PHẦN VĂN BẢN KHÁC

BỘ NGOẠI GIAO

BỘ NGOẠI GIAO

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

Số: 58/2015/TB-LPQT

Hà Nội, ngày 15 tháng 12 năm 2015

THÔNG BÁO
Về việc điều ước quốc tế có hiệu lực

Thực hiện quy định của Luật Ký kết, gia nhập và thực hiện điều ước quốc tế năm 2005, Bộ Ngoại giao trân trọng thông báo:

Khung chương trình quốc gia hợp tác giữa Chính phủ nước Cộng hòa xã hội chủ nghĩa Việt Nam và Cơ quan Năng lượng nguyên tử quốc tế giai đoạn 2016 - 2021, ký tại Viên ngày 02 tháng 11 năm 2015, có hiệu lực kể từ ngày 02 tháng 11 năm 2015.

Bộ Ngoại giao trân trọng gửi bản sao Bản ghi nhớ theo quy định tại Điều 68 của Luật nêu trên./.

TL. BỘ TRƯỞNG
KT. VỤ TRƯỞNG
VỤ LUẬT PHÁP VÀ ĐIỀU ƯỚC QUỐC TẾ
PHÓ VỤ TRƯỞNG

Nguyễn Văn Ngự

GOVERNMENT OF VIET NAM

INTERNATIONAL ATOMIC ENERGY AGENCY

COUNTRY PROGRAMME FRAMEWORK

2016 - 2021

On behalf of the Government of Viet Nam:

H.E Mr. PHAM Cong Tac
Vice Minister of Science and Technology

Vienna, Nov. 2. 2015
Date

On behalf of the International Atomic Energy Agency:

Dazhu Yang
Deputy Director General
Head, Department of Technical Cooperation

Vienna, Nov. 2, 2015
Date

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ACRONYMS

AGI	Agricultural Genetics Institute
CANTI	Center for Applications of Nuclear Techniques in Industry in Da Lat
CNEST	Center for Nuclear Energy Science and Technology
CNT	Center for Nuclear Techniques in Ho Chi Minh City
CPF	Country Programme Framework
CRB	Center for Radiation Plant Breeding
CT	Computed Tomography
DNA	Deoxyribonucleic Acid
EC	European Commission
ELISA	Enzyme Linked Immunosorbent Assay
EPC	Engineering, Procurement and Construction.
EPR	Emergency Preparedness and Response
EVN	Electricity of Viet Nam
FAO	Food and Agriculture Organization of the United Nations
FDG	Fluorodeoxyglucose, a radiopharmaceutical
FS	Feasibility Study
GDP	Gross Domestic Production
GEF	Global Environment Facility
GHG	Greenhouse Gas
GRS	Global Research for Safety (Gesellschaftfür Anlagen- und Reaktorsicherheit,Gemany)
HIC	Ha Noi Irradiation Center
HIV	Human Immunodeficiency Virus
IAEA	International Atomic Energy Agency
ICT	Information Communication Technologies
IFAD	International Fund for Agricultural Development
IMRT	Intensity-Modulated Radiation Therapy
INIR	Integrated Nuclear Infrastructure Review
INST	Institute for Nuclear Science and Technology
IPCC	Intergovernmental Panel on Climate Change
ITRRE	Institute for Technology of Radioactive and Rare Elements
IRMA	Immune Radio Metric Assay
IRSN.	Institute for Radiological Protection and Nuclear Safety (France)
ITNs	Insecticide treated bed-nets
ITP	Instructor Training Programme
IWP	Integrated Work Plan
JAEA	Japan Atomic Energy Agency
KAERI	Korea Atomic Energy Research Institute
KAIST	Korea Advanced Institute of Science and Technology
KINGS	KEPCO International Nuclear Graduate School (Korea)
LDR	Low Dose Rate
MARD	Ministry of Agriculture and Rural Development (Viet Nam)
MAT	Male annihilation technique
MDG	Millennium Development Goal
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MOIT	Ministry of Industry and Trade (Viet Nam)
MOH	Ministry of Health (Viet Nam)
MOST	Ministry of Science and Technology (Viet Nam)
MOU	Memorandum of Understanding
MRI	Magnetic Resonance Imaging
MSCT	Multislice Computed Tomography
NCS	Nucleonic Control Systems
NDT	Non-Destructive Testing
NDE	Center for Non-Destructive Evaluation in Ha Noi
NEA	National Energy Administration
NNREP	National Nuclear and Radiological Emergency Plan
NORM	Natural Occurring Radioactive Materials
NPP	Nuclear Power Plant

NSC	National Nuclear Security Committee
NSSC	Nuclear Safety and Security Commission
NRA	Japan Nuclear Regulation Authority
NRI	Nuclear Research Institute
PACT	Programme of Action for Cancer Therapy
PCR	Polymerase Chain Reaction
PET	Positron Emission Tomography
PSA	Probabilistic Safety Assessment
PSAR	Preliminary Safety Analysis Report
PPRI	Plant Protection Research Institute
QA/QC	Quality Assurance/Quality Control
R&D	Research and Development
RCA	Regional Co-Operative Agreement for Research, Development and Training Related to Nuclear Science & Technology
RIA	Radioimmunoassay
ROSATOM	Russian State Atomic Energy Corporation
RT	Radiographic Testing
S&T	Science and Technology
SAD	Site Approval Dossiers
SAR	Safety Analysis Report
SAT	Systematic Approach to Training
SIT	Sterile Insect Technique
SMEs	Small and Medium Enterprises
SPECT	Single Photon Emission Computed Tomography
SSDL	Secondary Standard Dosimetry Laboratory
TBD	Tick Borne Diseases
TC	Technical Cooperation
TCDC	Technical Cooperation among Developing Countries
TCF	Technical Cooperation Funds
TCP	Technical Cooperation Programme
TSO	Technical Support Organization
UN	United Nations
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNESCO	United Nations Education, Scientific & Cultural Organization
UNICEF	United Nations Children's Funds
URD	Utility Requirement Document
USNRC	United States Nuclear Regulatory Commission
VAEA	Viet Nam Atomic Energy Agency
VINATOM	Viet Nam Atomic Energy Institute
VARANS	Viet Nam Agency for Radiation and Nuclear Safety
VINASARCOM	Viet Nam National Committee for Search and Rescue
WHO	World Health Organization

References

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[2] Master Plan on Implementing Strategy on Peaceful Use of Atomic Energy up to 2020(Prime Minister Decision No. 114/2007/QD-TTg dated 23 July 2007)

[3] Atomic Energy Law. 2008

[4] Master Plan on Development and Application on Peaceful Use of Atomic Energy up to 2020(Prime Minister Decision No. 957/QD-TTg dated 24 June 2010)

[5] Directive Plan on Development of Nuclear Power in Viet Nam up to 2030 (Prime Minister Decision No. 906/QD-TTg dated 17 June 2010)

[6] National Programme on Education, Training and Development of Human Resource in the field of Atomic Energy (Prime Minister Decision No. 1558/QD-TTg dated 18 August 2010)

[7] Master Plan on Application Development of Ionizing Radiation in Agriculture up to 2020 (Prime Minister Decision No. 775/QD-TTg dated 2 June 2010)

[8] Master Plan on Development of National Network of Radiation Monitoring up to 2020 (Prime Minister Decision No. 1636/QD-TTg dated 31 August 2010)

[9] Master Plan on Application Development of Ionizing Radiation in Industry and other Techno-Economic Sectors up to 2020 (Prime Minister Decision No. 127/2011/QD-TTg dated 20 January 2011)

[10] National Project on "Implementation of measures for ensuring security in the field of atomic energy" (Prime Minister Decision No. 450/QD-TTg dated 25 March 2011).

[11] Master Plan on Application Development of Ionizing Radiation in Meteorology, Hydrology, Geology, Minerals and Environment Protection up to 2020 (Prime Minister Decision No. 899/2011/QD-TTg dated 10 June 2011)

[12] Master Plan on Application Development of Ionizing Radiation in Health Care up to 2020 (Prime Minister Decision No. 1958/2011/QD-TTg dated 04 November 2011)

[13] Viet Nam Sustainable Development Strategy for 2011-2020 (Prime Minister Decision No. 432/QD-TTg dated 12 April 2012)

[14] National Project for Public Information and Communication for Nuclear Power in Viet Nam up to 2020 (Prime Minister Decision No. 370/QD-TTg dated 28 February 2013)

[15] Master Plan for the development of nuclear power infrastructure up to 2020 (Prime Minister Decision No. 2241/QD-TTg dated 11 December 2014)

EXECUTIVE SUMMARY

The Country Programme Framework (CPF) described in this document constitutes the frame of reference for the development needs and priorities to be supported through technical cooperation (TC) between the Government of the Socialist Republic of Viet Nam and the International Atomic Energy Agency (IAEA) for the period 2016 - 2021. This will be the third CPF for Viet Nam.

Having envisaged the role of nuclear science and technology for achieving developmental goals from the national viewpoint and reflecting objectives that are common with the IAEA's TC Programme (TCP), this document outlines the relevant international development assistance opportunities and indicates its linkages and common objectives with the technical assistance programmes of other international organizations for Viet Nam. The CPF constitutes the frame of reference for the near-and-medium-term planning of technical cooperation between the Socialist Republic of Viet Nam and the IAEA for the period 2016 - 2021. This document also defines mutually agreed priority development needs and interests of Viet Nam, based on the national development plans, country specific analyses and lessons learned from past cooperation, which will serve as a platform for the planning and coordination of the IAEA's TC activities.

The CPF has been developed following broad and in-depth consultations between the IAEA and the competent authorities of Viet Nam on the basis of a thorough study of what nuclear science and technology can contribute to the achievement of national development objectives taking into account the current state of development of nuclear applications in Viet Nam, the steadily growing need for these applications in various fields, and the development imperatives set forth by the Government of Viet Nam in its Development Plans. These consultations, conducted at both political and operational levels, have involved decision-makers representing the various appropriate socio-economic sectors and managers of national institutions with an aim to define a common approach to the effective integration of relevant nuclear applications into high-priority national programmes for sustainable development.

Based on the results and experience gained from previous TC projects carried out under the CPF (2010 - 2015), the TC activities under this CPF will focus on the following priority areas: i) Nuclear power infrastructure building including nuclear safety, security and safeguards; TSO capacity development and human resource development, etc.; ii) Radiation safety and radioactive waste management; iii) Industrial applications of radioisotope technology; iv) Human health; v) Food and Agriculture; and vi) Environment protection. The envisaged cooperative activities are outlined as follows:

- *Nuclear Power Infrastructure:* in order to meet the requirements of IAEA Milestone regarding the establishment of nuclear power infrastructure and preparation for the construction of the first nuclear power plant (NPP), Viet Nam needs to develop human resource for the management and operation of the nuclear power programme as well as other related activities such as site qualification, electricity grid infrastructure development, public acceptance and communication. This CPF outlines the continued cooperation between IAEA and Viet Nam to implement the Integrated Work Plan (IWP) in the period 2016-2021 which incorporates national and partners' effort in a holistic manner so as to coordinate efforts and actions at all levels. This assistance will

include support to education and training institutions, governmental agencies, future operator and other stakeholders in the form of human resource development, provision of teaching materials in nuclear power engineering, and guidance and dedicated equipment for site studies. In the medium term, the IAEA and Viet Nam will continue working together within the framework of the IWP to achieve the necessary nuclear power infrastructure Milestones and be ready for the construction of the first NPP.

The CPF prioritises the development of relevant legal documentation, material and technical infrastructure as well as technical support capacity in relevant activities, and continue its assistance in this field under the on-going national and relevant regional projects. This assistance includes human resource development, provision of legal and safety/security documents, guidance as well as dedicated equipment. Particular attention will be paid to education in the field of nuclear safety to build a core team of specialists in the field.

In the medium term, the IAEA support is sought to continue its support to Viet Nam to help the country build a full-fledged national nuclear safety infrastructure capable of performing the various licensing activities related to the first NPP. In view of the ever-increasing uses of nuclear techniques in various economic sectors, and in preparation for the nuclear power programme, Viet Nam needs to strengthen its capability in safe management of radioactive wastes at both regulatory as well as technological levels. In this context, the CPF identifies focal areas and objectives such as to update and/or develop relevant regulations and to establish modern laboratories for the safe management of radioactive wastes using innovative conditioning and storage technologies and processes, including the near surface disposal.

- *Human Health*: Viet Nam has formulated and adopted directions and plans of action for the i) expansion of advanced nuclear applications in medical diagnosis and treatment, ii) equipping of all provincial hospitals with SPECT/PET, and iii) establishment of a national research center for diagnosis and treatment of radiation-caused sickness. In the short and medium term, the IAEA is requested to support this programme by providing advisory assistance, guidance, training and dedicated equipment in order to strengthen national competency of radiotherapy techniques and nuclear medicine, particularly in cancer control.

- *Food and Agriculture:* Viet Nam is planning to build an irradiation facility to facilitate breeding of important plants for high yield and greater tolerance to pests, diseases and hard environmental conditions due to climate change. In this context there is a plan to establish the Center for Radiation Plant Breeding (CRB) with an irradiation facility, biotechnology equipment and trained human resource to take advantage of the technology. By 2018, the CPF aims for the launch of at least one modern Irradiation Breeding Center at the Agricultural Genetics Institute (AGI). It is also necessary to establish a network of irradiation facilities for treatment of export commodities to ensure access to international markets. IAEA is expected to support this programme by providing advisory assistance, technical guidance, training and dedicated equipment, including specific assistance to help establish and operate the facility for mutation plant breeding in Viet Nam.

