IAEA Coordinated Research Activities in 2019

I. General Information

I.1. Statutory Provisions

The International Atomic Energy Agency (IAEA) is authorized under its Statute to encourage and assist research on, and development and practical application of, atomic energy for peaceful uses throughout the world. The IAEA's Programme and Budget for 2018–2019 provides, accordingly, for the placing of research, technical and doctoral contracts and research agreements with universities, colleges, research centres, and laboratories, as well as with other institutions in Member States, with the aim of encouraging and assisting research on subjects directly related to the IAEA's mandate.

I.2. Financial Support

The IAEA's financial support for a project is usually provided in the form of a lump-sum cost-sharing contract. The Contractor engaged by such a contract is usually expected to bear part of the cost of the project and, in any case, to continue to make normal contributions covering overheads and other expenses and the IAEA contributes an appropriate percentage of the total estimated costs. Owing to the limited resources available, the amounts awarded are rarely large — the present average being approximately €7000 per annum per contract. Larger awards may, however, be considered. In addition to the contract award, Contractors participating in IAEA coordinated research projects (CRPs) are invited to attend periodic Research Coordination Meetings (RCMs) at the IAEA's expense.

In addition to the contracts mentioned above, agreements may be awarded to institutes, normally in developed countries, for participation in an IAEA CRP. Under such agreements, no commitment to pay a financial award is made to the agreement holder other than the provision to attend RCMs at the IAEA's expense.

I.3. Selection of Institution

The IAEA selects the institutions to which research contracts and agreements will be awarded. When a specific proposal for research is made by an institution in a Member State, the decision to award a research contract or agreement is made after careful consideration of the technical merits of the proposal, the compatibility of the project with the IAEA's own functions and approved programmes, the availability of appropriate facilities and personnel in the institution and previous research work related to the project.

Additionally, where it is recognized that the award of a particular contract or agreement would materially assist one of the IAEA's programmes, an invitation is sent to those institutions believed to have the necessary facilities and personnel, and the Government of the Member State concerned is kept informed.

In providing research support from the limited funds available for the coordinated research activities programme, priority is normally given to proposals received from institutions in developing Member States and to qualified young and female researchers.

I.4. Formal Submission of Proposals

Based either on a proposal made by the IAEA, or a proposal developed at a research institute, a formal submission of a project proposal should be made by the institute concerned and **submitted directly to the IAEA's Research Contracts Administration Section**.

If the proposed project is approved, a contract or agreement will be sent to the head of the institution for approval and signature, and the Government of the Member State will be duly notified through the appropriate channels of the conclusion of the contract or agreement. For all research contract proposals, the "Proposal for Research Contract" form N-18/Rev.18 (Apr. 18) must be used. Proposals for research agreements should be made using the "Proposal for Research Agreement" form N-21/Rev.16 (Apr. 18). Both forms are available on the Coordinated Research Activities website, in the following link: https://www.iaea.org/services/coordinated-research-activities/how-to-participate.

II. General Conditions of Contracts and Agreements

II.1. Period of Contract or Agreement

Research contracts and agreements are generally awarded for the entire duration of the CRP. They may, however, be issued for shorter periods and, if need be, extended within the duration of the CRP.

II.2. Reports

Each Contractor must submit a **yearly progress report**, which should also contain the proposed programme of work for the following year, and a **final report** at the end of the contract. The positive evaluation of the progress reports by the appropriate Project Officer constitutes the basis for the continuation of the project and payment of the next instalment of the project award, while the final payment is made only upon positive evaluation of the final report and completion of work. Agreement holders must submit a report at each meeting of the CRP.

II.3. Conditions of Payment under Contracts

The timetable of the IAEA's payments is established when the contract is negotiated. Cash payments are normally made to the Contractor for expenses covered under the contract, except in cases where the IAEA is requested to procure equipment or other project-related supplies on behalf of the Contractor. In such cases, the portion of the total amount designated for equipment and supplies to be procured by the IAEA is not transferred to the Contractor and shall be held by the IAEA in a trust fund.

Funds are normally obligated when the contract is awarded, and, subsequently, every year upon certification by the Project Officer for the CRP that the progress reports have been received in due time and accepted by the IAEA. The obligation for the final year tranche is split into two instalments, one at the beginning of the final year and one at the end of the final year, upon certification by the Project Officer for the CRP that the final report has been received in due time and accepted by the IAEA. All efforts should be made to submit the required reports in a timely manner.

