IAEA Coordinated Research Activities in 2017

I. General Information

I.1. Statutory Provisions

The International Atomic Energy Agency (IAEA) is authorized under its Statute to encourage and assist research on atomic energy for peaceful uses throughout the world as well as on its development and practical applications. The IAEA's programme and budget for 2017 accordingly provide for the placing of research, technical and doctoral contracts and research agreements with universities, colleges, research centres, and laboratories, and other institutions in Member States on subjects directly related to the IAEA's work.

I.2. Financial Support

The IAEA's financial support of a project is normally in the form of a lump-sum cost-sharing contract. The Contractor 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.

Agreements may be awarded to institutes, normally in developed countries, for participation in an IAEA CRP. Under such agreements, no 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 research or technical contract or research 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.17 (Jan.16) must be used. Proposals for research agreements should be made using the "Proposal for Research Agreement" form N-21/Rev.15 (Dec.14). These forms are available on the Coordinated Research Activities website: 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

As of 2016, research contracts are generally awarded for the entire duration of the CRP (They were previously awarded for a period of one year and renewed each year for the duration of the project). Research agreements are awarded for 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. 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 is withheld.

Generally funds are obligated when the contract is awarded and subsequently every year upon certification by the Project Officer for the CRP that progress reports have been received in due time and accepted by the IAEA. The final year tranche obligation is split into two instalment payments, 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 Patent Rights

Publication, either by the institution or the IAEA, of the results of work performed under research contracts and agreements is recognized as being normally the most appropriate and effective way of bringing these results to the notice of other scientists. The Contractor must acknowledge the IAEA's support of the work in any publication.

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 in connection with the contract. Only items relating to the 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 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. Provision is also made for the settlement of disputes, usually by arbitration, and for the adoption by the Contractor of the applicable health, safety and other standards.

III. IAEA Coordinated Research Projects for Which Research May Be Supported in 2017

Most of the research supported by the IAEA is related to its CRPs developed in line with overall IAEA goals. 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 following list includes CRPs under which the IAEA may consider support of research in 2017. Additionally, the Coordinated Research Activities website: https://www.iaea.org/services/coordinated-research-activities will list all CRPs open for proposals.

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

List of IAEA Coordinated Research Activities That Are Open for Submission of Proposals in 2017

(by Major Programme, Programme and Project)

Table of Content

[1] AIPS: Agency-wide Information System for Programme Support
[2] AP: IAEA Action Plan on Nuclear Safety

[3] SIT: sterile insect technique

List of IAEA Coordinated Research Projects That Are Open for Submission of Proposals in 2017

(by Major Programme, Programme, and Project)

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

1.1 Nuclear Power	
Project 1000166	**1.1.5.001 Technology Development for Water Cooled Reactors**
CRP Title:	**Probabilistic Safety Assessment (PSA) for Multi-Unit, Multi-Reactor Sites**
CRP Code:	**2147**
Many nuclear power plants (NPPs), either of the same or of different types, designs, or age, are co-located on a single site. While operators and regulators recognize the potential for multiunit accidents, clearly demonstrated during the Fukushima-Daiichi accident in March 2011, past probabilistic safety assessments (PSA) of NPPs have mainly focused on estimating the risk arising from damage to a single NPP. This CRP will bring together experts from the Member States with water cooled reactor technologies to present and possibly consolidate their current (and planned) practices, assumptions and gain new insights into their (and others') methods for Level-1 and Level-2 Multi-Unit PSA (MUPSA) by comparing results of a meaningful benchmark exercise. The exercise will involve development of MUPSA based on single-unit PSA available in Member States. The insights gained from the exercise may identify areas where technology solutions to reduce these risks could be elaborated.	
Project 1000153	**1.1.5.002 Small and Medium-Sized Reactor Technology Development**
CRP Title:	**Design and Performance Assessment of Passive Engineered Safety Features in Advanced Small Modular Reactors**
CRP Code:	**I32010**
The purpose of this CRP is to support global development of advanced nuclear reactor designs, including small modular reactors that incorporate non-electric engineered safety features, such as passive residual heat removal and containment cooling systems and gravity driven core injection. The CRP will take into account lessons learned from major accidents to enhance the designs and the performance of such features to cope with extended station blackout and severe accidents. It will bring together global research and development activities that seek to achieve reactor designs with the highest possible safety levels by substantially reducing both the probability and consequences of severe accidents compared to existing reactors. The CRP will focus on four key topics: (1) separation and independence of reactor trip and safety system actuation logics; (2) diversity and redundancy for depressurizing the reactor coolant pressure boundary to facilitate safety injection during a high pressure transient; (3) diversity and redundancy of core cooling; and (4) options and approaches for assuring containment structural integrity.	

Project 1000154	1.1.5.003 Advanced Technology for Fast and Gas Cooled Reactors
CRP Title:	**Radioactive Release from the Prototype Fast Breeder Reactor under Severe Accident Conditions**
CRP Code:	**I32009**
In a sodium fast reactor (SFR), a hypothetical core disruptive accident (CDA) is the beyond design basis event resulting from the mismatch between power produced and power removed from the reactor, with the simultaneous shutdown system not responding on demand, typically under conditions of either unprotected loss of flow or unprotected transient overpower events. The assessment of the consequences of a CDA in terms of radioactivity release outside the containment system which may affect the environment and the public is of paramount importance from the point of view of public acceptance, especially after the Fukushima Daiichi accident. The objective of this CRP is to make realistic estimates, through numerical simulation, of the fission product transport mechanisms in typical pool type SFRs and to determine the fission products retained within the reactor primary vessel and ejected into the reactor containment building. The exercise would be carried out for a reference pool type SFR with a capacity of 500 MW(e) fuelled with mixed oxide (MOX) fuel.	
Project 1000155	**1.1.5.004 Non-electric Applications of Nuclear Power**
CRP Title:	**Assessing Technical and Economic Aspects of Nuclear Hydrogen Production for Near-Term Deployment**
CRP Code:	**2174**
This CRP will address the expected issues for the potential upscaling of nuclear hydrogen production technologies and assess the maturity of technologies currently under development. It will also consider the techno-economic and safety considerations, as well as the associated environmental and social impacts, of commercial nuclear hydrogen production worldwide and in specific Member States. This proposal has been planned on the basis of the successful completion of the CRP entitled “Examining the Techno-Economics of Nuclear Hydrogen Production and Benchmark Analysis of the IAEA HEEP Software” (2012–2016), and of extensive feedback from Member State experts participating in IAEA Technical Meetings and other activities on nuclear hydrogen production. The CRP is to be conducted by the Nuclear Power Technology Development Section.	
1.2 Nuclear Fuel Cycle and Materials Technologies	
Project 1000036	**1.2.3.001 Spent Fuel Storage**
CRP Title:	**Ageing Management Programmes for Dry Storage Systems**
CRP Code:	**T21028**
The continued operation of dry storage systems and the ability to eventually retrieve and transport spent fuel from/within such systems are dependent upon being able to demonstrate that ongoing safety and operability related structures, systems and components (SSCs) are still fit for purpose/compliant with the original safety justification (and assessed against any revision in safety standards). With storage periods continuing to increase as a result of the lack of availability of reprocessing and disposal routes, it is expected that the original licences will need to be renewed and/or that the original design life of these systems will be exceeded. As SSCs are subject to degradation mechanisms and ageing processes, a sound knowledge of how they evolve with time is required. This CRP aims to collect and share: up-to-date research and development on SSCs; information on monitoring, inspection and surveillance programmes in support of spent fuel dry storage, and how this information is used in licence or safety justification renewal; and experiences related to the development of ageing management programmes for spent fuel dry storage systems.	