Nuclear technology unaided techniques for diagnosing animal diseases are applied widely in Viet Nam, but they often show insufficient sensitivity, specificity and time efficiency. Therefore, application of advanced diagnostic techniques including nuclear related serological and

molecular technologies for animal disease diagnosis is of great importance to detect the early stage of the causal agents. Those techniques will help to improve the capabilities of Vietnamese veterinarians and therefore reduce the impact of animal disease outbreaks.

With initial success in area-wide management of fruit flies on dragon fruit in Binh Thuan, Viet Nam is seeking support for the construction of a mass rearing and a fly emergence and release facility for Bactrocera fruit flies to apply SIT in an area-wide integrated pest management approach to future expansion of the dragon fruit export markets.

- *Environment protection*: in this area priority will be given to the development of nuclear analytical and radiotracer techniques for environmental assessment, marine resources investigation, marine environment sustainability and establishment of a national radiological environmental monitoring network. The IAEA is requested to support this programme in the short and medium term by providing advisory assistance, guidance, training and dedicated equipment in order to establish a marine environment laboratory in the central part of Viet Nam.

- *RCA and non-RCA regional projects*: In addition to the national programme, Viet Nam gives importance to its participation in the RCA and non-RCA regional projects. This additional support will complement/supplement the assistance foreseen under the national projects with the particular aim to maximize the utilization of the national nuclear institutions and expertise, enhance the quality of nuclear services provided by these institutions and pave the way to accreditation. This CPF will also promote the fullest possible utilization of the available nuclear infrastructure to accompany optimally the socio-economic development of the country and the integration of nuclear techniques into national development programmes. Given the accumulated experience and expertise by some national institutions in nuclear science and technology, Viet Nam will be prepared to offer assistance to other developing countries in the region, particularly by hosting trainees and training courses, and by offering available experts and nuclear facilities for TC programme.

I. INTRODUCTION

Viet Nam is the easternmost country on the Indochina Peninsula in Southeast Asia. With an estimated 90.73 million inhabitants as of December 2014, it is the world's 13th-most-populous country, and the eighth-most-populous Asian country. In 2010, Viet Nam attained lower middle-income country status, testament to the rapid economic growth and poverty reduction the country has achieved over the past two decades. Viet Nam is on track to meet, or has met, a majority of the Millennium Development Goals (MDGs) at a national level. Viet Nam has reduced poverty at an unprecedented rate: the number of Vietnamese living on less than US$1.25 per day fell from 64% in 1992 to 6% in 2014. Economic growth has slowed in recent years, although GDP continued to grow in 2014, by 5.98%, despite weaknesses in the global economy.

I.1. Viet Nam's Agenda 21

Strategic Orientation for Viet Nam's Sustainable Development (Viet Nam's Agenda 21) is a strategic framework, outlining orientations that serve as the legal base for the relevant ministries, sectors, localities, organizations and individuals. Under the Agenda 21, priorities are given to the economic aspects to ensure sustainable development including: i) maintaining rapid and sustainable economic growth; ii) changing the production-consumption model towards an environment-friendly direction; iii) carrying out "clean industrialization"; and iv) aiming at sustainable agriculture and rural development. Priorities are also given to some social development aspects including: i) focusing on poverty reduction and hunger elimination; ii) promoting social equality and progress; iii) further reducing population growth and generating jobs for labourers; iv) clearly planning urbanization and relocation; v) raising education-training quality; vi) increasing health care services; and vii) improving working conditions and environment hygiene. Regarding the issues of natural resource exploitation and environment protection, such aspects are prioritized as: i) anti-soil degradation; ii) water environment protection; iii) proper minerals exploitation and utilization; iv) ocean, coastal and island environment conservation; v) sea resources development; vi) air pollution reduction in urban areas and industrial zones; vii) solid and toxic waste management; viii) preservation of bio-diversification.

Other planning documents include the Master Plan on economic restructuring in association with conversion of the growth model towards improving quality, efficiency and competitiveness during 2013 - 2020, and the Viet Nam Sustainable Development Strategy for 2011 - 2020. The overall target foreseen is the economic restructuring carried out in association with the conversion of the growth model in line with a roadmap with proper steps so as to form an in-depth model of growth by 2020, guarantee growth quality, and improve the economy's efficiency and competitiveness.

Recognizing the important role of nuclear energy in the national development planning on the basis of the achievements of the cooperation between the IAEA and Viet Nam, this CPF will focus on continuing promotion of the application of nuclear science and technology on both power and non-power areas in order to support Viet Nam for achieving goals of national development programmes indicated in the Viet Nam's Agenda 21, such as human resource development; sustainable agriculture development and food safety and security; increasing health

care services; water environment protection; marine environment conservation; and energy security.

I.2. Food and Agriculture

Viet Nam is an agriculture based economy, with paddy rice as the dominant crop. About 70% of the population earn their living in the agricultural sector. In recent years, agriculture has made remarkable progress. Starting as a food importer, Viet Nam has become one of the world largest exporters of rice, coffee, black pepper, cassava, cashew nut and fishery products, like cat fish, shrimp, etc. Recent entry of Vietnamese fruit, like green dragon fruit, lychees, and vegetables to international markets opens new opportunities for agriculture and rural development of the country.

On the other side Viet Nam is a heavy importer of some other agriculture commodities, like milk, milk products, animal meat and grains for animal feed. An increasing portion of import comes from maize – nearly 50%, and soy bean – 93% of local consumption in 2014. With entering new Free Trade Agreements and other international agreements, local production of these less competitive areas will face greater pressure of integration.

Livestock production has been contributing significantly as protein sources in Viet Nam. There has been great potential for development of livestock industry not only for local consumption but also for export markets. Viet Nam's fishing industry, which has abundant resources given the country's long coastline and extensive network of rivers and lakes, has generally experienced moderate growth.

The main challenges for food security in Vietnam are: i) Population growth, accounted for at 1.2% per year, which means that every year the country has to feed one more million mouths; ii) Shortage of land due to expansion of industry, urbanization, transport and housing every year as the country losses 50,000-70,000 ha of arable land; and iii) Climate change. Viet Nam is one of 5 countries in Asia most impacted by climate change. It is predicted that by the end of the century, the average temperature in Viet Nam will have risen by 2-3 degrees Centigrade: Sea levels will rise by 7.5-10 cm, and vast areas of important rice producing regions in Red River (10%) and Mekong River (39%) Deltas will be inundated. Respectively up to 30% area in Red River Delta and 70% area in Mekong River Delta will be impacted by saline intrusion. Changing of rain and temperature patterns cause concern of impending extreme weather, like flooding, drought, typhoon, and excessive cool and hot weather. Climate change may indirectly cause outbreaks of plant and animal diseases. Thus, climate change will affect strongly all agriculture areas, including crop, livestock production, forestry, fishery and human livelihood. In these conditions, food security may be threatened.

I.3. Industry

Manufacturing, information technology and high-tech industries now form a large and fast-growing part of the national economy. Almost all Vietnamese enterprises are small and medium enterprises (SMEs). Petroleum is the main source of energy, followed by coal, which contributes about 25% of the country's energy. Though Viet Nam is a relative newcomer to the oil industry, it is currently the third-largest oil producer in Southeast Asia.

I.4. Human Health

Currently, there are 28 radiotherapy and 30 nuclear medicine departments, and thousands of x-ray machines in operation in the country. Recently, thanks to the government efforts and also to IAEA' assistance, 4 cyclotron and 8 PET Centres (including 3 regional onsite cyclotron and PET Centres) have been established in Ha Noi, Da Nang and Ho Chi Minh City. Up to now, about 5000 cases of PET-CT procedures are conducted across the country every year. Over the last decade, many new other radiation technologies and modern techniques have been introduced into medical practice such as accelerators, cyclotrons, multi-slice CT, and many other medical devices with advanced application of science and technology. Those developments play a very important role in health care, and improve the quality of treatment and save the lives of millions of patients.

I.5. Environment

The country has more than 3,400 km of coastline facing the East Sea and much of the country is mountainous and hilly. Viet Nam falls in the sub-tropical and tropical zones. The Northern areas are subtropical while the southern area is more tropical, with a rainy season from May to October, followed by months of hot and dry weather. Over the years a number of random violent typhoons have hit the central and northern coasts, causing many losses in agriculture and rural areas of the country.

Viet Nam as a country has been predicted to be one of the worlds' most impacted by climate change. With its two major deltas and high population concentrations within the Mekong and Red River Deltas, the IPCC's Fourth Assessment characterized Viet Nam as a Hotspot of key future climate impacts and vulnerabilities in Asia. Long term predictions for the country show that expected impacts on the agriculture and rural development sector will primarily be caused by increase of average temperature, change of rainfall pattern and sea level rise.

Development of industry in the country in recent years has been accompanied with pollution. Agriculture is one of important sources of pollution due to excessive use of chemical fertilizers and pesticides. High population density and deforestation also worsen the pollution problem.

I.6. Radiation applications

In the current situation of Viet Nam, the application of Ionizing Radiation is expanding in various economic sectors. The main areas include health care, agriculture, industry, and environment protection. During the period 2016-2021, Viet Nam aims to achieve a number of objectives set out in the Master Plan on Application Development of Ionizing Radiation in various areas such as establishing nuclear agriculture centres; establishing irradiation facilities to ensure food hygiene and food safety for domestic use and export and to produce agricultural products; application of advanced diagnostic techniques including nuclear related serological and molecular technologies for animal disease diagnosis; developing facilities to practice SIT and apply SIT for area wide management in the future, thus expanding dragon fruit exportation markets; and application of irradiation technology for sterilization of healthcare products, food processing and material modification used in industry.

I.7. Nuclear Power

Viet Nam's present electricity generation is composed of hydroelectricity contributing about 40% of total electricity generation, followed by thermal gas turbines with 33%, coal with 22%, and petroleum and import accounting for the rest. Viet Nam is taking considerable steps to develop a national nuclear power programme and the required infrastructure. Viet Nam is simultaneously developing 2 NPP projects with two different vendors. Start of construction and operation of Viet Nam's first NPP has been postponed by several years as a result of a more realistic evaluation of the time needed to build the infrastructure to support the projects. IAEA has assisted Viet Nam through several TC projects and has contributed to the development of significant institutional capacity in the nuclear power project management, development of human resource, technical capacity, site characterization and evaluation as well as strengthening of the safety and regulatory infrastructure.

I.8. Nuclear safety and security

The Nuclear Atomic Law specifies that MOST is responsible for licensing research reactors, while nuclear power plants shall be licensed in several stages. For each stage, the authorization is issued by a different competent authority as mentioned in Article 7c, namely, site approval by the Prime Minister, construction permit by MOST, and commissioning of an operation license by the MOIT. The National Council for Nuclear Safety was established in 2010 and functions to advise the Prime Minister on policies and measures to assure nuclear safety in the use of atomic energy, the course of operation of NPPs, as well as measures to remedy particularly serious nuclear incidents; to examine and evaluate safety reports of nuclear power plants and results of assessment by the radiation and nuclear safety agency.

The project named "Implementation of measures for ensuring security in the field of atomic energy" [10] is being implemented by the Ministry of Public Security.

The Ministry of Public Security is developing the Design Basis Threat (DBT) for the Nuclear Power projects as one of the tasks under the "Master Plan for the development of nuclear power infrastructure up to 2020" [15].

The CPF formulation has been based on a dialogue between the Agency and all Viet Nam's national stakeholders and reflects agreement between all parties on where nuclear science and technology could contribute directly and cost-effectively to national development. This document and its annexes define mutually agreed priority development needs and interests that are to be supported through TC activities between Viet Nam and the IAEA during the period 2016 - 2021. The CPF's planned activities are based on the identified national development priorities in various sectors of socio-economic development, country specific analyses and lessons learned from past cooperation for formulation and delivery of a reliable TC programme meeting the quality and sustainability criteria required by the IAEA.

II. NATIONAL DEVELOPMENT PRIORITIES AND ACTIVITIES RELEVANT TO THE AGENCY'S TECHNICAL COOPERATION PROGRAMME

Based on an analysis of the national priorities of Viet Nam as elaborated upon in the Strategy on Peaceful Use of Atomic Energy 2020, the Master Plans on Application Development of Ionizing Radiation in Health Care, Agriculture, Industries, Natural Resources and Environment, as well as the National Programme on Education, Training and Development of Human Resource in the field of Atomic Energy, the country has identified development priorities in the areas of human health, food and agriculture, water and the environment, industrial applications, energy, as well as climate change and sustainable economic development.

The following is a summary of national development priorities and activities relevant to the Agency's Technical Cooperation Programme.

II.1. Nuclear Power

Viet Nam's national commitment to a nuclear power programme was formalized by the National Assembly's Resolution No. 41 on the Investment Decision for the Ninh Thuan Nuclear Power Project in 2009, which includes two 2-unit plants (1000 MW per unit). Aware that nuclear safety and security must be ensured at the highest level, the Government of Viet Nam has been actively preparing necessary conditions and will initiate construction of NPPs once national infrastructure and human resource are adequately developed in accordance with IAEA safety and security standards.

