Member States to control Aedes mosquitoes as vectors of human pathogens, particularly the Zika virus, using integrated vector management approaches with a Sterile Insect Technique (SIT) component

THE CHALLENGE

Mosquitoes are bloodsucking insects that can carry pathogenic micro- organisms, causing diseases that may result in severe illness or death. The growing outbreak in Latin America and the Caribbean of a mosquito-borne disease caused by the Zika virus has resulted in the World Health Organization (WHO) declaring a global health emergency. With no vaccines or safe, inexpensive drugs yet available to control diseases such as Zika, Dengue and Chikungunya, the sterile insect technique (SIT) could play a decisive role in controlling populations of Aedes mosquitoes.

IAEA RESPONSE

The IAEA has been working to further develop different aspects of the SIT for some major disease vectors, including the *Aedes* mosquitoes. Responding to the Zika outbreak and requests from affected Member States for urgent assistance, the IAEA is developing and implementing an off-cycle regional project aimed at strengthening capacity in Latin America and the Caribbean to help control the spread of the virus using an integrated vector management approach with a SIT component.

PROJECT ACTIVITIES

- **Development of strains** required for SIT-based integrated vector management approach for Aedes mosquitoes. More than one Wolbachia-infected strain of each vector species needs to be developed for the combined SIT and incompatible insect technique in order to select the best ones after evaluation and quality control analysis.
- **Development of genetic sexing lines.** To separate males from females before releasing the sterile males.
- **Mosquito rearing efficiency, handling, shipping and air releasing.** Refine rearing protocols and equipment, optimize handling and shipping methods, and assess different air release strategies.
- **Introgression and quality control analysis** of strains to be sent to Member States. Several strains of *Aedes* mosquitoes need to be developed for Member States. Before transferring these strains to Member States, they need to be introgressed into the genomic background of different local target populations.
- **Technical backstopping** of the off-cycle regional project activities. This includes managing technical coordination meetings, regional training courses, carrying out technical advisory missions to Member States, providing specifications for mass-rearing and related equipment and materials for their procurement, and shipping specialized supplies and strains to Member States.

DURATION

Four years

BENEFICIARY COUNTRIES

All IAEA Member States

EXPECTED RESULTS

This project will result in the development and transfer to Member States, in particular those in Latin America and the Caribbean, of evaluated strains of *Aedes* mosquitoes. These strains will be used in integrated vector management approaches with a SIT component for the population control of mosquitoes transmitting Dengue, Chikungunya and, particularly, Zika.

TOTAL ESTIMATED BUDGET

	Budget (EUR) with 7% PSC included
Year 1	895 590
Year 2	640 930
Year 3	592 780
Year 4	592 780
Total	**2 722 080**

Mutation breeding R&D networking for fighting coffee leaf rust

THE CHALLENGE

Coffee is the second most traded commodity in the world after crude oil. But around the globe, a fungal disease that kills coffee plants by withering its leaves is decimating crops and seriously impacting coffee-dependent economies. Coffee leaf rust is not new, but as climate change brings the warmer and wetter conditions that nurture the disease, countries in Latin America are facing an unprecedented epidemic. Coffee yields have fallen drastically, and the livelihoods of millions of people are under threat.

IAEA RESPONSE

In partnership with Food and Agliculture Organization (FAO), the IAEA actively supports Member States in their efforts to prevent the spread of new and emerging plant diseases. Using nuclear techniques, scientists breed plant varieties that are disease resistant, or can tolerate severe or changing climatic conditions. For example, mutation breeding was used successfully to address black stem rust of wheat.

The project's objective is to establish a global R&D network, with its core in Latin America, based on coffee leaf rust mutation breeding and plant biotechnologies that can improve breeding efficiency.

PROJECT ACTIVITIES

- **Development of R&D network.** This will include identification of endemic disease hotspots for in-field screening and the detection of resistant mutants.
- **Development of technology packages.** The mutation induction in coffee will be optimized through R&D on in vitro and in vivo techniques for preparing requisite populations to mutagenize. This includes the organization of a technical workshop for the inception of the R&D network to decide on test material and field locations, R&D on high throughput and low cost screening techniques for the detection of mutant resistance alleles and R&D in mutation induction methods in coffee.
- **Transfer of material and optimization of screening methodologies.** A technical workshop will be organized on mutation induction R&D in coffee, the optimization of technology packages for the detection of mutant resistance alleles, and the optimization of in vitro and in vivo methods.
- **Characterization of mutants showing disease resistance.** This is to be carried out through field screening in identified endemic hotspots.
- **Validation of technology packages.** These will be used for the detection of mutant resistance alleles, in vitro techniques, initiation of mutation breeding in chosen coffee parent lines, and the preparation of protocols and guidelines.

DURATION

Four years

BENEFICIARY COUNTRIES

IAEA Member States in Latin America and the Caribbean

EXPECTED RESULTS

Long-term, the potential economic impact expected to be derived from the establishment of coffee leaf rust-resistant varieties for Latin America is above US $1 billion per year. Considering the time-to-yield of coffee plantations, this impact should be achievable within 10-12 years of project completion.

TOTAL ESTIMATED BUDGET

Year	*Budget (EUR) with 7% PSC included*
Year 1	218 120
Year 2	209 163
Year 3	209 163
Year 4	223 898
Total	**860 344**