II.4. Publication of Results and Intellectual Property Rights

Publication, either by the institution or the IAEA, of the results of the work performed under research contracts and agreements is normally the most efficient and effective way of bringing these results to the notice of other scientists. In publishing the results of research, the Contractor must acknowledge the

contribution of the IAEA. The reports submitted by the Contractor shall normally be the exclusive property of the IAEA.

II.5. Provision of Equipment

The Contractor may wish to use a portion of the funds provided by the IAEA for the purchase of equipment required for the performance of the research. Only the items relating to the specific project concerned can be purchased from the funds provided by the IAEA. These items can be purchased directly by the Contractor or, upon request, procurement of equipment items can also be arranged by the IAEA, in cases where this expedites their supply. Funds reserved for the purchase of project-related supplies and equipment by the IAEA on behalf of the Contractor are transferred to a trust fund in which they remain until all foreseen purchases are made. No orders for supplies or equipment will be made by the IAEA after the contract is terminated.

II.6. Other Provisions

Each contract/agreement provides that the IAEA shall not be liable for any death, injury or damage arising out of the implementation of the research project; as a rule, a clause is included requiring the Contractor or agreement holder to hold the IAEA harmless from any damage suits. Special provisions are also made with respect to settlement of disputes. Given the immunity from jurisdiction awarded to the IAEA, settlement of disputes must be governed by arbitration or conciliation under the rules of the United Nations Commission on International Trade Law (UNCITRAL). Additional provisions are made with regards to, inter alia, applicable health and safety standards.

III. IAEA Coordinated Research Projects for which Research may be Supported in 2019

Most of the research supported by the IAEA is related to its CRPs, which are developed in line with the overall goals of the IAEA. Only in exceptional cases will research contract funds be used to finance individual contract proposals that, while not forming part of a CRP, deal with topics in the IAEA's programme. The enclosed document includes an open-ended list of CRPs under which the IAEA may consider providing support for research in 2019. Additionally, the Coordinated Research Activities website lists the most up to date CRPs open for proposals, which can be found at the following link: https://www.iaea.org/services/coordinated-research-activities.

All proposals received by the IAEA will be carefully considered. Enquiries concerning specific CRPs should be addressed directly to the IAEA's Research Contracts Administration Section, at: **research.contracts@iaea.org**.

List of IAEA Coordinated Research Activities
Open for Submission of Proposals in 2019
(by Major Programme, Programme and Project)

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Major Programme 1: Nuclear Power, Fuel Cycle and Nuclear Science

1.1 Nuclear Power	
Project 1000153	**1.1.5.002 Technology development for small and medium-sized or modular reactors (SMR)**
CRP Title:	**Technologies to enhance the competitiveness and early deployment of SMRs and HTRs**
CRP Code:	**2230**
The CRP will perform research and exchange information on technology developments and novel solutions to enhance the competitiveness of advanced Small Modular Reactors and s and modular High Temperature Gas-cooled Reactors for electricity production and non-electric applications of nuclear power. This includes aspects such as novel applications (for mines that needs tri-generation, i.e. electricity, heat and cooling), hybrid energy systems (also to support intermitting renewables on the grid), off-grid applications (islands, isolated communities), cogeneration (heat to industrial complexes), desalination, innovative power conversion systems (for example co-firing with gas or heat storage systems), dry cooling (for desert applications). It may also include the need for new reactor designs, enhancement in fuel, increased safety, flexible operational modes, waste solutions and enhanced economics. These proposed enhancements should improve the sustainability of the technology and facilitate earlier and increased deployment.	
1.2: Nuclear Fuel Cycle and Waste Management	
Project 1000037	**1.2.3.002 Spent fuel recycling**
CRP Title:	**Advanced fuel cycles**
CRP Code:	**2238**
As new fuel and reactor technologies are developed, advanced fuel cycle options have the potential to increase Nuclear Power's economic viability, decrease the environmental impacts and improve operational flexibility. The purpose of this CRP is to identify fuel cycle options for aqueous and pyro processes and provide a wide and inclusive forum to determine the factors that influence the choice of technology to be deployed. The objective of the CRP will be to enable collaboration between concerned Member States to identify technological approaches and key challenges to reach the goal of sustainable utilization of nuclear energy using Advanced Fuel Cycles.	
Project 1000038	**1.2.3.003 Nuclear materials transportation**
CRP Title:	**Spent fuel characterization**
CRP Code:	**2239**
The characterization of spent fuel is required in various steps of spent fuel management (SFM), with an emphasis in the steps of spent fuel storage, transportation and conditioning for disposal. Therefore, spent fuel characterization has often been partially discussed while addressing wider issues of SFM, but no specific information has been collated and shared on the matter through a dedicated IAEA publication in recent years. The main purpose of the Coordinated Research Project is to discuss and share information with concerned Member States on issues related to the characterization of spent nuclear fuel in the various steps of its management until its final disposition. This will be achieved by gathering information from Member States regarding the approaches to characterization they have taken and are developing for the various steps of SFM, including the validation of models, techniques and procedures, enabling the exchange of information and experiences between Member States with a greater maturity in this area with Member States with limited experience and infrastructures, aiming at compiling this information in an IAEA Technical Report as a CRP output.	
1.4 Nuclear Science	
Project 1000121	**1.4.1.003 Atomic and molecular data developments**
CRP Title:	**Hydrogen permeation in fusion-relevant materials**
CRP Code:	**2244**