CRP Title:	**Spent Fuel Performance Assessment and Research — Phase IV**
CRP Code:	**T13016**
Continued spent fuel storage and future transitions from one phase of the back-end of the nuclear fuel cycle to the next require that operational experience and research results be reported and disseminated to the Member States for input into continued operations safety assessments and the licensing of new facilities. Phases I, II and III of the CRP "Spent Fuel Performance Assessment and Research" (SPAR) have contributed to this through the reporting of ongoing performance and research on the behaviour of power reactor spent fuel and materials in wet and dry storage. A number of participants in these first three phases of the SPAR project indicated that they would be continuing their research activities to bridge knowledge gaps in relation to existing fuel behaviour, as well as carrying out further research and development to underpin new spent fuel facilities and dry storage systems and in support of fuel types being transitioned from a recycling strategy to direct disposal. A continuation of the SPAR project into a fourth phase to report on these activities and to continue to collect and report on fuel and system performance experiences, especially those related to the deployment of new technologies, is proposed.	
Project 1000137	**1.2.3.003 AP Support Related to Spent Fuel**
CRP Title:	**Management of Severely Damaged Spent Fuel and Corium**
CRP Code:	**T13015**
The Fukushima Daiichi accident (March 2011) resulted in severe damage and reported fuel core meltdown in three of the reactors on the nuclear power plant site. A fourth reactor, although it could be shut down, suffered severe damage to its structure from a hydrogen explosion, which resulted in plant and roofing materials being deposited in the fuel storage pool. The fuel in this pool may also have been damaged due to loss of cooling water and the introduction of seawater as a replacement. In terms of multiple failures, an accident of this scale has not been experienced previously, and this gave rise to a substantial remediation challenge. The objective of this CRP is to expand the existing knowledge base and identify optimal approaches for managing severely damaged spent fuel. Severely damaged spent fuel covers: material from post-irradiation examination; fuel debris; fuel damaged during fuel handling operations; fuel damaged as a result of loss of cooling; corium; and molten core–concrete interaction products.	
Project 1000002	**1.2.4.001 Predisposal Management of Radioactive Waste**
CRP Title:	**Management of Wastes Containing Long-lived Alpha Emitters: Characterization, Processing and Storage**
CRP Code:	**T13017**
This CRP aims to promote waste minimization, effective storage (including long term storage) and the development of new technologies for the characterization (including safeguards related parameters) and processing of waste streams containing long-lived alpha emitters (including disused sealed radioactive sources) of different activity levels and physical states. The objective of the project is to improve understanding of the inventory and diversity of wastes containing long-lived alpha emitters, as well as of methods for handling such wastes. The CRP will provide a forum to facilitate cooperation and sharing of common challenges, experiences, research and development, and technological activities associated with the development of processes suitable for the characterization, pretreatment, treatment, and conditioning of high alpha wastes to meet the waste acceptance criteria for storage and final disposal.	

1.3 Capacity Building and Nuclear Knowledge Maintenance for Sustainable Energy Development	
Project 1000047	**1.3.2.002 Topical Issues Related to Sustainable Energy Development**
CRP Title:	**Assessments of the Potential Role of Nuclear Energy in National Climate Change Mitigation Strategies**
CRP Code:	**I12006**
This CRP will coordinate research efforts by Member States, supported by the IAEA Secretariat, on the assessment of the potential role of nuclear energy in mitigating climate change. It will draw on background material prepared by the IAEA Secretariat, on scientific and technical support from the IAEA, and on the experience gained by Member States in decarbonizing their electric power supply. The investigations will focus on the assessment and effectiveness of support mechanisms (i.e. domestic policies, carbon pricing) recognized in the Paris Agreement under the United Nations Framework Convention on Climate Change (December 2015) in order to identify key barriers and develop approaches to address investments in low carbon technologies, including nuclear energy. A set of analytical IAEA tools and Member States' own models or tools will be combined, tested and applied to assess the potential role of low carbon electricity generation projects, including those based on nuclear energy, within long term national greenhouse gas mitigation strategies. The variety of starting points and national circumstances will provide an invaluable opportunity for both developed and developing Member States to share information when identifying least-cost decarbonization strategies.	
1.4 Nuclear Science	
Project 1000161	**1.4.1.002 Nuclear Data Developments**
CRP Title:	**Recommended Input Parameter Library (RIPL) for Fission Cross Section Calculations**
CRP Code:	**F41033**
The aim of this new CRP is to obtain a comprehensive set of input parameters (and corresponding uncertainties) for the modelling of fission cross sections for actinides, based on microscopic and phenomenological approaches. Significant improvement in fission modelling will result in improved estimates of cross section values and associated uncertainties for nuclear energy applications.	
Project 1000121	**1.4.1.003 Atomic and Molecular Data Developments**
CRP Title:	**Data for Atomic Processes of Neutral Beams in Fusion Plasma**
CRP Code:	**F43023**
Neutral beam injection is used to heat the plasma in fusion devices. Neutral beams also have diagnostic purposes, both via photoemission from the neutral beam following interaction with the plasma and via photoemission from plasma impurities after interaction with the beam. Modelling of beam penetration into the plasma and of spectroscopic signals relies on detailed data for atomic processes that involve the neutral beam particles. In spite of the importance of the data, there are significant gaps, especially related to processes starting from an excited state of the neutral atom. For processes starting from the ground state of the neutral atom there are often several families of data, obtained using different approximations or experimental methods. This CRP is intended to provide evaluated and recommended data for the principal atomic processes relevant to heating and diagnostic neutral beams in fusion plasmas.	