At the national level, Viet Nam already established a State Steering Committee chaired by the Deputy Prime Minister to coordinate the nuclear power programme and address policy and strategic matters. During the last years, the Viet Nam's Government has approved several projects for the development of nuclear power infrastructure in Viet Nam including the National Programme on Education, Training and Development of Human Resource in the field of Atomic Energy [6] and the National Project for Public Information and Communication for Nuclear Power [14]. In addition, Viet Nam has been conducting site evaluation and feasibility studies of Ninh Thuan 1 & 2 Nuclear Power Projects.

To ensure the timely development of the nuclear energy programme, Viet Nam will focus on the implementation of the Master Plan for the Development of Nuclear Power Infrastructure up to 2020, which will include 21 projects and plans covering all areas required for the development of a safe and secure nuclear power programme. Therefore, in the near and medium term, Viet Nam will focus on completing the evaluation and appraisal of the Site Approval Dossiers (SAD), Feasibility Study (FS) Reports, Technical Designs, as well as prepare the Engineering Procurement Construction (EPC) contract for the Ninh Thuan Nuclear Power Project.

II.2. Regulatory infrastructure

Viet Nam identified the importance of establishing a strong regulatory framework, which includes strengthening both the legal and regulatory framework, including the regulatory body as well as promoting the work of technical support organizations ensuring the safe and secure uses of atomic energy. Viet Nam achieved positive results in the area including the promulgation of the Atomic Energy Law, the establishment of a regulatory framework, as well as the ratification

of relevant international treaties. However, in order to facilitate the implementation of the Atomic Energy Strategy, especially for the Ninh Thuan Nuclear Power Project, further strengthening the nuclear regulatory infrastructure remains one of the main challenges to be addressed with the support of the IAEA.

II.3. Human Health

In 2011, the Government of Viet Nam approved the Master Plan for the Development of Ionizing Radiation in Health Care until 2020. The overall objective of the Master Plan is to enhance the application of diagnostics and nuclear medicine to improve the quality of healthcare, education and research in the country.

In Viet Nam, proper diagnosis and treatment of non-communicable diseases such as cancer, cardiovascular diseases and neurological disorders require the substantial development of health care facilities in the country. In particular, increased incidences of cancer and resulting mortality rates are challenging existing radiation medicine capabilities for diagnostic medicine. In addition, the number of people undergoing diagnostic X-ray techniques, as well as the applications of CT and angiographies are steadily increasing. Therefore, due to an increasing demand for cyclotron produced radioisotopes and radiopharmaceuticals, as well as for positron emission tomography applications to perform improved diagnostic studies for patients suffering from heart disease or cancer, there is a clear need to expand access to high end radiation medicine technologies in Viet Nam.

II.4. Food and Agriculture

Given the importance of the agricultural sector as the monetary foundation for industrialization in the country, Viet Nam is prepared to utilize its resources, including modern science and technology, financial investment, and policymaking to facilitate the sustainable development of agricultural sector.

Food Security

The Government approved in 2010 a national programme for the application of nuclear techniques in agriculture. The strategic objectives include promoting the establishment of the Center for Plant Mutation Breeding (CPMB) with irradiation facilities (at low and high dose), as well as equipping related biotechnology laboratories for mutation breeding capabilities to develop high yielding, high quality and resistant crop varieties suitable for cultivation in different climate conditions. This will support Viet Nam in ensuring food security, mitigating the effects of climate change and ensuring socio-economic stability in the country. The additional goal is to establish research centers dedicated to the application of irradiation techniques for plant protection, including through the application of the Sterile Insect Technique (SIT) for the safe control of pests in important production regions.

Food Safety

Viet Nam's food exports, especially seafood and fruits, have grown tremendously, fetching 31 billion dollars in 2014. For example, the country exported 37.9 thousand tons of aquaculture products to US and EU, representing a growth rate of 10.3%. However, strict international and

regional market demands regarding safety and quality require proper monitoring and control of agrochemicals including veterinary drugs and pesticides in aquaculture and livestock production. Other concerns include toxic metals, hormones, mycotoxins and related natural toxins, as well as food additives.

Food testing laboratories that meet international (and national) standards are therefore very crucial. The demand for food safety testing in Viet Nam is expected to grow by ~11% from 2010 to 2020, given the public health concerns (greater public awareness and government interest) and increasing trade among others. The country can therefore benefit from IAEA TC support to build and strengthen national food testing laboratories to complement the implementation of the New Food Safety Law of 2011 and associated sub-laws. Nuclear/isotopic analytical techniques alone or with complementary tools present advantages that the country could benefit from.

In the area of food safety, Viet Nam will focus on developing human resource and institutional capabilities for the application of isotopic techniques to ensure food safety. In addition, due to excessive nitrogen (N) fertilizer use by Vietnamese farmers, Viet Nam is facing increasing incidences of nitrate leaching and nitrogen volatilization from agricultural soil, which creates a risk for both the environment and human health. Utilizing isotopic techniques to investigate N use efficiency will contribute towards decreasing the potential negative impacts of fertilizer usage on the environment, improving overall food safety.

In addition, given Viet Nam's status as a leading agricultural exporter, nuclear and related techniques will be important for the traceability, proof of authenticity and detection of adulteration of food products to meet requirements for the international market. Especially in the context of increased use of veterinary pharmaceuticals concerns have been rising about veterinary chemicals in animal-derived food. Public awareness for a safe and high quality supply has grown in Viet Nam partly due to 50.000 cases of poisoning having been reported between 2001 and 2010 alone of which thirty percent may be attributed to chemicals, natural toxins and pathogenic microbes, while 70% cases remain untraceable.

Nuclear and related techniques can therefore help with the detection and control of residues in food and livestock and can provide data that allows the continuous improvement of food and livestock production.

Various institutions in the Ministry of Agriculture, Ministry of Health, the Vietnam Food Administration, Development & Research Department of Quality Assurance and Testing Centre 3 (Quatest 3) of the Directorate for Standards, Metrology and Quality, and Ministry of Science & Technology in Viet Nam are some institutions that could benefit from the IAEA TC support.

Soil Management

Soil erosion is a major problem in Viet Nam as three quarters of the territory is sloping land which has been over farmed over the years. Fallout radio nuclides (FRNs) of Berilium-7 (^{7}Be), Cesium-137 (^{137}Cs) and Lead-210 (^{210}Pb) techniques can help to quantify soil erosion rates to promote the introduction of soil conservation measures.

Livestock Production

Viet Nam identified sustainable livestock production as a key priority to ensure food security and

economic stability. However, frequent outbreaks of infectious diseases and zoonosis continue to be obstacles to ensuring stable livestock production and export to international markets. Emerging and re-emerging diseases caused significant economic losses in livestock production, and affected food security and trade. Many factors have been known to be causes of diseases and disease outbreaks such as husbandry techniques, sanitary condition, veterinary diagnosis, management and climate change. Therefore, developing capabilities for the early diagnosis of animal diseases plays a very important role in controlling animal diseases in a timely and effective manner.

Non-nuclear technology based techniques for diagnosing animal diseases are applied widely in Viet Nam, but they are not sensitive or specific enough and resulting diagnostic processes are time consuming. Therefore, the application of advanced nuclear diagnostic techniques using related serological and molecular technologies is imperative to promote early detection. The application of these techniques will therefore help to improve veterinary capacities and reduce the impact of animal disease outbreaks on the Vietnamese population.

II.5. Industry

Manufacturing, information technology and electronics industries form a large and fast-growing part of the national economy of Viet Nam. In order to support this rapidly developing sector, there is a growing need for investment in research, development and use of advanced radiation technology including in the application of Non-Destructive Testing (NDT) in transportation, construction, mechanics, manufacturing and energy. Developing the application of radioactive sealed sources and tracer techniques in chemicals, energy and construction materials and other industries to optimize manufacturing process and enhance product quality should further be promoted. High priority should be given to developing the application of irradiation technologies including gamma, electron beam and X-ray technologies, to enhance capabilities to monitor and evaluate the structural integrity of materials used in industries.

II.6. Environment and Water Resources

The development of infrastructure and technical know-how for the successful application of isotopic techniques for water resources management is a national priority for Viet Nam which faces increasing pressure from the effects of climate change and pollution. In particular, Viet Nam is developing an environmental research laboratory for the application of nuclear and isotopic techniques to assess the impacts of industrialization and urbanization on the coastal environment, as well as the impact of air particulate matter on human health. In addition, the laboratory will contribute to human resource training for environment protection and carrying out scientific research, transfer and application of waste treatment technologies and environmentally friendly technologies.

II.7. Capacity building/Human resource development

Within the framework of the National Programme on Education, Training and Development of Human Resource in the field of Atomic Energy, Viet Nam sent 350 students to study nuclear power plant engineering and operation in Russia and will be sending 100 students to Japan during the period 2016-2020. In addition, the Prime Minister assigned the Ministry of Science and

Technology (MOST) to formulate a comprehensive plan for training and retention of skilled personnel for state management, technical support, research & development.

II.8. Research Reactor

The Da Lat Nuclear Research Reactor (DNRR) is a pool-type, water-cooled and moderated reactor TRIGA Mark-II. This rector has been utilized to produce radioisotopes for medicine and industry use, to carry out neutron activation analysis of geological, crude oil and environment samples, to carry out fundamental and applied research on nuclear and reactor physics, and to create a large amount of human resource with high skills and experiences in application of nuclear techniques in Viet Nam. With support from the IAEA, the United States of America (USA) and the Russian Federation (RF), the conversion of Highly Enriched Uranium (HEU) to Low Enriched Uranium (LEU) was gradually implemented to ensure its full operation on LEU nuclear fuel.

Due to power level limitations, as well as aging of both the reactor and irradiation facilities, it has become increasingly difficult to meet production targets. Viet Nam therefore identified the construction of a new multi-purpose research reactor with a 15 MW power level as an essential component in ensuring that research and development, as well as industrial applications and energy generation activities can be undertaken in an efficient and satisfactory manner. Therefore, within the framework of cooperation between Viet Nam and Russia, a new Centre for Nuclear Energy Science and Technology (CNEST) is planned to be operational by 2025 with the objective of, inter alia, providing technical support for the nuclear power programme, promoting modern research activities in the field of atomic energy, producing radioactive isotopes, as well as enabling the use of neutron beam technologies for materials studies.

II.9. Nuclear Security

In addition to ensuring the safety of nuclear power plants, it is equally important to ensure the security of such facilities. Some regulations regarding the security of nuclear material and nuclear facilities are in place (i.e. Circular No 38/2011/TT-BKHCN on Requirements for Ensuring the Security of nuclear materials and nuclear facilities), but need to be upgraded or re-formulated. In the past several years, with the support from the IAEA and other international partners, Viet Nam has established a register for radioactive sources of all categories and regulations on the security of radioactive sources. Developing a comprehensive infrastructure for nuclear security is a high priority and VARANS and other relevant authorities need assistance from IAEA to deal with the review and approval process of license application regarding the security matters, safety and security of radioactive sources and radioactive materials, international and domestic transport regulations. The need for such assistance is outlined in Viet Nam's Integrated Nuclear Security Support Plan (INSSP), which was jointly developed with the IAEA and officially approved by the Government in May 2012 and last reviewed in December 2014. It is also foreseen that safeguards activities will increase with the start of nuclear power projects and assistance from IAEA will be required.

III. RELEVANT INTERNATIONAL ASSISTANCE

To achieve the objectives set by the Master Plan on Development and Application of Peaceful Uses of Atomic Energy and the Master Plan for the Development of Nuclear Power Infrastructure up to 2020, Viet Nam attaches great importance to international cooperation and support. Viet Nam has bilateral and multilateral cooperation agreements with both a number of international organizations and countries with advanced nuclear capabilities including India, Korea, China, Argentina, Russia, France, Japan and the USA, as well as the IAEA, the RCA, the FNCA and the EC.

III.1. Bilateral assistance and cooperation for human resource development for nuclear power programme

Russia offers Viet Nam several scholarships every year for undergraduate and graduate progammes in nuclear engineering. Since 2010, Viet Nam sent approximately 350 Vietnamese students to study Nuclear Power Plant Equipment and Installations in Obninsk, Russia. Additionally, the MOST cooperated with ROSATOM to train staff through short-term courses. Around 200 Vietnamese students in Obninsk were already committed to work for EVN after graduation and others might be recruited in governmental organizations or selected for post-graduate programmes.

Cooperation with the Japan Atomic Energy Agency (JAEA) for the development of human resource in the field of nuclear applications has been implemented for more than ten years. Two educational and training laboratories have been set-up at the VINATOM subsidiary institutes INST and NRI. Joint training courses as well as follow-up training courses on radiation protection, radiation measurements, application of nuclear techniques in industry and the environment, nuclear reactor engineering, nuclear and radiation emergency preparedness, as well as environmental radioactivity monitoring have been regularly organized.

Korea offers scholarships to MSc and PhD students in the field of nuclear engineering sciences at KAIST and KINGS, as well as organizing training programmes for government staffs in various nuclear infrastructure issues at Korea's nuclear organizations such as KAERI, KINS, and KINAC.

The USA has trained Vietnamese staff in the past in the area of nuclear safety and security for the duration of 3 to 6 months. In particular, USNRC provided safety assessment codes and training activities for technical staff to enhance the capability of Viet Nam Agency for Radiation and Nuclear Safety (VARANS) in nuclear safety assessment.

France is developing a framework to accept Vietnamese fellows in the areas of management and radiation safety.

A similar agreement was already implemented with Hungary which allowed for more than two hundred staff to complete education and training in the field of atomic energy.