A nuclear fusion reactor must, for reasons of safety and efficiency, minimise the amount of tritium fuel that is retained by its solid plasma-facing components. Indeed, their propensity to absorb hydrogen is the main reason that carbon-based compounds are not thought to be viable materials for the “first wall” of such a reactor. Another concern is the transport of tritium through structural materials into the water used to cool the first wall, where it readily generates tritiated water (a potential biological hazard and a loss of the reactor’s valuable fuel). Research, mostly involving theory and modelling, is ongoing to understand the behaviour of hydrogen isotopes in solids; this CRP will assist in the provision of evaluated data and modelling code comparison to assist such research, in support of ITER and Member State nuclear fusion reactor research programmes.	
Project 1000161	**1.4.1.002 Nuclear data developments**
CRP Title:	**Updating fission yield data for applications**
CRP Code:	**F42007**
Fission yield data are important for a range of applications such as reactor design and operation, fuel and reactor performance burnup calculations as well as for reprocessing of spent fuel and management of nuclear waste. Many of the evaluated libraries are rather old and date back to the 1990s. On the other hand, new measurements with improved accuracy and precision are now available, and new models and evaluation methods including correlations have been developed. The CRP aims to improve the evaluated fission yield data for four major actinides (U-235, U-238, Pu-239, Pu-241) and for the standard Cf-252, to reflect the progress achieved in measurements and theory. All the available experimental data on independent and cumulative fission yields at different energies, decay data for fission fragments as well as associated data on fission neutron spectra, average number of emitted neutrons, total kinetic energies of the fragments will be compiled, assessed and evaluated using modern evaluation methodologies with proper treatment of the uncertainties. The recommended fission yield data files will be validated against a series of benchmarks and through global testing exercises on decay heat data, delayed neutrons and reactor anti-neutrino spectra calculations. The final recommended files will be disseminated to the user community from online databases.	
Project 1000163	**1.4.3.002 Facilitating experiments with accelerators**
CRP Title:	**Facilitating access to ion beam accelerators**
CRP Code:	**G42008**
Accelerator based technologies are associated with a broad range of applications that have a societal and technological impact, and can contribute to the economic development of Member States. The utilization of accelerators enhances innovation in a variety of fields with health, materials, culture, environment, energy and natural resources being typical examples. In this context, accelerator applications are one of the thematic areas where the IAEA supports its Member States in strengthening their capabilities to adopt and benefit from the usage of accelerators. Although IAEA developing Member States recognize accelerator technologies as a key element to serve socioeconomic development, many of them have limited availability of funds required for the installation and effective operation of accelerator facilities and subsequent running costs. As a result, researchers from these Member States often have limited support to employ accelerator-based techniques, or their access to accelerator facilities is very limited. The overall objective of this CRP is to increase the impact of accelerator-based analytical techniques in IAEA developing Member States by increasing the number of users of accelerator facilities for analytical purposes and education.	
Project 1000165	**1.4.4.001 Nuclear fusion research and technology**
CRP Title:	**Pathways to energy from inertial fusion: materials research and technology development**
CRP Code:	**F13020**
Harnessing energy by fusing together Deuterium and Tritium nuclei requires very high temperatures (exceeding 100 million °C) and generates energetic neutrons, charged particles and other radiation that can cause material defects and damage the reactor core components. Therefore, for future commercial fusion power plant components, it is indispensable to develop a material that is strong at high temperatures, and do not degrade to the point where it could be overheated and fail under operational conditions. This CRP seeks to advance the fundamental fusion-material science and technologies	

development and enhance information exchange on Inertial Fusion Energy (IFE) research and development (R&D), establishing an international network of working groups. This will open the door for more Member States to join the research efforts at different levels and contribute to moving forward in developing the peaceful use of fusion energy, serving the needs of both IFE and Magnetic Fusion Energy (MFE) communities.