CRP Title:	**Plasma–Wall Interaction with Reduced Activation Steel Surfaces in Fusion Devices**
CRP Code:	**F43022**
Various kinds of reduced activation steel are being considered as wall material for a fusion reactor, but not enough is known about plasma–wall interaction, erosion and tritium retention in such steels. Erosion brings impurities into the plasma and limits the lifetime of the wall. Hydrogen penetration and retention in the surface remove tritium from the plasma, making it unavailable for fusion. This CRP will enhance the knowledge base and develop new databases on the interaction of fusion plasmas with reduced activation steel alloys that are being considered for fusion devices. The CRP will seek to quantify the erosion due to exposure to plasma and to quantify the retention and transport properties of tritium in the surface.	
Project 1000165	**1.4.4.001 Nuclear Fusion Research and Technology**
CRP Title:	**Utilization of the Network of Small Magnetic Confinement Fusion Devices for Mainstream Fusion Research (Phase 2)**
CRP Code:	**2161**
Small magnetic confinement fusion devices such as tokamaks, stellarators and others have played and continue to play an important role in fusion research. Thanks to their compactness, flexibility, low operation costs and the high skill of their personnel they contribute to a better understanding of phenomena in a wide range of fields. This CRP seeks to take advantage of an existing network of small magnetic confinement fusion devices to perform joint and comparative experiments in support of technology development, modelling analysis and the development of simulation and communication tools. The CRP aims to contribute to enhancing international collaboration and increasing the impact of the small magnetic confinement community. This will open the door for more Member States to join the research efforts and contribute to the success of magnetic confinement fusion.	

Major Programme 2: Nuclear Techniques for Development and Environmental Protection

2.1 Food and Agriculture	
Project 2000011	**2.1.2.001 Improving Animal Production and Breeding**
CRP Title:	**Application of Nuclear and Genomic Tools to Enable the Selection of Animals with Enhanced Productivity Traits**
CRP Code:	**D31028**

The world will be facing the challenge of achieving a manifold increase in the production of food from animal origin to address the high demand that is expected to arise from population growth, income increases and urbanization. Breeding for robust animals with production systems optimized for exponential increase in productivity while retaining their adaptability to harsh environments and tolerance to tropical diseases could remain the only option for the intensification of livestock production with the least possible environmental impact. This project is aimed at enhancing animal breeding with the application of nuclear and nuclear-derived molecular techniques to address two major issues prevailing in developing countries. Firstly, to enable breeders to deliver an effective artificial insemination service where sires will be selected based on data on performance and parentage and genetic admixture of pedigree animals. Secondly, cobalt-60 will be applied to develop a radiation hybrid panel for whole genome sequencing and identification of breeding markers in camels. The project is expected to (1) develop an animal identification system connected to the artificial insemination service; (2) develop a gene bank coupled with a database of 1000 performance recorded animals per breed/population from each country as a foundation for sire selection; (3) validate genetic tools for testing parentage, relationship and admixture level; (4) develop whole genome radiation hybrid panels for camel; (5) develop a set of performance data for animal breeds/population in different production systems and (6) deliver standard operating procedures, protocols and guidelines for using genetic tools in animal breeding and assisted reproductive technologies. The project will run for five years and will involve ten research contract holders from developing countries together with technical contract and research agreement holders from laboratories engaged in high level animal genetics, breeding and the delivery of artificial insemination services.

Project 2000012	**2.1.2.002 Decreasing Transboundary Animal and Zoonotic Disease Threats**
CRP Title:	**Quantification of Intake and Diet Selection of Ruminants Grazing Heterogeneous Pastures Using Compound Specific Stable Isotopes**
CRP Code:	**D31029**

Optimization of the utilization of grassland, including rangeland, by livestock growers would benefit many millions of farmers in the world, since 40.5% of the terrestrial area, excluding Greenland and Antarctica, is covered by grasslands, which are important as a feed source for livestock. This CRP aims to develop a practical method to predict pasture intake of ruminants grazing heterogeneous pastures and grassland using stable isotopes, in order to provide tools for better grassland management that enhances animal productivity and reduces the impact on the environment due to overgrazing, and to enable the design of effective feed supplementation strategies at the farm level to optimize animal production. Three major laboratory activities are planned: (a) the analysis of concentrations and stable carbon isotope composition of *n*-alkanes in plant and faecal samples to predict dry matter (DM) intake and its plant proportions; (b) the use of conventional chemical analysis of plants to determine their nutritional value; and (c) the development of near infrared reflectance spectroscopy (NIRS)-derived predictive equations of DM intake and the plant profile of that intake. These equations, once developed using data from stable isotope analyses, NIRS and

conventional feed analyses, will make it possible to predict the intake of DM and plant species only on the basis of NIRS values of the plants and faeces. This will facilitate the design of diets and supplements required to cover the nutritional needs of animals so as to achieve the expected production levels. The combination of the three techniques applied to plant and faecal samples obtained in a common research protocol used by all participating countries will allow the scientific objectives of the CRP to be attained. The project will run for five years and will involve seven research contract holders from developing countries together with technical contract and research agreement holders from laboratories engaged in the use of stable isotopes and advanced techniques for measuring the nutritional feed value of plants.

Project 2000017	**2.1.3.002 Traceability to Improve Food Safety and Quality and to Enhance International Trade**
CRP Title:	**Integrated Radiometric and Complementary Techniques for Mixed Contaminants and Residues in Foods**
CRP Code:	**D52041**

Consumers can be exposed to mixed contaminants or residues in food and related matrices such as water. However, systematic programmes to monitor/control such hazards are not in place in Member States, and their laboratories lack the necessary analytical techniques. Accordingly, the overall goal of this CRP is to enhance Member States' food control systems and risk assessment programmes through the improvement of laboratory capabilities. The specific CRP objectives will include research on: development, optimization/adaptation and validation of analytical methods; innovative generic sample preparation techniques; the application of effective methods to routine surveillance; and, where possible, the establishment of base/reference 'fingerprints' of food matrices with mixed contaminants or residues. Sensitive and selective multi-antimicrobial analytical methods useful for monitoring residues of substances associated with antimicrobial resistance will also be investigated.