VARANS has been receiving the support of NRA (Japan), Rostechnadzor (Russia), USNRC, and EC in developing the human resource for regulatory aspects of nuclear power programme. In the field of nuclear safety, bilateral cooperation has been established with Japan and Russia. In addition, VARANS received support from the EC through the VN3.01/09 project on enhancing

the technical capacity of the Regulatory Body and its TSO, which has contributed to the development of regulatory competence in terms of developing safety regulations and internal procedures for the nuclear regulatory body at the phase of site approval and the early phase of construction.

III.2. Human Health

In cooperation with Korea, the design and installation of a 13 MeV KONTRON-13 cyclotron for radioisotopes production and research on accelerator techniques was completed in 2014 at the Ha Noi Irradiation Center (HIC). The licensing process to supply radioisotopes to nuclear medicine departments for diagnostics is pending approval, but it is expected that routine supplies of FDG radioisotopes to end-users would start at the end of 2015.

The World Health Organization (WHO) has been working side-by-side with the Government and development partners in Viet Nam for more than 50 years and played a critical role in disease prevention and control. The Organization has been at the forefront of numerous public health efforts, assisting the government with the elimination of poliomyelitis and neonatal tetanus, devising strategies to combat public health threats and setting standards across a range of public health issues.

III.3. Food and Agriculture

Viet Nam is supported by relevant international agricultural organizations, including the FAO and the IAEA, with the application of radiation technologies in the area of agriculture. Particularly strong support has been received from the IAEA through capacity building activities focused on the application of gamma irradiation for rice and soy bean breeding. In Addition, Viet Nam and the Advanced Radiation Technology Institute (ARTI) in Korea signed a MOU for cooperation in the field of food irradiation and mutation breeding in November 2014 which will significantly strengthen human resource capabilities in the field.

III.4. Partnerships and Resources Mobilisation

In the process of implementation of the TC programme, the IAEA works in close partnership with Viet Nam, United Nations agencies, research organizations and with civil society to maximize the contribution of nuclear science and technology to the achievement of national development priorities. Through agreements and working relationships with partner organizations, the reach of IAEA services is extended and benefits multiplied. The IAEA seeks to continuously develop additional partnerships that will promote a more strategic and holistic approach to overcoming development challenges, to add value to and to leverage synergies for its strategic and programmatic activities

It is imperative that the same spirit of cooperation and collaboration be exercised by Viet Nam to maximize the contribution of nuclear science and technology to the achievement of national development priorities. It will lead to better coordination and optimization of complementary activities to ensure the best possible economic impact of the IAEA's TC Programme.

III.5. The UN One Plan 2012 – 2016 and UN One Plan 2017-2021

The UN One Plan 2012 - 2016 represents the programmatic and operational framework for delivering comprehensive UN support to the Government of Viet Nam over the next five years in support of national development priorities. The UN will work with the Government and people of Viet Nam to ensure a balance between economic, human and sustainable development objectives, directing its efforts to supporting the government in achieving inclusive, equitable, and sustainable growth, access to essential services, social protection, as well as enhanced governance and participation. These three focus areas form the overall conceptual framework for the One Plan 2012 - 2016 and are aligned with the Socio-Economic Development Plan (SEDP) 2011 - 2015. The UN Country Team of Vietnam is currently engaged in the preparation of the UN One Plan 2017-2021 based on the Viet Nam's Sustainable Development (Viet Nam's Agenda 21) that outlines the strategic framework fully considered in the development of this CPF.

FAO's Country Programme Framework:

Priority areas for collaboration with the FAO are selected based on Viet Nam's Socio-Economic Development Strategy (2010 - 2020) and strategic development plans for agriculture, forestry and fishery. The priorities areas of the Programme Framework include support in the areas of food security, food safety and nutrition, as well as environment protection and climate change adaptation, as well as sustainable environmental and groundwater management.

International Fund for Agricultural Development (IFAD):

IFAD's Results-Based Country Strategic Opportunities Programme 2013 - 17 aims to promote the adoption of climate change mitigation and adaptation measures and enhance capabilities in the field.

IV. OVERVIEW OF AGENCY PAST AND PRESENT TC ACTIVITIES IN THE COUNTRY

During the past 10 years, the IAEA provided Viet Nam through the national TC programme approximately USD 7.8 million worth of technical assistance, of which equipment purchase accounts for 44% of expenditure, while expert hiring and training account for about 23% and 28%, respectively. The areas which received the most financial aid are nuclear applications in the field of industry and isotope hydrology (26.8%), followed by human health (15.1%), chemistry and radiochemistry (12.5%), nuclear engineering and technology (11.5%), and agriculture (10.8%). The projects receiving less aid from the Agency are nuclear safety and security (8.6%), atomic energy development (8.5%), as well as radioactive waste management and fuel cycling (5.1%).

IV.1. Food and Agriculture

In the area of agriculture, by implementing the different TC projects, The IAEA supported Viet Nam in building capacity at the Agricultural Genetics Institute the Southern Agricultural Science Institute and the Cuu Long River Delta Rice Research Institute in the area of mutation breeding techniques. The expertise provided resulted in the development and dissemination of high productivity rice and soybean mutant varieties which are adaptable to different climate conditions. These new varieties have significantly contributed to establishing food security in the country since the 1980s. In addition, the release and wide cultivation of rice mutant varieties with improved yield, tolerance to biotic and abiotic stresses, not only significantly increased the production of Vietnamese rice, but also its competitiveness on the global market, hence contributing to both food security and social welfare in Viet Nam. The application of mutation breeding techniques to other crop plants such as peanuts, tomatoes, chrysanthemums, carnations, and gerbera and fruit trees has brought promising results and will be further developed in the near and medium term.

IAEA support also targeted the efficient use of nitrogen fertilizer using Nitrogen-15 for vegetable production which promotes crop growth without causing adverse environmental impacts.

In addition, the IAEA supported Viet Nam in building capabilities for food traceability and food safety control systems through the use of nuclear analytical techniques.

Fruit flies are the most damaging pests for dragon fruit causing loss of fresh fruit export opportunities. To support Viet Nam to expand dragon fruit markets, the IAEA provided Viet Nam with materials, equipment and experts to establish an area-wide management of fruit flies in Binh Thuan province. Several professionals were trained in the use of the Sterile Insect Technique (SIT) as an environmental-friendly technique to suppress insect populations through the application of protein bait spray, Male Annihilation Technique (MAT), and removal of fruit fly host plants. The results showed that in the demonstration site, infestation level reduced to 2.08%, compared to 6.17% in control areas. Farmers will therefore directly benefit from the reduction of the fruit fly populations and related fruit losses as the quality of the fruits both for internal and external markets will subsequently raise. Consumers will also benefit from reduced insecticide residues on fruits and vegetables through the control of fruit flies with environmental friendly techniques such as the SIT.

IV.2. Industrial Applications

The IAEA helped Viet Nam in establishing advanced non-destructive testing (NDT) techniques for inspections of heat exchangers in thermal power plants and to facilitate training of NDT personnel require to ensure the safety of the future nuclear power programme in Viet Nam. More specifically, the IAEA assisted in building a laboratory at the Centre for Non-Destructive Evaluation in Ha Noi (NDE) for the application of non-destructive testing techniques in QA/QC processes aimed at maintaining the safe, stable and efficient operation of thermal power plants. In addition, the IAEA provided assistance for the development of the non-destructive testing laboratory in the Centre for Nuclear Techniques (CNT) in Ho Chi Minh City, which has the ability to implement quality-testing activities such as concrete quality testing for large construction projects, quality assurance and controlling of shipbuilding industry and other heavy industry. The IAEA also collaborated with Viet Nam to establish the Laboratory on Radionuclide Tracer Technique at the Centre for Applications of Nuclear Techniques in Industry (CANTI) in Da Lat, which was created to provide testing services for the industrial sector in Viet Nam.

IV.3. Human Health

In the healthcare sector, IAEA support helped Viet Nam in developing and expanding the network of nuclear medicine departments in hospitals, thereby improving quality and access to medical diagnosis and treatment all over the country. Improved prognosis and patient quality of life are dependent on the introduction of more effective and precise diagnostic techniques of which positron emission tomography (PET) is the most advanced biomedical technique available today in cancer management. This technology was relatively new in Viet Nam creating the need for the establishment of both imaging techniques and quality assurance and control (QA/QC) programmes of two newly established PET centres in Viet Nam. Viet Nam has been additionally supported by the IAEA to train nuclear medicine physicians, radiation oncologists, medical physicists and technicians. In nuclear medicine, many doctors and physicists received fellowships and on-the-job training. In addition, several expert missions aiming at establishing and developing many nuclear medicine and cyclotron centres were implemented throughout the country. For radiation oncology and nuclear medicine, the regional projects (RCA and non-RCA RAS projects) also provided training courses not only for nuclear medicine personnel, but also for radiation oncologists and medical physicists. IAEA support played a very important role to accelerate the application of radiation in medicine.

Viet Nam has been one of the PACT model demonstration sites and was one of the earliest countries to receive an imPACT mission. The mission performed a comprehensive, multi-agency needs assessment of the cancer control system in Viet Nam which identified gaps in the treatment of breast and cervical cancer. IAEA assistance has been provided to develop relevant techniques for breast and cervical cancer for women between 35 - 54 years of age which can be integrated within the existing health care system. The target of the project funded by OFID with 450,000 USD is to screen for 24,000 women in Viet Nam during the period 9/2015 - 6/2016.

IV.4. Environment

The IAEA assisted Viet Nam in establishing nuclear analytical laboratories in Da Lat, Ho Chi Minh City and Ha Noi for environmental monitoring and food safety analysis including the

analysis of toxins in water and food, pesticide residues and natural occurring radioactive materials (NORM) In addition, the IAEA assisted Viet Nam in strengthening capabilities of existing nuclear analytical laboratories to provide analytical services to government agencies in charge of environmental pollution control by estimating natural radionuclides contents resulting from the exploitation of natural resources.

IV.5. Irradiation Facilities

In terms of radiation technology, several irradiation facilities have been established and made operational in Viet Nam with IAEA support. The irradiation facility in Ho Chi Minh City is now operating at its full capacity to sterilize medical instruments, preserve frozen food and exported fruits and treatment materials from the nearby provinces of Ho Chi Minh City. In the North of Viet Nam, the (HIC) received IAEA assistance to upgrade its Co-60 irradiation source provided by the IAEA in the early 1980s to meet the needs for sterilization of medical, food and agricultural products. In addition, the facility is utilized for other applications including radiation-induced modification of marine polysaccharides, treatment of domestic waste and sewage sludge, radiation-induced cross linking of bio-polymers, elimination of pathogens and shelf life extension of frozen seafood.

IV.6. Legal Framework

In order to establish an adequate legal and regulatory infrastructure in Viet Nam, the IAEA trained relevant staff to draft nuclear legislation and regulations and provided expertise on aspects of regulatory control in accordance with IAEA safety standards and security guidance. As a result of this collaboration, the Atomic Energy Law was approved by the National Assembly in 2008. However, the Law does not adequately establish an independent regulatory body, does not clearly delineate regulatory from promotional activities and does not address radioactive waste or spent fuel management. A revision of the Atomic Energy Law is therefore being prepared to address these issues and is planned to be submitted for ratification to the National Assembly in 2016. Legislative assistance may be requested from the Agency to support Viet Nam in establishing a comprehensive legal framework through the Agency's Legislative Assistance Programme.

IV.7. Nuclear Power

In the area of Nuclear Power infrastructure capacity building, the IAEA contributed to the development of significant institutional capacity in nuclear power project management, technical capacity building, site characterization and evaluation as well as the strengthening of the safety and regulatory infrastructure.

Studies and evaluations, based on available documents and a site survey, were used to identify satisfactory sites for constructing nuclear installations. Assistance was provided for site determination by establishing the required capabilities for evaluating and verifying reports on site determination activities for the new research reactor and nuclear power plant.

In addition, the IAEA supported in evaluating the status of nuclear power infrastructure in Viet Nam through INIR Missions and by providing expertise and training for staff to enhance

competencies in the following areas of project management, human resource development, public information and stakeholder involvement, grid-NPP interaction, site characteristics and nuclear safety. In addition, equipment procured by the IAEA includes a server and a PC Based Nuclear Power training simulator.

INIR Missions

The second INIR mission was conducted from 5 to 14 December 2012 in Ha Noi and evaluated the status of development of nuclear power infrastructure and progress made towards achieving the IAEA milestones. The mission noted that Viet Nam made notable progress since the 2009 INIR Mission, but that considerable work remains to be done before completing Phase 2. Accordingly, the INIR team outlined 42 recommendations for further actions in seven key areas including legislation, regulatory framework, human resource development, management systems, funding and financing, spent fuel and radioactive waste, as well as emergency preparedness and response.

The 2014 INIR follow up Mission concluded that Viet Nam continues to make progress on the development of national nuclear power infrastructure and completed 6 of the recommendations made by the 2012 INIR mission. However, the other 36 recommendations require further work.