Major Programme 2: Nuclear Techniques for Development and Environmental Protection

2.1: Food and Agriculture	
Project 2000005	**2.1.1.001 Land management for climate smart agriculture**
CRP Title:	**Developing climate smart agricultural practices for mitigation of greenhouse gases**
CRP Code:	**2252**

Agriculture produces a substantial amount of greenhouse gas (GHG) emissions, which contribute greatly to global warming and climate change. In this CRP, participating researchers will identify the best practices for their specific agroecosystem to increase crop productivity with lower GHGs emissions as well as to improve soil fertility by retaining more plant nutrients, especially nitrogen and carbon. Stable and radioisotopes will be used to develop technology packages that assist Member States to sustainably reduce these emissions, improve resource use efficiency and increase crop and animal productivity. Knowledge and new information generated through this CRP will help researchers, extension workers and land users to deal with the challenges of GHGs emissions from agriculture and land use changes.

Project 2000016	**2.1.3.001 Food irradiation applications using novel radiation technologies**
CRP Title:	**Innovation of irradiation technologies on surface treatment of food commodities**
CRP Code:	**2258**

This CRP will use low energy beams and other nuclear techniques to develop novel irradiation techniques and small-scale machines being applied in the surface sterilization of food and agricultural products. New approaches include using the limited ability of low energy electrons, having energy below 300 keV, to penetrate below the surface of products. Such irradiation is effective at decontaminating surfaces but leaves the bulk (internal volume) of the food untreated, in contrast to conventional food irradiation (e.g. with high energy electrons, gamma rays or x-rays) where the whole volume of food is irradiated. Outputs will include: Research publications on the efficacy of surface irradiation; New dosimetry systems capable of quickly and accurately determining surface irradiation dose; and Data relating to the application of new food irradiation technologies and their ability to eliminate food borne pathogenic organisms, maintain quality, prevent early spoilage or eliminate pests.

Project 2000017	**2.1.3.002 Traceability for food safety and quality to enhance international trade**
CRP Title:	**Depletion of veterinary pharmaceuticals and radiometric analysis of their residues in animal matrices**
CRP Code:	**2257**

This CRP will apply nuclear and related techniques including single dose administration of radiolabelled drugs to determine distribution/depletion patterns of targeted veterinary substances. Edible and related tissues of animal matrices will be analysed by whole-body radiography, liquid scintillation counting and chromatography. The following outputs will be achieved: Residue depletion disposition and distribution data for selected veterinary drugs and pharmacologically active substance in edible and associated tissues and material; Useful reference materials to facilitate future relevant research; and Publications (including technical document) and manuals for use by researchers and regulatory institutions as well as risk assessors. Expected outcomes will include: (a) Research capabilities and relevant scientifically reliable information available to Member States to facilitate Maximum Residue Level (MRL) settings and risk assessment; and (b) Research data that facilitates the work of Joint FAO/WHO Expert Committee on Food Additives (JECFA).

Project 2000023	**2.1.4.003 Development of the SIT for the control of disease transmitting mosquitoes**
CRP Title:	**Mosquito irradiation, sterilization and quality control**