Project 2000021	**2.1.4.001 SIT and Related Technologies to Manage Major Insect Plant Pests**
CRP Title:	**Integration of the Sterile Insect Technique (SIT) with Biocontrol for Greenhouse Insect Pest Management**
CRP Code:	**D43003**

The use of greenhouses for the production of food is increasing rapidly throughout the world. In such protected and confined environments, pest populations can build up very rapidly causing substantial loss of production. Biological control of most of these pests has been successfully developed but there are a few pests (mostly moths) that can periodically invade greenhouses and get out of control, resulting in the need to apply broad spectrum pesticides that disrupt the biocontrol environment. In addition, existing pests in one region can spread to new areas where biological control systems are not available. This CRP will investigate the potential of the sterile insect technique to complement existing biocontrol to counter these threats and enhance the existing control.

CRP Title:	**Assessment of Simultaneous Application of the Sterile Insect Technique and the Male Annihilation Technique to Enhance Bactrocera Fruit Fly Management**
CRP Code:	**2190**

This CRP will develop cost-effective semiochemical treatments for *Bactrocera* spp. that improve the sexual performance of sterile males and reduce their response to male lures to allow the simultaneous use of the male annihilation technique (MAT) and the sterile insect technique (SIT). The objective of the CRP is to explore the potentially synergistic relationship between MAT and SIT when applied simultaneously and how this can

dramatically improve the efficacy of *Bactrocera* fruit fly management.	
Project 2000022	**2.1.4.002 Management of Livestock Insect Pests for Sustainable Agriculture**
CRP Title:	**Improvement of Colony Management in Insect Mass Rearing for Sterile Insect Technique Applications**
CRP Code:	**2191**
This CRP will develop best practices for insect colony management in support of the cost-effective production of high quality sterile males for applications of the sterile insect technique (SIT) against major insect pests and disease vectors through a multidisciplinary approach. The CRP will draw on existing as well as novel knowledge and tools with regard to mass rearing, the mother colony, cryopreservation, symbionts/pathogens and behavioural quality control.	
Project 2000031	**2.1.5.001 Mutation Induction for Better Adaptation to Climate Change**
CRP Title:	**Improving Resilience to Drought in Rice and Sorghum through Mutation Breeding**
CRP Code:	**D23031**
Drought is the most devastating abiotic stress factor affecting crop production worldwide, and it is projected to worsen as a result of anticipated climate change. Improving drought tolerance in crops and enhancing agricultural water productivity under rain-fed conditions are among the top priorities for most countries. This CRP seeks to combine expertise obtained in the field as well as in greenhouse and laboratory settings in order to enhance mutation breeding and to develop robust protocols for rapid advancement of generations, as well as efficient packages for the screening of mutant populations for drought tolerance. Screening packages will be optimized for phenotyping and genotyping for drought tolerance to develop/adapt technology for accelerated identification of drought tolerant rice and sorghum mutants. Rapid generation-advancement techniques such as rapid cycling of crop generation and efficiency enhancing technologies using doubled haploids and genomic and molecular markers will be adapted in the CRP as appropriate.	

2.2 Human Health	
Project 2000010	**2.2.1.001 Health Effects of Nutrition and the Environment**
CRP Title:	**Applying Nuclear Techniques to Understand the Link between Early Life Nutrition and Later Childhood Health**
CRP Code:	**E43032**

Non-communicable diseases (NCDs) are increasing worldwide, with overweight and obesity being the major risk factors for NCDs. Early life factors significantly contribute to the development of poor body composition, and the first 1000 days of life starting from conception are a critical period for influencing long-term health and risk of developing NCDs. Body composition follow-up studies using stable isotopes carried out on mothers and children involved in nutrition interventions can provide insight into the long term effects of interventions and improve understanding of the link between early life nutrition factors and long term obesity and NCD risks. This proposed CRP will assess longitudinal maternal and child body composition from preconception to childhood in population groups for which early life interventions are in place to reduce acute malnutrition or risk of later childhood obesity. Improved understanding of body composition and growth from preconception to childhood, of the relationship between early life nutrition and later childhood health, and of how early life interventions can impact on later childhood health can guide policymakers in tailoring early nutrition intervention programmes to prevent obesity and associated premature deaths from NCDs.

CRP Title:	**Application of Stable Isotope Techniques in Environmental Enteric Dysfunction Assessment and Understanding Its Impact on Child Growth**
CRP Code:	**E41016**

Retarded linear growth, widely referred to as stunting, is rampant in low and middle income countries, affecting a total of 161 million children under the age of five years. It develops in the first 1000 days of life, and becomes irreversible if no appropriate interventions are in place. Environmental enteric dysfunction (EED) is the presence of diffuse, upper small bowel villous atrophy accompanied by the presence of morphologic evidence of barrier disruption and inflammation. EED affects presumably 50–95% of all children under the age of 5 years in resource poor settings. Retarded growth, altered gut microbiota, and decreased vaccine responsiveness are considered to be the most important consequences of EED and are attributable to: altered intestinal structure and function, defects in nutrient absorption, reduced growth hormone activity, altered host immunity, and changes in microbiota composition and diversity. Despite the significance of EED for infant and child nutrition and health, biomarkers and simple diagnostic techniques for the definition and classification of EED are lacking. This CRP aims to test the applicability of the stable isotope based ^{13}C-sucrose breath test (^{13}C-SBT) in the diagnosis and classification of EED compared to biopsy and dual sugar tests, and to improve our understanding of pathways underpinning EED and child growth.