Integrated Work Plan

In 2011 Viet Nam and the IAEA developed and adopted an Integrated Work Plan (IWP) for the development of Nuclear Power Infrastructure covering the period 2010-2015. The IWP has been a useful tool for planning, prioritizing, integrating and coordinating technical assistance to Viet Nam and has been updated and revised regularly to reflect changes, challenges and evolving priorities. The IWP integrates all TC Projects related to nuclear power infrastructure, as well as relevant Vietnamese stakeholders participating in the nuclear power programme (regulatory body, government agencies, utility, R&D organization, etc.) and various technical departments and divisions at the IAEA. During the design process, the activities of IWP are established on the basis of the IAEA's nuclear infrastructure evaluation methodology taking into account Viet Nam's practical circumstances. The Viet Nam Atomic Energy Agency (VAEA) is the main focal point in developing and implementing the IWP. In March 2015, the IAEA and Viet Nam reviewed the progress made and achievements from IWP 2011-2015; both sides have agreed on the IWP 2016-2020.

IV.8. Nuclear Safety and Security

The VARANS was established in 2003 to ensure the safety of all nuclear installations in the country. However, as most of its staff have limited experience in the field and are faced with insufficient technical infrastructure, VARANS is struggling to meet the increasing demands in the field of nuclear safety. In particular as Viet Nam is now considering the construction of both a research reactor and a nuclear power plant, VARANS requires qualified staff, supported by appropriate technical infrastructure, to effectively fulfil its assigned functions. IAEA assistance is required to train human resource capacities to support regulatory activities and to establish an independent regulatory body capable of leading safety assessments, licensing and inspection processes. This has been underlined by the IRRS–Follow-up Mission in 2014 whose findings

stressed that the regulatory body should develop the action plan to make progress on the effective independence of regulatory body, the licensing responsibility, inspection and emergency preparedness and response. Especially, it is required to develop a competent agency in radiation and nuclear safety, and issues related to staffing, funding and technical competence have to be adequately addressed.

Moreover, VARANS needs support to build its infrastructure, including computer codes and nuclear data libraries used for nuclear safety analysis and assessment, and needs to be equipped with reference material for staff training, nuclear safety analysis and assessment.

IV.9. Research Reactor

The Da Lat Nuclear Research Reactor (DNRR) was reconstructed from the TRIGA Mark II reactor built in 1963 with a nominal power of 250 kW. In 1975 all fuel elements of the TRIGA reactor were dismounted and removed, which effectively caused the reactor to stop its operation. Reconstruction of the reactor with a high operating power of 500 kW was accomplished with Russian technological assistance. The new reactor reached its planned nominal power of 500 kW for the first time in February 1984. With IAEA support, the first renovation of the Instrument and Control (I&C) system, including the upgrading of instrumentation, computerization of reactor data storage and the procurement of spare parts was successfully performed. In addition, the establishment of a QA/QC management system for analytical laboratories has been implemented and Highly Enriched Uranium (HEU) to Low Enriched Uranium (LEU) fuel conversion successfully accomplished with support from the IAEA, USA and Russian Federation (RF). All LEU working cores using 92 Fuel Assemblies (FAs) were launched on 14 December 2011 and by July, 2013 all FAs from DNRR were shipped back safely to the RF.

To support the CNEST project which has a new research reactor as main equipment, IAEA dispatched experts for site selection for the new research reactor in March, 2015.

V. ENVISIONED COUNTRY PROGRAMME OUTLINE

The high priority areas for technical cooperation with IAEA have been identified following a thorough intensive consultations and study of what nuclear science and technology can contribute to the achievement of national development objectives set forth by the Government of Viet Nam in its Plans for period of 2016-2021.

For effective implementation of the CPF, through active participation in the formulation of future development assistance frameworks, efforts will be made to identify programmatic linkages with other UN Agencies, that have a lead mandate in areas such as food and agriculture and health (FAO and WHO) and explore the idea of possible joint programming with other UN Agencies.

Based on the results and experience gained from previous TC projects carried out under the CPF (2010-2015), the cooperation activities under this CPF will focus on the following priority areas: i) Nuclear power infrastructure building, including nuclear safety, security and safeguards; Nuclear regulatory infrastructure; Emergency preparedness and response; TSO capacity development; Human resource development, etc. ii) Human health; iii) Food and Agriculture; iv) Radiation safety and radioactive waste management; v) Applications of radioisotope, radiation technology; vi) Environment protection.

V.1. The Near Term Programme

V.1.1. Nuclear power

Nuclear power infrastructure

Viet Nam and the IAEA jointly developed and implemented the Integrated Work Plan for Developing Nuclear Power Infrastructure in Viet Nam (IWP). The INIR Mission in 2012 concluded that Viet Nam had significant work to do in order to complete Phase 2 activities, and made recommendations and suggestions to assist Viet Nam in making further progress, by focusing on seven key areas such as i) Legislation, ii) Regulatory framework, iii) Human Resource Development, iv) Management systems, v) Funding and financing, vi) Spent fuel and radioactive waste, and vii) Emergency preparedness. In December 2014, the Prime Minister of Viet Nam approved the Master Plan for the development of nuclear power infrastructure up to 2020 [15], which includes 12 approved projects/tasks and additional 19 new projects/tasks to be developed for implementation by relevant ministries, organizations in order to fulfill the requirements of implementation of the Ninh Thuan Nuclear Power Project. The objective of the Master Plan is to develop comprehensively the national nuclear power infrastructure in accordance with IAEA's guidance and Viet Nam's condition, meeting requirements for implementing the Ninh Thuan NPP safely, secured and effectively. For the near term, the IAEA is expected to continue supporting Viet Nam in developing nuclear power infrastructure through TC Projects proposed by VAEA.

Integrated Work Plan (IWP)

Viet Nam and the IAEA jointly developed the IWP 2016-2020 with 10 priority areas for cooperation. The IAEA is expected to continue assisting Viet Nam through national and regional TC projects to achieve the objectives set by the IWP 2016-2020 aimed at enhancing competences

of ministries and organizations in supporting the development of nuclear power infrastructure. Priorities for cooperation until 2020 include strengthening the legal and regulatory framework, supporting human resource development and infrastructure capacity building, as well as establishing public information and communication strategies. In addition, IAEA support is required to establish a national strategy for radioactive waste and spent fuel management, sustainable financing, safety and security, as well as emergency preparedness and response, engineering procurement and construction as well as grid connection. The assistance is expected to be provided by way of expert missions, review missions, consultancies, scientific visits, fellowships, training courses and the provision of materials.

Nuclear Regulatory Infrastructure

In order to ensure the safety of nuclear power plants at all stages, it is necessary to promulgate adequate regulatory documents, standards and technical regulations, processes and procedures for licensing the site, design, construction, commissioning, operation, decommissioning, and releasing from regulatory control, and building an independent technical support organization capable of analyzing, verifying and assessing nuclear safety. Development of an adequate infrastructure for nuclear safety is one of the highest priorities for Viet Nam in the coming years. Therefore, international experience exchange through IAEA support is highly important for Viet Nam.

Technical assistance is needed to strengthen Viet Nam's national legislative framework in all aspects of safety, security and safeguards. Legislative assistance may be provided to Viet Nam to enhance the awareness of policy-makers on the importance of ratifying said legal instruments. In particular, it may avail itself of the regional project supporting the provision of legislative assistance to enhance Viet Nam's legal framework, in view of aligning it with IAEA Safety Standards and relevant international legal instruments adopted under the Agency's auspices.

Additionally, IAEA assistance is required to strengthen the regulatory infrastructure of Viet Nam for the establishment of an independent regulatory entity which will be responsible for all regulatory functions including that of licensing, authorization and inspection. The regulatory body will implement regulatory functions such as authorization of facilities and activities using radiation sources, including authorization for import and export of radiation sources. The regulatory body will also establish and implement an inspection system to verify compliance with regulatory requirements and conditions of authorization, as well as an enforcement policy and procedures in response to non-compliance with regulatory requirements. These measures will significantly facilitate the physical protection and security of nuclear materials ensuring the safe and secure handling, usage, transportation and storage of radioactive materials in the country.

Emergency preparedness and response (EPR)

In enhancing capabilities in the field of emergency preparedness and response, Viet Nam has issued important legal documents. Viet Nam National Committee for Search and Rescue (VINASARCOM) is responsible for all emergencies, including nuclear and radiological emergencies. For nuclear and radiological emergency at national level, Viet Nam has been developing draft National Nuclear and Radiological Emergency Plan (NNREP) to define clearly responsibilities of relevant organizations such as National Commander Committee

(NACOMDER), VINASARCOM, MOST, the functions of the National Emergency Center, Off-site Emergency Center and other response centers. The NNREP will be put up for approval by the end of 2015 or early 2016 by the Prime Minister. At the same time, Ministry of Defense is preparing a capacity building plan to be submitted for approval by the Prime Minister in 2016. For enhancing capabilities in supporting emergency response in the country, Viet Nam has cooperated with international organizations and development countries in providing diverse training courses for relevant organizations in the field of emergency response.

For the near term, the priority is to improve the ability of first responders to recognize radiological emergency, take action and response. Moreover, there is a need to enhance capabilities for all relevant organizations on preparedness and response for nuclear and radiological emergencies including equipment and trainings. In particular VARANS lacks capabilities to judge the acceptability of onsite emergency response plans which remains critical in view of the introduction of the country's first nuclear power plant. Therefore, the IAEA is expected to provide assistance to enhance the capabilities for on-site EPR arrangements during siting, construction and commissioning which can include utilizing bio-monitoring strategies.

Viet Nam is also establishing national radiological environmental monitoring and warning networks with the purposes of establishing environment protection capabilities and supporting emergency response activities. The successful implementation of environmental monitoring techniques will not only improve public understanding of existing levels of radiation, but enable the government to better implement public health policies and react to potential nuclear emergencies.

Technical Support Organisations' Capacity Development

TSOs are organizations established to provide specialized support in various areas including research and development, engineering, law, safety inspections, seismic assessment and qualification walk downs, design changes and reviews, maintenance, emission monitoring and testing. In addition, TSOs are expected to provide expertise, professional output, independent technical or scientific advice, competent judgment, services and assistance to utilities. The term TSO is also used to indicate an independent specialized support organization to regulatory authority.

In order to establish the first nuclear power programme in Viet Nam, it is a critical to establish and build the capacities of the Technical Support Organizations (TSOs) for construction, commissioning and operational activities. The provision of effective TSOs is essential to optimize the safe operation of nuclear power plants and to maximize their availability and productivity which was again demonstrated in the reviews that followed the Fukushima accident.

At present VARANS and EVN both have plans to develop their own technical support resources. Recognizing the importance of enhancing technical capacity for safety assessment for NPPs, much attention has been paid to the training of human resource, implemented through multilateral and bilateral collaboration with the IAEA, EC, Japan, Russia, and the USA. The training programs focus on issues of safety for internal TSOs, such as site characterization, safety analysis, PSA, dose estimation and measurements of radioactive dispersion in air and water. Viet

Nam needs to contract international consultants to support VARANS and EVN to evaluate the Safety Analysis Report and FS approval phases. IAEA support is therefore essential to define the role and responsibilities of the TSO.

The establishment of a Technical Support Center for nuclear security and safeguards under VARANS is necessary to verify/evaluate and inspect the physical security for protection systems of nuclear power plants. It is envisioned that this Center would serve multiple purposes: 1) providing technical support for regulatory activities relating to nuclear security and safeguards; 2) providing training for staff, other relevant agencies such as the Customs and Ministry of Public Security, and facilities in nuclear security in general and detection and response as well as equipment maintenance in particular; 3) as safeguards laboratory (some equipment used for security can also be used for safeguards purposes). Addition, VARANS plans to establish a nuclear forensics laboratory within the Center.

Human resource development

Growing attention is being paid by the Government of Viet Nam to the human resource development in the field of atomic energy as it plays a significant role in a successful nuclear power project. The Vietnamese Government approved the National Project on Training and Human Resource Development in the Field of Atomic Energy in 2010 elaborating the national human resource development strategy for nuclear energy. The focus is on generating graduates for governmental organizations, regulatory bodies, and the utility to work for the future nuclear power programme. In 2013, the Prime Minister also approved the EVN's project "Human resource training for Nuclear Power Plant Projects in Ninh Thuan Province", under this project EVN is in charge of implementing domestic and overseas training for staff after recruitment and implementing non-degree education (technician). In addition, the Draft Plan for training specialists of governmental agencies, R&D and technical support organizations for nuclear power development up to 2020 to be approved by the Prime Minister in 2015 will be coordinated by the MOST.

Under this CPF, the IAEA is expected to assist Viet Nam in developing human resource capacities by supporting key stakeholders in developing and evaluating nuclear power infrastructure, enhancing competence in safety assessment and management systems, as well as licensing processes. In addition, IAEA assistance is required in the area of legislative assistance and the establishment of technical standards, as well as to guide local industrial involvement, and develop capabilities for emergency preparedness and response. With reference to the above areas, building national competences for the application of the Systematic Approach to Training (SAT), as well as establishing competences for the utilization of SACRoN to assess the capacities and design appropriate training programmes for the development of core competences for staff, is essential. Support is expected to be provided through activities aimed at reviewing and upgrading the nuclear educational curriculum in universities, acquiring equipment and materials for nuclear education and training, establishing laboratory facilities for teaching and training of trainers, as well as providing expertise in designing training programmes for state management organizations, regulatory bodies, TSO and the utility. Activities may include sending international experts as lecturers for training courses organized in Viet Nam, providing scholarships for overseas fellowships and scientific visits, as well as provide assistance for Vietnamese participation in relevant regional events.

In the area of nuclear security, Viet Nam's updated INSSP also addresses the need for human resource capacity development to successfully ensure the development of security and contingency plans, the detection and recovery of both radioactive sources and nuclear material, as well as the development of physical protection capabilities for nuclear facilities and the public.