CRP Code:	**D44004**
This CRP aims to create knowledge leading to the development of standard irradiation procedures for mosquitoes ensuring a homogeneous high sterility rate while maintaining their quality, particularly competitiveness. The proposed research will include: (1) Assessment of different sources of variation of irradiation on induced sterility and the quality of sterile male mosquitoes, especially at large scale; (2) Evaluation of the interactions between irradiation and other handling processes (mass-rearing, sex-sorting, transport and release) on the quality of sterile male mosquitoes; and (3) Development of quality control tools allowing a fast and cheap evaluation of sterile males.	
Project 2000031	**2.1.5.001 Mutation induction for better adaptation to climate change**
CRP Title:	**Enhanced biotic-stress tolerance of pulses towards sustainable intensification of cropping systems for climate-change adaptation**
CRP Code:	**D22006**
The CRP aims to use mutation induction and associated genomics technologies for productivity improvement of three pulses, namely, chickpea, cowpea and lentil, which together account for 40% of the global pulses production. The research focus is on enhancing the tolerances of chickpea to the pod borer, *Helicoverpa armigera*; cowpea to the bod borer, *Maruca vitrata*, and lentil to the disease *Stemphylium* blight. Towards this end, the CRP, with the participation of the National Agricultural Research Systems of countries where the crops are grown extensively and the CGIAR centers with the respective mandates, shall over a period of four to five years, generate mutant populations, including advanced lines, and develop, validate and publish genotyping and phenotyping protocols. The overall objective of the CRP is to develop genetic resources through induced mutations and associated genomic tools for accelerated adaptation of pulses-based cropping systems to climate change.	
CRP Title:	**Integrated breeding of major mutant traits for food security and climate-smart agriculture**
CRP Code:	**2261**
Significantly enhanced crop productivity is crucial to the food security and nutrition of a growing global population and the achievement of the 2030 Agenda. In developing nations, these productivity increases have been very slow or sometimes stagnant, and significant yield gaps still exist for many crops. Climate change further exacerbates this situation by causing serious production losses from rising temperatures, frequent droughts, flooding, and increasing incidence of pests and diseases. Sustainable intensification of cropping systems hence becomes increasingly imperative if we are to meet the rising demands for food and nutrition without adverse environmental footprints. The upcoming new CRP in 2020 will address mutation breeding for food security and climate-smart agriculture in specific crops that are not being currently addressed by a CRP within the Food and Agriculture sub-programme. A consultation meeting in early 2020 will finalize the concept note for this new CRP.	
2.2: Human Health	
Project 2000010	**2.2.1.001 Health effects of nutrition and the environment**
CRP Title:	**Optimising nuclear techniques to assess accurate quantitative biomarkers of added sugar intake in adults**
CRP Code:	**E43034**
This CRP will contribute to a better understanding of the appropriate use of natural abundance stable isotope ratios of carbon ($^{13}C/^{12}C$, hereafter the "CIR") to develop a biomarker to assess free sugar intake in different populations. It aims at testing the utility of total CIR and, if resources allow, CIR-ala as biomarkers of free sugar intake in adults, and to identify and gain knowledge of interfering dietary practices and other limitations. Therefore, adults from different populations outside the USA with different dietary background, including those who eat corn, millet or sorghum as a staple, will be assessed by comparing the biomarker with accurate measurements of the daily added sugar intake. The Doubly Labelled Water method will be used to validate the accuracy of the dietary recalls.	
Project 2000015	**2.2.2.001 Nuclear medicine and radiology techniques in health conditions**
CRP Title:	**FDG PET/CT in ovarian cancer (POCA)**
CRP Code:	**2054**

Ovarian cancer is one of the most common gynaecologic malignancies, is the most fatal gynaecologic malignancy, and is the fifth most common cause of female cancer–related death. Several studies have evaluated the diagnostic value of FDG PET/CT for ovarian cancer. Despite advances in medicine over the past decades, only minor improvement in 5-year survival has been achieved in patients diagnosed with advanced epithelial ovarian cancer. The CRP aims to provide Member States with a first-hand understanding and experience on the use of this new models of imaging, including the methodology, patient selection, clinical indications and limitations; and to facilitate the local regulatory authorities to authorize the use of these procedures.

Project 2000024	**2.2.3.001 Clinical radiation oncology**
CRP Title:	**Image-guided brachytherapy for cervix cancer: an implementation study**
CRP Code:	**E33042**

Brachytherapy is essential for the radical treatment of cervical cancer. This CRP will produce an economic model for high dose rate (HDR) brachytherapy as used to treat cervical cancer, including resources needed and costs based on the activity costing model. It will also validate the model in centres migrating from two-dimensional (2-D) film based HDR brachytherapy to three-dimensional (3-D) HDR brachytherapy based on computed tomography or magnetic resonance imaging. The CRP will begin with a large-scale survey of brachytherapy practice at centres of all income levels, followed by a detailed study of the resources, costs and times needed to implement 2-D and 3-D brachytherapy in different settings. The economic model will be produced using these data, and the third phase will consist of the validation of the model in a number of centres adopting 3-D brachytherapy following certain criteria proposed by the economic model. Once validated, the model will allow new users to precisely calculate the resources needed for, and the costs of, 3-D brachytherapy, and to predict the efficacy of this technique.