Project 2000015	2.2.2.001 Nuclear Medicine in the Diagnosis and Therapy of Non-communicable Diseases
CRP Title:	**PET–CT in the Evaluation of Locally Advanced Breast Cancer**
CRP Code:	**E13044**

Locally advanced breast cancer (LABC) is a leading cause of cancer related morbidity and mortality in many Member States. In many low and middle income countries approximately 45% of patients present with LABC, and most of them undergo neoadjuvant chemotherapy (NAC), which is defined as any pharmacological treatment given before primary therapy (surgery), and administered for 4 to 6 months, with an intent to downstage (reduce) the tumour so that patients can become candidates for surgery. Mammography and ultrasound are the diagnostic imaging modalities most commonly used for the initial evaluation of LABC, whilst magnetic resonance imaging (MRI) is used to establish the extent of the disease and for the assessment of NAC response. Fluorine-18 fluorodeoxyglucose (^{18}F-FDG) positron emission tomography–computed tomography (PET–CT) is a functional imaging modality which has shown similar efficacy to MRI in NAC assessment in multiple- and single-centre, small-scale studies. In the last few years, a new dedicated PET scanning technique for the breast known as positron emission mammography (PEM) has emerged as a promising imaging modality. This modality offers higher special resolution than regular PET and the equipment is less expensive. It can be used for assessment of the response to NAC. No multicentric, multinational prospective comparative studies to establish the efficacy of MRI versus whole body PET–CT and versus dedicated breast PET have been published yet. Efficacy is defined as the capacity for beneficial change of a given intervention. This CRP aims to prospectively investigate the diagnostic accuracy of MRI versus whole body PET–CT and dedicated breast PET (PEM) for assessment of response to NAC in LABC patients with pathologic response as the reference standard. Accurate pathological diagnosis of tumour mass before treatment and careful examination of specimens after treatment are two main objectives in the diagnostic process of neoadjuvant-treated breast cancer. To achieve the first objective, multiple core biopsies can be taken to assess intra-tumour heterogeneity. This three-year CRP will be organized by the Nuclear Medicine and Diagnostic Imaging Section within the IAEA's Division of Human Health. In order to be able to select the research centres that have the required infrastructure to participate in the project, a survey that must be completed by centres interested in participating has been developed and should be completed by applicants.

CRP Title:	**Use of PET–CT with Gallium-68 Labelled Prostrate-Specific Membrane Antigen in the Diagnosis and Follow-up of Patients with Prostate Cancer**
CRP Code:	**E13046**

This CRP will focus on the appropriate use of molecular imaging using prostate-specific membrane antigen (PSMA) labelled with gallium-68 (^{68}Ga) for the evaluation and follow-up of patients diagnosed with prostate cancer. Positron emission tomography–computed tomography (PET–CT) with ^{68}Ga-PSMA is a molecular imaging technique that has shown promising results for the initial evaluation and follow-up of patients diagnosed with prostate cancer. The purpose of this project is to evaluate the role and accuracy of ^{68}Ga-PSMA–PET–CT in comparison to magnetic resonance imaging (considered to be the standard of care at the moment) for the evaluation of patients with prostate cancer as well as its impact on the management of this group of patients.

CRP Title:	**Comparison of Planar Multiple Gated Acquisition (MUGA) Scanning, Single Photon Emission Computed Tomography–MUGA and Echocardiography in the Evaluation of Chemotherapy Related Cardiotoxicity**
CRP Code:	**2158**

This CRP will focus on the comparison of planar multiple gated acquisition (MUGA) scanning versus single photon emission computed tomography (SPECT)–MUGA versus echocardiography in the evaluation of patients undergoing treatment with chemotherapeutic agents that have potentially cardiotoxic effects, such as anthracyclines and monoclonal antibodies (trastuzumab). Anthracyclines, such as doxorubicin and idarubicin, remain an important class of chemotherapeutic agents. Unfortunately, their efficacy in treating cancer is limited by a cumulative dose dependent cardiotoxicity, which can cause irreversible heart failure. The same collateral effects can be observed with monoclonal antibody-based chemotherapy such as trastuzumab. Ventriculography is the method of choice to evaluate cardiac functional parameters. There are nuclear based techniques, such as planar MUGA and SPECT–MUGA, that have been used for many years to assess the left ventricular ejection fraction (LVEF) among other parameters that can indicate the cardiotoxicity associated with the therapy and lead to withdrawal of the ongoing treatment. In recent years, non-nuclear techniques, such as echocardiography, have been used increasingly instead of MUGA studies. However, a comparison of the two modalities in terms of their accuracy in evaluating the LVEF has not been undertaken. The focus of this CRP will be on comparing head to head the accuracy, reproducibility and reliability of these techniques for the early detection of cardiotoxicity in patients with breast cancer.

Project 2000024	**2.2.3.001 Clinical Radiation Oncology**
CRP Title:	**Modern Radiotherapy Techniques in Cervical Cancer**
CRP Code:	**2137**

Brachytherapy is mandatory 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 resources, costs and times needed to implement 2-D and 3-D brachytherapy in different settings. The economic model will be produced with 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 as well as to predict the efficacy of this technique.

Project 2000042	2.2.3.002 Biological Effects of Radiation
CRP Title:	**Applications of Biological Dosimetry Methods in Radiation Oncology, Nuclear Medicine and Diagnostic and Interventional Radiology**
CRP Code:	**E35010**
Biological dosimetry is one of the most developed branches of radiobiology; its technical aspects, particularly those relevant to cytogenetic assays, are well defined and have reached the level of international standardization. The aim of this CRP is to address various uses of biological dosimetry methods in radiation oncology, nuclear medicine and diagnostic and interventional radiology. It will include filing in knowledge gaps and developing new approaches to assist with the transition to personalized medicine. The project will bring together a number of institutions to progress towards the common goal of improving the quality of health care using radiation technologies.	
Project 2000029	**2.2.4.003 Clinical Medical Radiation Physics**
CRP Title:	**Dosimetry in Molecular Radiotherapy for Personalized Patient Treatments**
CRP Code:	**E23005**
Molecular radiotherapy has demonstrated unique therapeutic advantages in the treatment of an increasing number of cancers. As with other treatment modalities, there is related toxicity to a number of organs at risk. The clinical benefit of performing dosimetry has now been demonstrated for a number of nuclear medicine therapies. However, propagation of dosimetric methods into nuclear medicine practice has been slow and considerable uncertainties in the dose estimation still remain. Harmonized dosimetric protocols and methodologies should guide a personalized patient treatment with the aim of improving efficacy and reducing toxicity. The main goal of this CRP is to contribute to the standardization of dosimetric methods in nuclear medicine. Its specific objectives are to assist Member States in testing and adopting harmonized dosimetric protocols and to assess the typical accuracy with which dosimetry can be performed in nuclear medicine practice.	
2.3 Water Resources	
Project 2000059	**2.3.2.001 Comprehensive Assessment of Resources**
CRP Title:	**Use of Isotope Techniques for the Evaluation of Water Sources for Domestic Supply in Urban Areas**
CRP Code:	**2206**
In many urban centres of the world, rapid population growth and water demand for various uses have placed a serious constraint on both the quantity and quality of available local water resources. In many cases, urbanization results in profound changes in the local water balance and groundwater recharge conditions, perturbation of the hydraulic conditions (aggravating, for example, the impact and magnitude of floods) as well as in significant pollution and degradation of water quality. Assessing the sources, pathways and interactions of groundwater bodies in urban areas to determine their suitability for domestic uses and developing sustainable management strategies require the use of various tools. This CRP will focus on the use of isotope tracers in combination with other conventional hydrological tools to obtain key information that can help in assessing the sustainability of water resources in urban areas.	