Public information and communication

Public information and communication is essential for the successful introduction of nuclear power, especially after the Fukushima Daiichi accident. This is reflected by the Prime Minister of Viet Nam's 2013 approval of the project on public information and communication for nuclear power development which aims to establish an adequate level of awareness and understanding of the benefits of nuclear power in ensuring energy security and socio-economic development of the country. Emphasis is placed on demonstrating that requirements on safety and security are met, in which is believed to improve public acceptance for the implementation of the Ninh Thuan Nuclear Power Project. Organizations involved in the implementation of the project include the Ministry of Science and Technology, the Ministry of Industry and Trade, the Ministry of Education and Training, the Ministry of Information and Communications, Viet Nam Electricity, Viet Nam Television, Voice of Viet Nam, Viet Nam News Agency, Ninh Thuan province, Ha Noi, and Ho Chi Minh City.

Under this CPF, Viet Nam would like to request the support of the IAEA (in establishing the Center for Nuclear Information and Consulting, which will organize public information and communication activities to promote nuclear applications and energy as a whole and public acceptance of specific projects including the Ninh Thuan NP and CNEST projects. In addition, the IAEA will provide training to enhance competences of relevant staff in charge of public information and communication activities by conducting training courses, fellowships, scientific visits, meetings and providing relevant tools and materials.

V.1.2. Human health

Although significant capabilities were developed through previous assistance projects in the field, rapid technological developments and increasing demands for radiation medicine require continued support from the IAEA. The country still suffers from a lack of qualified personnel, including radiation oncologists and medical physicists and lacks experience in the use of advanced techniques for diagnosis and treatment. To meet this national demand and the goals of Master Plan on Application Development of Ionizing Radiation in Health Care up to 2020, IAEA assistance is required to train physicians in nuclear medicine, radiation oncology, radiology and medical physics by focusing on modern techniques such as MSCT, PET/CT, Cyclotron, Gamma Knife, Cyber Knife and IMRT. In addition, training for the application of quality assurance protocols is essential to ensure occupational and medical exposure control. Lastly, IAEA assistance is also required to establish emergency medical centers for nuclear and radiological emergencies.

In Viet Nam there is no training programme for education and training of medical physicists, who play an important role in the application of the radiation and nuclear techniques in diagnosis and

treatment, especially in the departments of radiation therapy. They are also pivotal for the implementation of new equipment and advanced techniques. Currently, there is a lack of accredited medical physicists in radiation therapy, nuclear medicine and diagnostic radiology departments. In order to meet this shortage of medical physicists, the Government is planning to establish a training program in medical physics to expand human resource for the application of radiation in medicine. To aid the development and enhance the quality of nuclear medicine, Viet Nam will need to develop a training programme and this will require IAEA assistance in the development of the curriculum.

V.1.3. Food and Agriculture

Mutation Breeding

Viet Nam is planning to build an irradiation facility to facilitate crop mutation breeding. This will facilitate the development of quality crops, with high yields and nutritional content, as well as tolerant to pests and diseases, and adaptable to climate change. In this context, there is a plan to establish the Center for Radiation Plant Breeding (CRPB) with irradiation facilities, biotechnology equipment and trained human resource. In addition, there will be at least one modern Irradiation Breeding Center at Agricultural Genetics Institute (AGI) by the year 2018. Mutation breeding of rice as well as soybeans, peanuts, chrysanthemum, tomato and fruit trees will be encouraged to create new varieties resistant to climate change.

Food Safety

Food irradiation technologies will be also developed to quarantine harmful insects, pests and diseases, as well as to pasteurize, sterilize and reduce microbial contamination for food safety and food security. The IAEA is expected to support this programme by providing advisory assistance, guidance, training and dedicated equipment, including specific assistance to help establish and operate facility for mutation plant breeding in Viet Nam.

Given the importance of food exports to the economy, the continued development of food safety and traceability systems are important. Continued support from IAEA to ensure the transfer and application of isotopic techniques to underpin food control systems is expected, as well as support to establish a network of irradiation facilities for treatment of export commodities to ensure acceptance by host countries.

In view of the excessive application of nitrogen (N) fertilizer, which not only causes environmental pollution, but also threatens human health, IAEA assistance is required to utilize N-15 techniques to assess the pathways of N fertilizer and to quantify greenhouse gasses to develop improved soil, water and fertilizer management practices with the aim of improving food safety of vegetable products.

Soil Management

Similarly, support from the IAEA is required to develop best management practices for improving soil fertility via sequestering more carbon from the atmosphere and enhancing soil resilience to climate change and variability to help mitigate soil erosion through the use of ^{13}C and fallout radionuclides which can help assess soil content and establish whether organic matter and essential plant nutrients are missing from it. This will significantly help Viet Nam in promoting food security by maximizing agricultural output.

Insect and Pest Management

With initial success in area-wide management of fruit flies on dragon fruit and potential subsequent mass-rearing of *Bactrocera* fruit fly populations, Viet Nam will develop capabilities to apply the SIT for area-wide insect pest management (AW-IPM). In the near-term IAEA support will help establish SIT capabilities to address the fruit fly problem, and support its integration into an AW-IPM system. In particular, Viet Nam requires technical advice and training from IAEA experts, as well as support with the development of adequate infrastructure. The IAEA will therefore also support Viet Nam with the preparation of bankable documents to solicit resources from international development agencies such as the European Union (EU) and Asian Development Bank (ADB).

IAEA support could also be used to enhance capabilities for food traceability and authenticity as well as food irradiation (benefiting areas such as the fruits e.g. the dragon fruit). Additional support can be obtained to promote best practices such as but not limited to, comprehensive education and training for food inspection, regular/systematic information gathering and dissemination including rapid alert food and feed systems.

V.2. The Medium Term Programme

Regarding the Medium Term Programme, in the cooperation with the IAEA, the Government of Viet Nam will continue to give priorities to nuclear power and energy security, agriculture and human health, which were described in Near Term Programme. In the near term these activities will continue with expanded duration or the formulation of new projects.

V.2.1. Radiation safety and radioactive waste management

Emergency Preparedness and Response

Viet Nam has been developing a comprehensive legal and regulatory framework for safety and security of radiation facilities, radioactive sources and radioactive waste. However, in the medium term, Viet Nam will continue to develop and enhance national standards and codes on radiation protection, environmental radiation monitoring, radioactive dispersion modeling and emergency response issues.

The country will continue to strengthen its emergency preparedness and response capacity by strengthening high quality radiation safety laboratories and both the operating and offsite emergency response centers. Viet Nam will furthermore continue to construct and improve the national radioactive environmental monitoring and warning network to enhance the capability of the regulatory body by enhancing staff competence, promoting coordination between relevant organizations, reviewing existing regulation, procedures and guidelines and by promoting on-the job training for all inspectors.

Radiation Safety

The INST (VINATOM) developed a Secondary Standard Dosimeters Laboratory (SSDL) to ensure radiation safety in the country. However, a better technical infrastructure is required to comply with the requirements of a nuclear power programme. Therefore, upgrading the existing

SSDL facility, as well as developing capabilities in the field of neutron calibration, is essential for the medium term. In addition, Viet Nam should also enhance the capability of the regulatory body to manage testing and calibration procedures for facilities providing calibration services in the field of nuclear applications.

There are two nationally accredited dosimetry services, which are appropriately equipped and staffed to carry out radiation protection activities. The only method currently available for internal dosimetry is bioassay of biological (urine) samples. The monitoring programme is established in a co-operative way between the licensee and the service provider. The regulatory requirements for dosimetry services dictate adherence to IAEA RS-G-1.3, but Viet Nam reported an incomplete coverage of occupationally exposed persons in the areas of radiology (75%), as well as analytical services (50%) and mineral extraction and processing (25%). Viet Nam reported that no workers involved in nuclear medicine are currently covered. The country has also reported inability to provide internal dosimetry services in North Viet Nam.

Viet Nam appears to consider a number of the elements in RS G-1.2 *Assessment of Occupational Exposure Due to Intakes of Radionuclides* in the establishment of a program for internal dosimetry. This program is however in a developmental stage and the service coverage is limited. Viet Nam requires IAEA assistance in the development of internal dosimetry capability.

Radioactive Waste Management

Regarding radioactive waste management, there are at present two dedicated radioactive waste storage facilities in Viet Nam. One is at the Nuclear Research Institute in Da Lat and the other at the Institute for Technology of Radioactive and Rare Elements (ITRRE) in Ha Noi. The stored radioactive waste comprises of waste from the operation of the research reactor and its radioisotope production activities, as well as from the use of radioactive materials for medical, industrial and research purposes. Although VINATOM centralized interim storage facilities of radioactive waste, the investigation for long term storage options, including borehole facilities, is ongoing. Site characterization studies have been initiated by the Government.

However, the study on planning the national radioactive waste storage and disposal location has been initiated. Particularly, the draft Prime Minister's Decision on national policy on nuclear fuel cycle, management of radioactive waste and spent fuel is being prepared by VINATOM and provides the policy guideline for the management of radioactive waste and spent fuel.

The IAEA is expected to continue supporting Viet Nam for the planning and development of radioactive waste management facilities through the provision of equipment for specialized laboratories and by building capacity for the handling and processing of both radioactive waste and spent fuel.

V.2.2. Applications of radioisotope, radiation technology in industry, environment and water resource

Viet Nam will continue developing and expanding the application of NDT, nucleonic gauge, NCS, sealed source and radiotracer techniques, as well as facilitate the establishment of commercial irradiation facilities. Much emphasis will be given to developing the application of nuclear techniques in the petroleum industries, mineral exploration and exploitation, industrial processes, as well as water resource management and waste treatment.

The design and exploitation of a new research reactor (including the suitable core, hot cells and related facilities) is essential to ensure that enough radioisotopes are available in Viet Nam and neighboring countries for application in medicine and industry. In order to achieve the targets, IAEA assistance is required to strengthen the competency of R&D. The expected assistance will include guidance, human capacity building activities and provision of dedicated equipment. It will also assist relevant national institutions to develop and implement strategic action plans to enhance sustainability and credibility.

Viet Nam will consider designing projects on radiation processing for the TC Cycle 2018-2019.

V.2.3. Environment protection and management

With a steady growth of the population and industrial activities, it is expected that these changes will affect the environment. It is therefore important to develop the application of isotope tracer techniques for the monitoring of the marine environment. Viet Nam is developing a medium-term plan to establish an environmental research laboratory responsible of mapping coastal concentrations of pollutants such as heavy metal, organic contaminants, pesticides, nutrients and radionuclides. This will allow the authorities to assess the impacts of industrialization and urbanization on the environment through the application of isotopic techniques. Based on these studies, remediation methodologies could be developed for affected areas as deemed appropriate by the country.

The establishment of a national environmental monitoring network is particularly crucial to monitor the safe operation of the nuclear power programme. The National network will be built and operated by MOST to receive data of environmental radiation monitoring stations located in provinces which will be providing information on the levels of background exposures in Viet Nam. The IAEA is expected to continue its assistance to Viet Nam, including human resource development, provision of documents, guidance as well as equipment for the establishment of a network of laboratories including a Marine Environmental Laboratory. In the medium term, particular attention will be paid to the establishment of the national environmental monitoring network.

V.3. General Support Activities

V.3.1. Regional/Inter-regional Projects

In addition to the national TC programme, the Vietnamese Government gives importance to its participation in the RCA and non-RCA regional projects. This additional support will complement the assistance foreseen under the national projects with the particular aim to maximize the utilization of the national nuclear institutions and expertise, enhance the quality of nuclear services provided by these institutions and pave the way to accreditation.

With regard to food and agriculture, food safety and trade are a regional and global concern and countries need to establish partnerships to implement international standards including those associated with Codex Aliment Arius referenced by the WTO. Viet Nam could therefore benefit from a newly proposed IAEA non-agreement RAS2014018 project "Enhancing Food Safety

Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants" (2016 - 2019). Viet Nam could also benefit from a newly proposed interregional project INT2014004 "Improving food safety by creating an interregional network that produces reliable scientific data through nuclear and isotopic techniques due to commence 2016.

IAEA assistance is also expected to support efforts to develop human resource, including education in nuclear science and technology, as well as nuclear power engineering. At the same time, special efforts will be made to develop and promote a harmonized curriculum for national teaching institutions, utilizing innovative tools and methodologies, such as e-learning and Information Communication Technologies (ICT). Moreover, specific assistance will be provided to relevant nuclear institutions in Ha Noi, Da Lat and Ho Chi Minh City to enable them to develop and implement Strategic/Plans to enhance their sustainability.

This CPF will also promote, to the fullest possible, the utilization of available nuclear infrastructure to accompany the socio-economic development of the country by integrating nuclear techniques into national development programmes. Given the accumulated experience and expertise by some national Vietnamese institutions in the field of nuclear science and technology, Viet Nam will be prepared to offer assistance to other developing countries in the region, particularly by hosting trainees and training courses, as well as by providing experts and nuclear facilities for the implementation of IAEA activities.

V.3.2. Research and Development

Coordinated Research Project

Vietnamese research institutions are active participants in the IAEA Coordinated Research Activities (CRA). Currently Vietnamese institutions have signed 17 research contracts with the IAEA in the fields of food and agriculture, human health, isotope hydrology, radiation technology, and energy economy environment analysis.