2.4: Environment	
Project 2000076	**2.4.3.001 Radioactive and non-radioactive pollution and impact on environment**
CRP Title:	**Behaviour of radionuclides in arid and semi-Arid environments for radiological environmental impact assessment**
CRP Code:	**2270**

The safe, sustainable planning and operation of facilities and activities, such as nuclear installations and long-term radioactive waste disposal facilities, in countries characterised by arid or semi-arid climate requires science-based knowledge of the radiological baseline, of the fate and transfer processes, and related data for radiological environmental impact assessment (REIA) within these regions. However, although significant work has been undertaken for temperate climatic conditions, major knowledge and data gap has been identified for arid and semi-arid regions under the IAEA's Modelling and Data for Radiological Impact Assessments II (MODARIA II) programme (https://www-ns.iaea.org/projects/modaria/modaria2.asp). It is important to acknowledge that there are differences in soil and crop types, soil physicochemical characteristics, agriculture practices and food consumption habits in arid areas in different parts of the world, in comparison with temperate or tropical regions. Therefore, the key fate and transfer mechanisms governing the movement of radionuclides between different environmental media and within the food chain are expected to be different. The research question of this CRP proposal is whether the available models and data for REIA are still applicable to arid and semi-arid regions, and what are the uncertainties and limitations in their applicability to ensure safe and sustainable long-term planning and operation of nuclear facilities and activities in such environments. The results of such a CRP would serve: (1) to improve the existing limited information on the natural and artificial radionuclide levels in arid and semi-arid countries by producing comprehensive and reliable baseline data; (2) to better understand the environmental behaviour of radionuclides in these environments and the key mechanisms of their fate and transfer through the food chain; (3) to further develop and adapt the existing models for REIA to arid and semi-arid environments, based on measurement data from various exposure situations; and (4) to support optimisation and harmonisation of Research and Development (R&D) activities of IAEA Member States on the

assessment of radiological impacts in arid and semi-arid environments, in the view of facilities and activities, such as the development of nuclear power, the design, siting and operation of long-term radioactive waste disposal facilities, emergency preparedness, and others.	
Project 2000131	**2.4.2.001 Isotopic tools to study climate and environmental change**
CRP Title:	**Benchmarking ocean models for the dispersion and radiological impact of radionuclides released from nuclear power plants in emergency situations**
CRP Code:	**2068**
The 2011 accident at the Fukushima Daiichi nuclear power plant has released huge amounts of radioactive substances into the Pacific Ocean. These radionuclides are being dispersed and transferred through the ocean, and numerous studies of these processes have been carried out using three-dimensional hydrodynamic circulation models, dispersion models and compartmental models on different space- and time-scales to predict the behaviour of the radionuclides and, further on, to estimate doses to biota and human populations. Similar studies, focusing mainly on short-term and short- to medium-range predictions, can be applied to other coastal nuclear facilities and various emergency scenarios. The objective of this CRP is to compare available ocean models, adapt operational models to radionuclide modelling, work out connections to real-time data streams and assist Member States in the development of expert systems for emergency preparedness. The Fukushima discharges will be used as a benchmark study for the Pacific Ocean. The simulated data will be compared with actual measurement results from that region. Measurement data can be used from the Asia–Pacific Marine Radioactivity Database (ASPAMARD), which has been updated under the IAEA regional technical cooperation project RAS/7/021, “Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia–Pacific Region”. The CRP will also compare predictions obtained from different models and further develop models for dispersion and transfer of radionuclides in the marine environment, which can be used for radiological and environmental impact assessments in support of decision-making in case of accidental releases of radionuclides to the marine environment. The CRP will develop the scientific basis of marine modelling during nuclear and radiological emergencies and will be coordinated with relevant activities under the IAEA’s Modelling and Data for Radiological Impact Assessments (MODARIA) programme in order to improve capabilities in the field of environmental radiation dose assessment.	
Project 2000132	**2.4.2.002 Assessing carbon cycle and impacts of ocean acidification**
CRP Title:	**Evaluating the impact of ocean acidification on seafood – a global approach**
CRP Code:	**K41018**
Ocean acidification has been recognized as a major threat to marine ecosystems. Concern about the impacts of ocean acidification on socioeconomically important seafood is increasing world-wide, and ocean acidification is now an integral part of the United Nations 2030 Agenda for Sustainable Development. Furthermore, recent studies have demonstrated that ocean acidification may also impact the quality of seafood, and there is a growing body of literature documenting the biological response of seafood to ocean acidification. Long-term studies are essential to track the effects of ocean acidification, but there are few of these studies. Furthermore, data on economically and socially important seafood in developing countries are still largely lacking. This CRP applies a common experimental approach to assess the long-term impacts of ocean acidification on key seafood species (e.g., oysters, mussels, shrimps, lobsters and/or fish) around the globe. Impacts will be assessed using both conventional and nuclear and isotopic techniques.	
CRP Title:	**Applied radioecological tracers to assess coastal and marine ecosystem health**
CRP Code:	**K41019**
Sustainable management of coastal and marine resources requires extensive comprehension of the current health of these ecosystems as well as capacity for anticipating and predicting future impacts due to changing climate conditions and anthropogenic stressors. Radioecological tracers are invaluable for assessing many aspects of the marine environment, particularly with regards to external perturbations. However, to maintain relevancy and efficiency it is necessary to develop new and further refine existing radiotracers so that these techniques continue to best serve Member States in evaluating coastal and marine ecosystems. Through this CRP, the IAEA will support the development, refinement, and	