Project 2000123	2.3.2.002 Management Strategies for Groundwater and Surface Water Resources
CRP Title:	**Application of an Isotope-enabled Model for Improved Estimates of Water Balance in Catchments**
CRP Code:	**F33022**
Recent advances in various fields relevant to hydrological sciences have led to the development and refinement of new approaches to improve the accuracy and value of water balance models, a key source of information required for adopting sound water resource management policies. The use of stable isotope tools to identify the main flow paths and residence times of both surface and ground waters has been expanded to improve the simulated components of the water balance model at several scales: from small catchment areas to larger hydrological basins. The IAEA's Isotope Hydrology Section has developed, in cooperation with various partners, the IAEA Water Balance Model with Isotopes (IWBMIso), which aims to promote and expand the use of common isotope tracers to obtain more precise estimates of the various water balance components and water fluxes in a range of climatic and hydrological settings. Once the model has been fully tested in different selected catchments and scenarios, which is the main objective of this CRP, it can be routinely incorporated into future technical cooperation projects dealing with isotope hydrology and water resources management.	
Project 2000064	**2.3.3.002 Noble Gas Isotopes for Groundwater Recharge and Pollution Studies**
CRP Title:	**Global Monitoring of Nitrogen Isotopes in Atmospheric Waters**
CRP Code:	**2209**
Atmospheric nitrogen deposition has become a large source of nitrogen for terrestrial and aquatic ecosystems worldwide. NOx gases are released into the atmosphere as a result of human activities (e.g. fossil fuel combustion, electricity generation) and natural processes (e.g. biogenic soil emissions, lightning, biomass burning). The major sink for NOx in the atmosphere is converted to nitric acid (HNO3) and nitrate (NO3), which can be deposited through wet deposition. This CRP will consider the use of nitrogen and oxygen isotopic ratios of atmospheric nitrogen species coupled with novel isotopic approaches (e.g. $\delta^{17}O$ measurements) to provide a measure of the magnitude of atmospheric inputs to various hydro(geo)logical environments, which can help in better understanding the possible environmental and anthropogenic impacts of nitrogen compounds on water resources and thereby support optimal water resources management and remediation strategies.	
CRP Title:	**Use of Isotope Hydrology to Characterize Groundwater Systems in the Vicinity of Nuclear Power Plants**
CRP Code:	**F33022**
Nuclear energy remains the largest source of low carbon electricity in the world. Although the site selection and operation of nuclear power plants (NPPs) follow strict safety guidelines, there is always the possibility of unforeseen accidents such as the Great East Japan Earthquake of 11 March 2011, which triggered an extremely severe nuclear accident at the Fukushima Daiichi NPP, resulting in the release of radioactive materials into the environment and the contamination of groundwater. The main focus of this CRP is to develop guidelines for comprehensive characterization of local and regional groundwater systems in the vicinity of NPPs by using isotope techniques. The CRP aims to use newly developed isotope tools, including those based on noble gas isotopes, in order to provide better information on the dynamics of very fast and/or very slow moving groundwater near NPPs that will assist in controlling contamination of water resources in case of unforeseen incidents.	

2.4 Environment	
Project 2000131	**2.4.2.001 Isotopic Tools to Study Climate and Environmental Change**
CRP Title:	**Radioanalytical and Isotopic Studies of Climate Trends and Variability in Marine Paleo-records**
CRP Code:	**K41015**
Future climate projections rely on sound knowledge of the basic physical and chemical processes responsible for setting baseline climate conditions coupled with an understanding of the dynamics of these processes (i.e. interactions and feedbacks). The reliability and robustness of climate model projections require calibration and validation using real climate data. For this purpose, climatologists study environmental climate records from the industrial era and from the more distant past, such as those found in corals, ocean and lake sediments, and ice cores. The use of naturally occurring radioisotopes allows precise dating of temporal records, and the analysis of isotopic ratios, trace elements and other biogeochemical proxies can provide information about past climate conditions, including temperature, salinity and precipitation levels. Through this CRP, the IAEA will enable the participating Member States to assess climate trends and variability by studying new climate records in relevant regions, and to build upon existing knowledge.	
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 released large 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 areas offshore 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 with real-time data streams and assist Member States in the development of expert systems for emergency preparedness. The Fukushima discharges will be used for a model benchmark study of radionuclide dispersion and transfer in the Pacific Ocean. The simulated data will be compared with actual measurement results from that region. Relevant measurement data are available 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”, and from the IAEA’s database for marine radioactivity, MARiS (‘Marine Information System’). 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.	