While not all Coordinated Research Projects (CRPs) lead to TC projects, the two are complementary. CRPs offer Viet Nam the ability to develop cutting edge technologies and to undertake research in nuclear techniques through collaboration between their respective research institutions and IAEA experts. By advancing national knowledge and expertise in a particular field, Viet Nam is better equipped to carry out TC projects. This moves scientific research and development out of the laboratory and into the field, allowing the IAEA to help Viet Nam implement new methodologies expediently, thus ensuring that country and its populations benefit promptly from the application of new scientific discoveries.

V.3.3. Environment Protection

Participation of selected laboratory in the IAEA coordinated ALMERA network could provide assistance and training for environmental radioactivity measurement and emergency preparedness and response.

V.3.4. New Research Reactor

The Pre-FS of the CNEST Project has been submitted to Prime Minister for approval and is expected to be approved by the end of 2015. A new multi-purpose and high capacity research reactor will serve the nuclear power programme, promote the application of nuclear science and technology, and train staff for employment in the nuclear sector.

To ensure the efficient construction and utilization of CNEST, human resource and expert consultation are highly needed. In this context, IAEA assistance for training of project management staff, technical experts, and specialists for nuclear R&D organizations, will be essential. Integrated Research Reactor Infrastructure Assessment (IRRIA) mission experts will assess existing capacities and guide future action aimed at developing the capacities of the research reactor.

V.3.5. Other activities

In order to promote activities in the field of atomic energy, Viet Nam organized many important events, such as the International Exhibition on Nuclear Energy, National Conference on Nuclear Science and Technology, and National Regulatory Conference... The IAEA is expected to support and participate in the events.

Annex 1: Compilation of International Legal Instruments to which Viet Nam is a party

	Title	In Force	Status
P&I	Agreement on the Privileges and Immunities of the IAEA	1969-07-31	acceptance: 1969-07-31
CPPNM	Convention on the Physical Protection of Nuclear Material	2012-11-03	accession: 2012-10-04
CPPNME	Amendment to the Convention on the Physical Protection of Nuclear Material		ratification: 2012-11-03
NOT	Convention on Early Notification of a Nuclear Accident	1987-10-30	accession: 1987-09-29
ASSIST	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	1987-10-30	accession: 1987-09-29
NS	Convention on Nuclear Safety	2010-07-15	accession: 2010-04-16
RADW	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	2014-01-07	accession: 2013-10-09
RSA	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA)	1983-05-01	Signature: 1983-05-01
RCA	Fifth Agreement to Extend the 1987 Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA)	2012-06-18	acceptance: 2012-06-18
SA	Agreement between the Socialist Republic of Viet Nam and the IAEA for the application of safeguards in connection with the NPT	1990-02	
AP	Protocol Additional to the Agreement between the Socialist Republic of Viet Nam and the IAEA for the Application of Safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons	2012-9	
PVC	Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage		Non-Party
SUPP	Convention on Supplementary Compensation for Nuclear Damage		Non-Party
JP	Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention		Non-Party
VC	Vienna Convention on Civil Liability for Nuclear Damage		Non-Party
VC/OP	Optional Protocol Concerning the Compulsory Settlement of Disputes		Non-Party

Annex 2: List of Current TC Projects with Viet Nam

Active National Projects (10)

Project Number	Title	Field	1st Year of approval
VIE1009	Applying Digital Industrial Radiography for Inspection of Materials with High Thickness and Density	18	2014
VIE2010	Developing Nuclear Power Infrastructure - Phase II	05	2012
VIE2011	Enhancing the Capability of Uranium and Related Atomic Mineral Exploration for Nuclear Energy	07	2012
VIE2012	Developing Nuclear Power Infrastructure (Phase III)	05	2014
VIE5017	Supporting Area-Wide Integrated Pest Management to Improve the Quality of Fruit for Export	23	2012
VIE5018	Adapting Rice-Based Cropping Systems to the Impact of Climate Change by Nuclear Mutation Breeding and Improving Nitrogen Use Efficiency Using Nitrogen-15 for Vegetables in Main Growing Areas	20	2014
VIE6025	Upgrading the Standard Dosimetry and Nuclear Safety Laboratories of the Institute for Nuclear Science and Technology (INST)	29	2012
VIE6027	Consolidating Human Resource Capacity in Nuclear Medicine for Improving Cancer Management with Positron Emission Tomography/Computed Tomography and Novel Cyclotron Production	27	2014
VIE9014	Developing a Nuclear Safety Infrastructure for the First Nuclear Power Plant	10	2012
VIE9015	Strengthening the National Infrastructure and Capacity for Regulating the First Nuclear Power Programme safety Regulatory Body	11	2014

Active Regional/Interregional Projects (60)

RAS0064	Supporting Nuclear Education and Training through e-Learning and Other Means of Advanced Information Communication Technology (ICT)	2012	01	Active
RAS0065	Supporting Sustainability and Networking of National Nuclear Institutions in Asia and the Pacific Region	2012	01	Active
RAS0068	Enhancing the Management of the Regional Agreement and Programme (RCA)	2014	01	Active
RAS0069	Reviewing the Country and Regional Programme	2014	01	Active
RAS0070	Providing Pre-Project Assistance	2014	01	Active
RAS0071	Providing Legislative Assistance on Establishing and Upgrading the Legal Framework for Safe, Secure and Peaceful Use of Nuclear Energy	2014	03	Active
RAS0073	Supporting Human Resource Development and Nuclear Technology	2014	01	Active
RAS1014	Supporting Radiation Processing for the Development of Advanced Grafted Materials for Industrial Applications and Environmental Preservation	2012	18	Active
RAS1019	Enhancing Safety and Utilization of Research Reactors	2012	08	Active
RAS1020	Building Capacity for Applications of Advanced Non-Destructive Evaluation Technologies for Enhancing Industrial Productivity (RCA)	2014	18	Active
RAS2016	Supporting decision making for nuclear power planning and development - Phase II	2012	05	Active
RAS5055	Improving Soil Fertility, Land Productivity and Land Degradation Mitigation	2012	21	Active

RAS5056	Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change	2012	20	Active
RAS5060	Supporting Early Warning, Response and Control of Transboundary Animal Diseases	2012	22	Active
RAS5061	Supporting Food Irradiation Technology to Ensure the Safety and Quality of Meals for Immunocompromised Patients and Other Target Groups	2012	24	Active
RAS5062	Building Technological Capacity for Food Traceability and Food Safety Control Systems through the Use of Nuclear Analytical Techniques	2012	24	Active
RAS5064	Enhancing Productivity of Locally-underused Crops through Dissemination of Mutated Germplasm and Evaluation of Soil, Nutrient and Water Management Practices	2012	20	Active
RAS5065	Supporting Climate-Proofing Rice Production Systems (CRIPS) Based on Nuclear Applications	2012	20	Active
RAS5067	Integrating Sterile Insect Technique for Better Cost-Effectiveness of Area-Wide Fruit Fly Pest Management Programmes in Southeast Asia	2014	23	Active
RAS5069	Complementing Conventional Approaches with Nuclear Techniques towards Flood Risk Mitigation and Post-Flood Rehabilitation Efforts in Asia	2014	21	Active
RAS5070	Developing Bioenergy Crops to Optimize Marginal Land Productivity through Mutation Breeding and Related Techniques (RCA)	2014	20	Active
RAS5071	Strengthening Adaptive Climate Change Strategies for Food Security through the use of Food Irradiation (RCA)	2014	24	Active
RAS6053	Improving Image Based Radiation Therapy for Common Cancers in the RCA Region (RCA)	2009	6C	Active
RAS6062	Supporting 3D Image-Guided Brachytherapy Services	2012	26	Active
RAS6065	Strengthening the Application of Stereotactic Body Radiation Therapy to Improve Cancer Treatment	2012	26	Active
RAS6070	Supporting Quality Assurance Team for Radiation Oncology (QUATRO) Training	2012	29	Active
RAS6071	Strengthening Radionuclide Therapy for High Impact Cancer Treatment Strategy in Member States of the Regional Cooperative Agreement (RCA)	2014	27	Active
RAS6072	Strengthening Intensity Modulated Radiation Therapy Capability in the Region (RCA)	2014	26	Active
RAS6073	Using Stable Isotope Techniques to Monitor Situations and Interventions for Promoting Infant and Young Child Nutrition	2014	30	Active
RAS6074	Improving Quality of Life of Cancer Patients through Streamlined and Emerging Therapeutic Nuclear Medicine Techniques	2014	27	Active
RAS6075	Optimizing the Role of Nuclear Medicine Techniques in the Diagnosis and Clinical Management of Childhood Cancer and Inborn Diseases	2014	27	Active
RAS6076	Improving Cancer Management Through Strengthening the Computed Tomography Cancer Staging Process (RCA)	2014	27	Active
RAS6077	Strengthening the Effectiveness and Extent of Medical Physics Education and Training (RCA)	2014	29	Active
RAS6079	Strengthening Hybrid Imaging in Nuclear Medicine in Asia	2014	27	Active
RAS6080	Preventing Overweight and Obesity, and Promoting Physical Activity among Children and Adolescents	2014	30	Active
RAS7021	Marine benchmark study on the possible impact of the Fukushima radioactive releases in the Asia-Pacific Region	2011	7A 7F 7L 7M 7N	Active
RAS7022	Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resource Management	2012	15	Active
RAS7023	Supporting Sustainable Air Pollution Monitoring Using Nuclear Analytical Technology	2012	17	Active
RAS7024	Supporting Nuclear and Isotopic Techniques to Assess Climate Change for Sustainable Marine Ecosystem Management	2012	17	Active
RAS7026	Supporting the Use of Receptor Binding Assay (RBA) to Reduce the Adverse	2014	17	Active

	Impacts of Harmful Algal Toxins on Seafood Safety			
RAS9061	Strengthening Regional Nuclear Regulatory Authorities and Safety Culture	2012	10	Active
RAS9062	Promoting and Maintaining Regulatory Infrastructures for the Control of Radiation Sources	2012	09	Active
RAS9063	Providing Legislative Assistance	2012	03	Active
RAS9064	Strengthening the Transfer of Experience Related to Occupational Radiation Protection in the Nuclear Industry and Other Applications Involving Ionizing Radiation	2012	12	Active
RAS9065	Strengthening Radiation Protection of Patients in Medical Exposure	2012	12	Active
RAS9066	Strengthening Education and Training Infrastructure and Building Competence in Radiation Safety	2012	09	Active
RAS9067	Strengthening an Effective Compliance Assurance Regime for the Transport of Radioactive Material	2012	13	Active
RAS9068	Strengthening and Harmonizing National Capabilities for Response to Nuclear and Radiological Emergencies	2012	16	Active
RAS9069	Harmonizing Approaches and Measures for Radiation Protection of the Public and the Environment in Line with the International Safety Standards	2012	19	Active
RAS9071	Establishing a Radioactive Waste Management Infrastructure	2012	19	Active
RAS9073	Strengthening the Regulatory Infrastructure for Radiation, Transport and Waste Safety	2014	09	Active
RAS9074	Enhancing and Strengthening National Regulatory Infrastructure for Safety through Self-Assessment	2014	09	Active
RAS9075	Strengthening Radiation Protection Infrastructure and Technical Capabilities for the Safety of Workers, Patients and the Public	2014	12	Active
RAS9076	Strengthening of National Capabilities for Response to Nuclear and Radiological Emergencies	2014	16	Active
INT1056	Supporting Non-Highly Enriched Uranium (HEU) Molybdenum-99 Production Capacity for Nuclear Medicine Applications)	2012	08	Active
INT2013	Supporting nuclear power infrastructure capacity building in Member States introducing and expanding nuclear power	2012	05	Active
INT2014	Supporting Member States to Evaluate Nuclear Reactor Technology for Near-Term Deployment	2012	06	Active
INT9174	Connecting Networks for Enhanced Communication and Training	2012	19	Active
INT9175	Promoting safe and efficient clean-up of radioactively contaminated facilities and sites	2012	19	Active

National Projects Awaiting Financing (Footnote a/) (1)

Project Number	Title	Field	1st Year of approval
VIE6028	Upgrading the Standard Dosimetry Laboratories of the Institute for Nuclear Science and Technology(Not Funded)	29	2014

Regional/Interregional Projects Awaiting Financing (Footnote a) (1)

Project Number	Title	Field	1st Year of approval
RAS9072	Supporting Human Resource Development in Nuclear Security (Not Funded)	14	2014
INT9181	Building Capacity and Supporting Self-Evaluation of Capacity Building Activities on Safety in Member States with Nuclear Power Plants and Those That Are Thinking of Embarking on Nuclear Power Programmes (Not Funded)	11	2014

Newly proposed projects (beginning 2016)

RAS5078: "Enhancing Food Safety Laboratory Capabilities and Establishing a Network in Asia to Control Veterinary Drug Residues and Related Chemical Contaminants"

INT5154: "Improving food safety by creating an interregional network that produces reliable scientific data through nuclear and isotopic techniques"