application of radioecological tracers to assist Member States in appraising their coastal and marine resources under both current and future environmental regimes.	
Project 2000137	**2.4.4.001 Developing methodologies for environmental monitoring and assessment**
CRP Title:	**Application of Carbon and Nitrogen stable isotopes for marine pollution studies**
CRP Code:	**2211**
Stable isotopes such as 13C, 15N, 34S are useful tools to better understand the sources of the organic matter and to provide basic information that may be used for predicting the fate of contaminants released into the marine environment and study climate and environmental change. However, there are still gaps in our knowledge about the processes that cause fractionation making this tool less powerfull than it could be. The objective of this CRP is to provide guidance to improve and harmonize the current analytical procedures on stable isotopes, promoting confidence in the isotope composition of natural samples with low element content. The CRP seeks to improve expertise among participating Member States in the implementation of stable isotopes for the assessment of sources of pollution, providing an important asset to elucidate past environmental conditions and climate change.	
CRP Title:	**Analytical problems in the determination of Mercury as a global pollutant in the marine environment**
CRP Code:	**2212**
Mercury pollution is now identified as a global problem and awareness has been raised on an international action plan to minimize anthropogenic mercury emissions and clean up mercury pollution. The Minamata Convention on Mercury has entered into force and the monitoring of mercury in several matrices is now legally binding for all 128 signatory parties. However, there are still techical issues with the presicion, accuracy and sensitivity of the determination of mercury and it's even more toxic form, methyl mercury, which makes the comparability of data difficult and the decision for governments to react almost impossible. This new CRP aims at further-developing reliable methods for mercury pollution assessments (isotopic, elemental, and chemical speciation) to assist Member States in their implementation of the Minamata Convention on Mercury.	
2.5: Radioisotope Production and Radiation Technology	
Project 2000090	**2.5.1.001 Development and production of medical radioisotopes**
CRP Title:	**Production of new theranostic radioisotopes**
CRP Code:	**2273**
This proposed CRP covers the cyclotron production of ^{68}Ga and ^{68}Ga radiopharmaceuticals. Gallium-68 decays with a physical half-life of 67.71 min via positron emission. ^{68}Ga-based radiopharmaceuticals have attracted increasing interest in recent years due to the expanding clinical applications. This growth is fostered by expanding theranostic applications in oncology where a diagnostic scan performed with ^{68}Ga-labelled PET agent is used to select patients who will benefit from targeted radiotherapeutic agents containing ^{90}Y or ^{177}Lu. While currently ^{68}Ga is mainly coming from ^{68}Ge/^{68}Ga generators, supply challenges for ^{68}Ga remain. This CRP will enable Member States with existing cyclotron infrastructure and personnel to produce and adapt ^{68}Ga radioisotope and radiopharmaceuticals through knowledge and expertise exchange.	
Project 2000094	**2.5.2.001 Applications of radiotracers and radiation techniques**
CRP Title:	**Development of radiometric methods and modelling for measurement of sediment transport in coastal systems and rivers - natural radioactivity technologies in sediment transport**
CRP Code:	**2274**
Radiation techniques are increasingly applied and continuously evolving for better understanding sediment transport mechanisms to better protect coastal environment and water resources. The increasing need of such techniques is coming from both climate changes and increasing human activities impact on coastal areas. Compared to conventional techniques, nuclear techniques have the unique advantage to provide quick response (months instead of decades). Key issues the technologies face	