2.5 Radioisotope Production and Radiation Technology	
Project 2000090	**2.5.1.001 Development and Production of Medical Radioisotopes**
CRP Title:	**New Ways of Producing Technetium-99m (Tc-99m) and Tc-99m Generators (Beyond Fission and Cyclotron Methods)**
CRP Code:	**F22068**
Technetium-99m (Tc-99m) radiopharmaceuticals are the major diagnostic tools in the clinical practice of nuclear medicine worldwide, used in some 35 million procedures annually. Over 95% of the molybdenum-99 (Mo-99) required for Tc-99m generators is produced by the fission of uranium-235 targets in nuclear research reactors. In recent years, a Mo-99 supply crisis occurred as a result of various factors such as the extension of planned outage and the prolonged or unplanned shutdown of many reactors around the world. In response to the crisis, operating producers increased production to the extent possible, and alternative routes were also suggested for the production of Mo-99 and/or Tc-99m radionuclides. As a major platform for coordination in research and development activities on the production of Mo-99 and Tc-99m, and for identifying the new potential production capacities in the Member States, the IAEA has initiated a number of research programmes to mitigate the effects of future shortages in the supply of Mo-99. The objective of this CRP is to evaluate new ways of producing Tc-99m, such as the Mo-100(γ,n)Mo-99 reaction, and also new Mo-99/Tc-99m generators using low specific activity Mo-99.	
Project 2000094	**2.5.2.001 Industrial Applications of Radioisotopes and Radiation Techniques**
CRP Title:	**Development of Radiometric Methods and Modelling for Measurement of Sediment Transport and Dispersion of Particles and Pollutants from Outfalls**
CRP Code:	**F22066**
It is well known, albeit not always well accepted, that there is a real lack of knowledge on the mechanisms of sediment transport. The equations which are the core of computational fluid dynamics models were developed in the first half of the twentieth century and are still used in most models with some adaptation using ‘black box’ coefficients. In order to acquire better knowledge of sediment transport mechanisms, there is a need for reliable and efficient measurement tools that can be used in the field, at real scale, and allowing the collection of data without disturbing the hydrodynamical and physical conditions in the environment. Nuclear techniques are the most useful and efficient tools for this purpose. This CRP will focus on the development and improvement of relevant nuclear techniques (radiotracers and nucleonic measurement systems) and the associated methodologies in order to enhance their application and the quality of data obtained from their use and, ultimately, to provide the scientific community with the best possible tools to fill knowledge gaps in this area. Guidelines for the use of such techniques, with a special emphasis on safety and regulatory aspects, will also be developed. The CRP will contribute to a wider utilization of nuclear techniques in Member States by enhancing their availability and the range of their application.	
CRP Title:	**Development of Radiometric Methods for Exploration and Process Optimization in Mining and Mineral Industries**
CRP Code:	**F22065**
Radiation techniques are increasingly being applied and developed further for exploration and efficient tapping of natural resources by the mining, metallurgy and mineral processing industries. Such industries are present in most countries and often are the major contributors to the national economies. This CRP will seek to promote the development and	

or enhancement of nuclear techniques and associated methodologies in the following areas: (1) Use of radiotracers to derive data in a simple manner from a variety of complex and closed systems. Using radiotracers provides vital information which can facilitate optimal recovery of the desired mineral; (2) Geophysical radiation techniques, such as nuclear borehole logging systems which are used for exploration purposes, (3) Nucleonic control systems used for on-line measurements on processing lines for elemental analysis, for quality control and real-time process management. New radiotracers, miniature neutron generators and X-ray systems, user friendly software, new detectors and data acquisition systems are being developed or improved and introduced in practice. This CRP aims to find solutions to the challenges faced by the exploration, mining, mineral and metallurgical industries that can be addressed and potentially overcome through the use of radiation technologies.	
CRP Title:	**Imaging Technologies for Process Investigation and Component Testing**
CRP Code:	**F22069**
Use of radiation based visualization technologies is expanding and continuously evolving. New methodologies and modelling approaches are being developed and introduced in practice. The overall objective of this CRP is to facilitate further advancement and implementation of nuclear technologies in the exploration, mining, mineral, and metallurgical industries. Specific goals to be addressed will include the safety, cost and availability of nuclear technologies, as well as knowledge transfer with a particular focus on developing Member States.	

Project 2000095	2.5.2.002 Radiation Technology for Health Care and Environmental Applications
CRP Title:	Radiation Inactivation of Biohazards Using High Powered Electron Beam Accelerators
CRP Code:	2220

There are several known conventional microbial decontamination technologies, of which those using thermal and chemical agents have been widely applied for the inactivation of biohazards in various scenarios. These agents have served a useful purpose under certain conditions but they are also subject to considerable limitations. In the past four decades, radiation technology has emerged as an effective tool for decontamination of biohazards. It has been instrumental in improving the quality of human life through its proven effectiveness in sterilization of medical and health care products, and also for improving food safety. This technology was ultimately the only means available to effectively decontaminate postal mail that was deliberately contaminated by a large scale bioterrorist attack in the USA in 2001. Over the years this technology has been primarily based on the use of gamma radiation sources such as cobalt-60 (Co-60). 400 million curies of Co-60 is currently being used at gamma irradiator facilities worldwide, and more than 14 million cubic metres of products are sterilized annually in these facilities. However, emerging concerns regarding the safety and security of radioactive sources, along with issues related to the shipment of such materials through normal supply chain processes, have encouraged the industry to consider machine based electron beam radiation sources in future. The application of electron beam irradiation has led to significant advances in material processing, and it is already being used for a wide range of technologies in industry, agriculture and research. Electron beam technology has been adopted in industries such as cable production, thermos-shrinkable materials, foam sheets, coating and curing. In recent years, the technology has started attracting interest for use in the sterilization of medical products, food preservation and environmental protection. To bring out its full potential in these areas related to the inactivation of microorganisms, it is important to establish the kinetics of inactivation — a task that is complicated by the variety of radiation sources, their dose rates and energies, as well as by the differences in the nature of microbes and their environments. It is therefore important to understand the fundamentals of microbial inactivation with different radiation sources under varied conditions. This CRP will aim to establish the kinetics of inactivation of microbes at high dose rates in order to support the use of electron beam technology for the inactivation of biohazards in a variety of scenarios, such as sterilization of medical products, food irradiation, decontaminating sewage sludge and sterilization of allografts. The data generated and the experience gained will serve as a guide to the scientific community and policy-makers on microbial biohazards and their control using electron beam technology.

Major Programme 3: Nuclear Safety and Security

3.4 Radioactive Waste Management and Environmental Safety	
Project 3000049	**3.4.2.001 Safety for Decommissioning and Remediation**
CRP Title:	**Integrating Perceived and Actual Risk in Stakeholder Communications (IPARSC)**
CRP Code:	**J91007**
The objective of this CRP is to promote effective risk communication through the development of a standardized methodology for assessing perceived risk in populations affected by radioactive waste management and decommissioning and environmental remediation activities, where securing public acceptance is a prerequisite to implementing radiation protection, health and safety measures. Contextual analysis (i.e. assessment of text within the context of its historical and cultural setting) is one of the techniques that will be applied to develop risk messaging that responds effectively to perceived risks. Contextual analysis will also be applied for integrating the messaging of perceived and actual risk.	
3.5 Nuclear Security	
Project 3000151	**3.5.1.003 Information and Computer Security, and Information Technology Services**
CRP Title:	**Enhancing Computer Security Incident Analysis at Nuclear Facilities**
CRP Code:	**J02008**
This CRP will explore key areas such as good practices, technology, analytical methods and recommended procedures for the response (including forensic activities) to computer security incidents at nuclear facilities. The results of this project will be disseminated as a non-serial IAEA publication on nuclear security and will additionally serve to inform the development of nuclear security guidance and training. This CRP provides the opportunity to participate in four activities to enhance computer security incident analysis and response: (1) operator support for computer security incident recognition and response; (2) analysis and technology support for computer security incident response; (3) computer security information exchange; and (4) cybercrime investigation. The objective of this CRP is to conduct activities which improve computer security capabilities at nuclear facilities to support the prevention and detection of, and response to, computer security incidents that have the potential to either directly or indirectly adversely affect nuclear safety and nuclear security.	
Project 3000152	**3.5.2.001 Integrated Nuclear Security Approaches for the Nuclear Fuel Cycle**
CRP Title:	**Nuclear Security for Research Reactors and Associated Facilities**
CRP Code:	**J02006**
The objective of this CRP is to simplify the process for developing, and enhancing the effectiveness of, nuclear security programmes to reduce the risk of theft of nuclear and/or other radioactive materials and sabotage at research reactors and associated facilities (RRAFs). This project includes the following research activities: 1- Review the assessment methodologies for regulated facilities developed by the CRP on nuclear security assessment methodologies (CRP code: J02004) in relation to RRAFs and develop case studies for RRAFs. 2- Identify factors for developing a comprehensive normalized ranking scheme for security risks posed by nuclear and radioactive materials while considering the unique characteristics of RRAFs. 3- Identify and assess open source data to develop a general threat basis statement for	

RRAFs.
4- Identify and assess available computer-based analytical tools (including their technical suitability) that can be used by non-security experts to evaluate the dispersal consequences of the introduction of external energy sources into RRAFs.
5- Identify and assess available databases for evaluating the performance effectiveness of nuclear security of RRAFs.

Project 3000153	**3.5.2.002 Enhancing Nuclear Materials Security Using Accounting and Control**
CRP Title:	**Preventive and Protective Measures against Insider Threats at Nuclear Facilities**
CRP Code:	**J02010**

The objective of this CRP is to enhance existing preventive and protective measures against insider adversaries to reduce the risk of theft of nuclear material and sabotage at nuclear facilities. The aim is to develop: (1) a predictive model for trustworthiness programmes; (2) a predictive model for identifying colluding insider adversaries; (3) tools and methods to be used in the application of process monitoring for nuclear security to improve detection capability, including analysis of technological barriers in process designs that may prevent or limit achievement of detection goals; (4) technical measures to enhance the control of nuclear material and control of access to personnel.and (5) a database for selecting nuclear material accounting and control measures for specific facility types.

Project 3000154	**3.5.2.003 Upgrading Security of Radioactive Material and Associated Facilities**
CRP Title:	**Improving the Security of Radioactive Material and of Associated Facilities and Activities**
CRP Code:	**J02011**

This CRP will focus on several activities, including: an examination of radioactive material subject to regulatory control and current safety thresholds to validate if they are an appropriate basis for security; an assessment of security measures for radioactive material in fixed and portable applications to identify gaps and develop solutions to address those gaps; and an analysis of how security measures are responding to identified threats. The results of the project are intended to form the basis of guidance for States on how to establish and/or enhance their national nuclear security regimes for radioactive material and associated facilities and activities.

Project 3000155	**3.5.2.004 Nuclear Security in Transportation of Nuclear and Radioactive Material**
CRP Title:	**Enhancing Security in Transport of Nuclear and Other Radioactive Material**
CRP Code:	**J02009**

This CRP is intended to identify and evaluate technologies that can be applied to strengthen the security of nuclear and other radioactive material during transport. This will include identifying gaps between existing transport security systems and more technologically advanced systems that can provide more efficient comprehensive security coverage appropriate for the potential consequences of the material being transported (i.e. as part of a graded approach). The CRP is open to institutes from IAEA Member States that will undertake experimental/research/technical activities aimed at enhancing nuclear security during transport. It will create an encouraging environment for the development of innovative and new approaches to providing integrated technologies that support security elements such as detection, assessment of alarms, identifying the location of a security event and

communications (both overt and covert). The project will serve as a collaboration platform for sharing knowledge and experience and for the exchange of information and expertise.	
Project 3000157	**3.5.3.002 Nuclear Security Detection and Response Architecture**
CRP Title:	**Improved Assessment of Initial Alarms from Radiation Detection Instruments**
CRP Code:	**J02005**
With literally millions of vehicles and people crossing borders every day, radiation portal monitors (RPMs) have become a critical tool for detecting the unauthorized transboundary movement of nuclear and other radioactive materials. The proper assessment of radiation alarms from RPMs is an essential part of the effort to combat the global problems associated with these unauthorized movements. Coordinated research and development work is needed, and will be conducted under this CRP, to provide peer reviewed and validated methodologies and guidelines for assessing radiation alarms and providing confidence that nuclear and other radioactive material out of regulatory control is detected and credible response actions initiated. The CRP's scope includes the establishment of a database of materials that cause radiation alarms and the development of a software tool that provides analysis of alarms to improve the decision process for determining whether an alarm is innocent or suspicious, i.e. whether or not the alarm is the result of the presence of nuclear or other radioactive material out of regulatory control.	
CRP Title:	**Advancing Radiation Detection Equipment for Detecting Nuclear and Other Radioactive Material Out of Regulatory Control**
CRP Code:	**J02012**
The current state of radiation detection instruments and systems used to detect and identify illicit trafficking in nuclear and other radioactive material is inadequate to meet the nuclear security needs of the Member States. Research under this CRP will assist in advancing design attributes, communication means, operational conditions and sustainability elements related to passive radiation detection instruments and methods. Needed advances in the effectiveness and sustainability of detection systems will be addressed through a range of research and development topics that include, but are not limited to: improved or alternative detection and identification algorithms; improved understanding of equipment performance and recommendations for more effective use or design; improved designs and data formats for networking and information communication; improved alert and alarm mechanisms and displays; improved designs to reduce maintenance and calibration issues; improved human factors designs for use and training; and improved recommendations for functional, testing and technical specifications for detection systems.	