nowadays are the public concern and associated regulatory restrictions (licensing). This CRP objectives will be the development of the use of natural radioactivity and naturally radioactive sediment for tracing (black sand tracing) and associated methodologies.	
CRP Title:	**Development of Radiometric Methods to measure and study hydrodynamics of constructed wetlands**
CRP Code:	**2275**
Constructed wetlands (CW) can be very efficient processes to economically treat water pollution, but they are difficult to optimise, and pollution removal strongly depend on their hydrodynamics. There is no real good method to measure hydrodynamics of CW except for the use of the very promising radioactive tracing. The design of CWs should be optimized as to reduce the requested area in the more and more constrained environment of large cities expansion. A key parameter is hydrodynamics and it has a strong influence on the pollution removal by conditioning the residence time of water solutes and suspended maters in oxic and redox zones. Radioactive tracing seems the best and non-expensive solution to identify and measure CW hydrodynamics, allowing afterwards a good modelling to design further CWs.	
Project 2000095	**2.5.2.002 Radiation processing: technologies and applications**
CRP Title:	**Recycling of polymer wastes**
CRP Code:	**2276**
As of 2015, over 6000 Mt of plastic waste had been generated, less than 10% of which had been recycled, around 10% was incinerated, and approximately 80% was accumulated in landfills or the natural environment. If current production and waste management trends continue, roughly 12,000 Mt of plastic waste will be in the natural environment by 2050. The CRP is relevant to the main objective of the project in recycling of plastic wastes by radiation technology and to provide feasible innovative application areas for solving the environmental problem introduced by large amounts of plastic wastes and to recommend guidelines and possible directions to the member states. This innovative approach should lead to a safe recycling for the waste material at the same time providing a novel material solution.	

Major Programme 3: Nuclear Safety and Security

3.2: Safety of Nuclear Installations	
Project 3000023	**3.2.2.002 Safety assessment competency building, methods and approaches**
CRP Title:	**Developing a phenomena identification and ranking table (PIRT) and a validation matrix with the objective to perform a benchmark for IVMR**
CRP Code:	**2283**

While sufficient safety margins exist for implementing IVMR strategy for low and medium power reactors, the demonstration of such safety margins is difficult to be made for high power reactors, due to the lack of common understanding of major physical phenomena involved, different expert opinions and the lack of a common basis for validating the simulation tools that represent a crucial part of the safety demonstration. This CRP is aimed at developing a PIRT and a minimal validation matrix for IVMR, and at performing subsequently a benchmark of simulation tools against available experimental results. The benchmark will include also the simulation of a complete analytical case. Depending on the accessibility, it will possibly be based on the Westinghouse AP1000 reactor design (NUREG/CR-6849) or another complete case which can be made available (e.g. Chinese technology). The CRP will ultimately contribute to further develop a technical basis available to Member States for the assessment of IVMR strategy.

3.5: Nuclear Security	
Project 3000158	**3.5.3.003 Radiological crime scene management and nuclear forensics science**
CRP Title:	**Applying nuclear forensic science to respond to a nuclear security event**
CRP Code:	**J02013**

This CRP uses innovation from research to promote consistent and scientifically defensible implementation of a nuclear forensics examination to meet requirements of national laws and international legal instruments relative to unauthorized acts involving nuclear or other radioactive material encountered out of regulatory control. In particular, the research seeks to link nuclear science with investigative requirements. Nuclear forensics is the analysis of nuclear and other radioactive material, or evidence contaminated by radionuclides, in the context of legal proceedings under international or national law related to nuclear security. States will benefit from better implementation of validated procedures and methods that are consistent with the requirements of a potential criminal prosecution. This research will yield enhanced methods to document and collect evidence, rapid identification of nuclear and other radioactive material that pose a nuclear security threat, and improved processing of traditional forensics evidence contaminated with radionuclides. The project will contribute to improved quantitation of a forensic examination through consensus approaches techniques in the nuclear forensics laboratory used to measure small samples and particles. The research will further promote better understanding and use of nuclear forensic science by law enforcement and legal officers.