Annex 3: Plan of Action

CPF Referenced Planning Opportunities (Project ideas)	Proposed Action	Responsibility for Action	Expected Output	Time Frame	Resource Requirements	Project Number
1	Strengthening the Nuclear Power Infrastructure of Viet Nam	- Coordinator: VAEA - Involved organization: EVN, VARANS, VINATOM, MOC.	1. Training plan developed in some key areas such as assessment of nuclear infrastructure, safety analysis, EIA, QA&QC in civil engineering management system, legislation, spent fuel and radioactive waste. Staff trained using simulator. 2. Public acceptance of nuclear power development maintained and enhanced; 3. Enhanced human capability in industrial involvement, environmental management, QA/QC in civil engineering, emergency preparedness and response, legal framework, nuclear fuel cycle and radioactive waste management; 4. EVN's Management competency enhanced and detailed workforce plan for NPP construction developed.	2016-2017	1. From IAEA: - Training programmes, expert missions, Scientific visit, fellowship, equipment. - Guidelines, technical standards. 2. From Viet Nam side: - Utilization of laboratory facilities of VINATOM, VARANS, universities, utilities and PC-based Simulator sponsored by IAEA - Indicative budget from the Government will be determined at the later stage.	VIE2013
2	Enhancing the National Nuclear Regulatory Infrastructure for effective regulatory oversight of the construction phase of the first nuclear power plant (NPP)	- VARANS	1. Enhanced in-house capability to develop safety regulations and guides for effective supervision of nuclear installations including research reactors and NPPs; 2. Enhanced capability of staff to perform regulatory activities in the construction phase of first NPPs; 3. Enhanced inspection capability in the construction phase of first NPPs and new RR, as well as the existing radiation facilities.	2016-2017	1. From IAEA: - Training programmes, expert missions, equipment; - Guidelines, technical standards. 2. From Viet Nam side: - Utilization of existing resources of VARANS including laboratories and facilities; - Indicative budget from the Government will be determined at the later stage.	VIE9017

3	Promoting Reactor Safety Development Programme	- VINATOM	1. Report on Viet Nam Current R&D status and infrastructure supporting VNPP; 2. Long-term national R&D plan for time period of 2018-2030 focusing on reactor safety development (strategically), including Recommendation for Vietnamese Government in nuclear power safety R&D; 3. Established HRD plan for the RSDP development; 4. Mechanism for networking and coordinating reactor safety research activities is in place.	2016-2017	1. From IAEA: - Training programmes, expert missions, equipment. - Guidelines, technical standards related to nuclear safety. 2. From Viet Nam side: - Utilization of laboratory facilities of INST,NDE,ITRRE, NRI and NARIME - Estimated budget from the Government: 500,000 USD	VIE9016
4	Radiation Therapy Planning for the Treatment of Cancers Based on Hybrid PET/CT Images	- Cho Ray Hospital; - Tran Hung Dao General Hospital; - Hospital 175 - Bach Mai Hospital	1. Enhanced Human Resource in Nuclear Medicine and Radiation Oncology and increased knowledge in hybrid imaging and its use for Radiation Therapy Planning; 2. Cancer patients indicated to perform hybrid imaging and treated by radiotherapy with PET/CT based RTP; 3. Guidelines and protocols on application of PET/CT in radiotherapy planning developed.	2016-1017	1. From IAEA: - Training programmes, expert missions, equipment. 2. From Viet Nam side: - Utilization of nuclear medicine departments, radiotherapy facilities of the hospitals; - Estimated budget from the Government: 2,000,000 USD	VIE6029
5	Integration of the Sterile Insect Technique with other suppression methods for control of Bactrocera Fruit Flies in dragon fruit production in Binh Thuan province of Viet Nam	- Plant Protection Research Institute (PPRI); - Southern Fruit Research Institute (SOFRI); - VINATOM.	1. Improving capacity of identification, mass rearing and quality control of fruit flies; 2. Establish an area -wide integrated control of fruit flies programme on dragon fruit production area.	2016 -2017	1. From IAEA: - Training programmes, expert missions, equipment. 2. From Viet Nam side: - Utilization of laboratories of PPRI, SOFRI and VINATOM; - Establishment of the facility; - Estimated budget from the Government: 400,000 USD.	VIE5021
6	Enhancing	- Agricultural	1. Established irradiation facilities and	2016 -2017	1. From IAEA:	VIE5020

	capacity for research and applications of nuclear techniques in plant breeding in Viet Nam	Genetics Institute (AGI) - Concerned stakeholder agencies.	laboratory equipment for mutation plant breeding by radiation; 2. Training human resource on nuclear security and mutation plant breeding; 3. A new gene bank with of mutant lines of rice, soybean, chrysanthemum and gerbera added in Viet Nam.		- Training programmes, expert missions, equipment and training materials. 2. From Viet Nam side: - Utilization of laboratories and training facilities of VINATOM and universities; - Estimated budget from the Government: 500,000 USD.	
7.	Application of nuclear related techniques for Transboundary Animal Diseases (TADs) diagnosis in Viet Nam	- National Center for Veterinary Diagnosis (NCVD); ...	1. Improved laboratory infrastructure; 2. Development and application of relevant nuclear techniques; 3. Enhanced knowledge of TADs, including the infection, prevalence etc.	2016 - 2017	1. From IAEA: - Training programmes, expert missions, equipment. 2. From Viet Nam side: - Utilization of laboratories of NCVD and Regional Animal Health Offices (RAHO) for nuclear related techniques; - Estimated budget from the Government: 100,000 USD.	VIE5019

Annex 4: Resource Estimates and Forecasts
Country Programme 2016-2021

			US$
	These figures should be based on a historical reference figure from past approved national programmes (annual average of previous TC Programme Cycles from 2005- 2015), as an indicative planning figure for the period of coverage.		**$1,000,000**
Estimated government in-kind contribution for the planning period Estimated government in-kind contribution for the programme period			$ 500,000 $ 12,000,000
1	**Total estimated resources Government**		**$12,500,000**
2	Preliminary estimates for the agreed programme/projects reflected in the CPF		
		Title	
	(i)	Strengthening the Nuclear Power Infrastructure of Viet Nam	$1,582,860
	(ii)	Enhancing the National Nuclear Regulatory Infrastructure for effective regulatory oversight of the construction phase of the first nuclear power plant (NPP)	$1,185,000
	(iii)	Promoting Reactor Safety Development Programme	$385,500.00
	(iv)	Human Health Radiation Therapy Planning for the Treatment of Cancers Based on Hybrid PET/CT Images	$375,220
	(v)	Food and Agriculture (Insect Pest Control) Integration of the Sterile Insect Technique with other suppression methods for control of Bactrocera Fruit Flies in dragon fruit production in Binh Thuan province of Viet Nam	$1,148,790
	(vi)	Food and Agriculture: Crop Improvement and Soil Management: Enhancing capacity for research and applications of nuclear techniques in plant breeding in Viet Nam	$385,500
	(vii)	Food and Agriculture: Livestock Production and Health Application of nuclear related techniques for Transboundary Animal Diseases (TADs) diagnosis in Viet Nam	$387,130
	(viii)	Radiation safety and radioactive waste management	$200,000
	(ix)	Applications of radioisotope, radiation technology in industry, environment and water resource	$200,000
	(x)	Environment protection	$150,000
2	**Total estimated costs IAEA**		**$6,000,000**
3	**Estimated grand total financial requirements**		**$18,500,000**

Annex 5: List of Resource Institutions

The Ministry of Science and Technology (MOST)

MOST performs functions of State management on Science and Technology, including Science and Technology activities; development of Science and Technology potentials; intellectual property; standards, metrology and quality control; atomic energy, radiation and nuclear safety; and State management on public services in fields under the Ministry's management as stipulated by law.

Viet Nam Atomic Energy Agency (VAEA)

VAEA, a government agency under MOST was established in 2010. VAEA is in charge of advising and assisting the Minister of MOST in implementing the state management for research, application and development activities of atomic energy nationwide, and performing public and technical services in accordance with the Agency's management functions.

VAEA has responsibility and is authorized to perform some main tasks as follows: (i) develop the draft strategies, plan, long-term, five-year and annual plans, mechanisms, policies, projects on research on, application, development of atomic energy; legal documents, standards, technical regulations, procedures, techno-economic norms on research, application, development activities and services supporting atomic energy application; (ii)conduct statistical survey, assessment and analyze the human resource need in atomic energy field; develop and organize the implementation of the plan for developing human resource in nuclear energy field; to conduct and organize the performance of the activities in nuclear knowledge management; (iii) organize the assessment of, suggest the plan and solution and co-organize in carrying out the plan of national nuclear power infrastructure development; (iv) guide, organize to implement the program, plan on public information, communication for nuclear power development, radiation and radioisotope application development in techno-economic sectors; coordinate the implementation of the projects on public information for nuclear power development of the Ministry of Science and Technology; (v) organize the implementation of the international cooperation activities for the development, application of atomic energy; to participate in studying, suggesting the signing, accession in, implementation of the international treaties, conventions, agreements in atomic energy field.

VAEA is the standing agency of (i) the National Atomic Energy Council, taking responsibility for assisting the Council in preparing for the working programme, plan of the Council and for ensuring the physical infrastructure for the activities of the Council, and (ii) the Sub-Committee for Education, Training,. Public Information and Communication, under the State Steering Committee for Ninh Thuan Nuclear Power Project.

Viet Nam Agency for Radiation and Nuclear Safety (VARANS)

VARANS is under MOST and has the responsibility and authorities to develop draft legal documents on radiation safety and nuclear safety; organize registration of radioactive sources, radiation devices, nuclear material, nuclear equipment, and to license for conducting radiation activities in accordance with its competency, conduct and organize verification on radiation safety and nuclear safety, carry out inspection, checking; to handle violations against regulations on radiation and nuclear safety; and to suspend radiation activities in accordance with its competency; to recommend to the relevant State competent authority to suspend research reactor, nuclear power plant operation if suspecting there is unsafe element. In addition, VARANS is also responsible for international safeguards related activities, emergency response to radiation and nuclear incidents within its competency: establishing and maintaining the national

information system on radiation safety and nuclear safety; to organize and cooperate for professional trainings on radiation safety and nuclear safety, and carry out international cooperation activities in radiation and nuclear safety.

VARANS also utilizes external support from other domestic organizations in fulfilling its tasks. In phases of site and FS approval, VARANS is being provided with expertise from the VINATOM, the Institute of Geosciences and Mineral Resources (MONRE), Center on earthquake information and tsunami warning, Institute of Geophysics (Viet Nam Academy of Science and Technology), Institute of Geology (Viet Nam Academy of Science and Technology), Geological Department (University of Mining and Geology), Faculty of Hydrology, Meteorology and Oceanography (University of Sciences, Viet Nam National University) Seismic Division, Institute of Geophysics (Viet Nam Academy of Science and Technology).

Viet Nam Atomic Energy Institute (VINATOM)

VINATOM is a governmental scientific organization under MOST, for Research and Development in atomic energy, applications of nuclear techniques and radiation technology for the socio-economic development in the country, and serves as a Technical Support Organization for nuclear power programme, particularly in the areas of quality control, safety, environment protection, education and training, etc. It has several constituent institutes/centers for activities in various areas of interest:

- Institute for Nuclear Science and Technology (INST), Ha Noi
- Institute for Technology of Radioactive Rare Earths (ITRRE), Ha Noi
- Nuclear Research Institute (NRI), Da Lat
- Center for Nuclear Techniques in Ho Chi Minh City (CNT), Ho Chi Minh
- Research and Development Center for Radiation Technology in Ho Chi Minh City (VINAGAMMA)
- Ha Noi Irradiation Center (HIC), Ha Noi
- Center for Application of Nuclear Techniques in Industry (CANTI), Da Lat
- Center for Non-Destructive Evaluation (CNE), Ha Noi
- Nuclear Training Center (NTC), Ha Noi

The Viet Nam Academy of Agricultural Sciences (VAAS)

VAAS has a long and prestigious history and a proud scientific reputation. It originated in 1952 as the Institute of Crop Production. Since then it has undergone a series of name changes and amalgamations becoming the Institute of Agriculture and Forestry Research in 1955, the Institute of Crop Production Research in 1957, the Academy of Agriculture and Forestry Research in 1958, the Institute of Agricultural Sciences in 1963 and the Viet Nam Agricultural Sciences Institute in 1978. On 9th September 2005 the Academy took its present name.

The mandate of VAAS is to provide a comprehensive vision, strategic direction and oversight of agriculture R&D programs; conduct basic and applied research and to foster the transfer of new technologies; and provide post-graduate and professional training. Its main activities include Genetic resource conservation of plants, animals and micro-organisms, Plant and animal breeding and genetics, Agricultural biotechnology, Soil science, Plant and animal nutrition, Plant protection and animal health, Agricultural environment and ecology, Climate change mitigation and adaptation, Agrarian and farming systems, Food safety, Integrated farming technology, Rural development, Technology transfer and extension, and Post-graduate training and capacity building

National Center for Veterinary Diagnosis, Department of Animal Health

NCVD of the Department of Animal Health (DAH), Ministry of Agriculture and Rural Development (MARD) has several functions and mandates such as (i) Diagnosing diseases of the terretial and aquatic animals; (ii) Research and/orparticipation in research in veterinary diseases and in controlling of animal diseases; (iii) Quality evaluation of locally produced and imported vaccines and diagnostic kits for veterinary use, (iv) Organizing and/or participating in technical training courses for the veterinarians working at the district veterinary stations or at provincial veterinary laboratories; Besides the routine diagnostic work, NCVD actively participates in research, training in animal diseases and technical service contracts with animal holders. The NCVD carries out numerous research projects of the national and ministerial level and contributes actively to diversified activities of the internationally cooperation projects managed by the DAH. Currently, the NCVD carries out surveillance of the Foot and Mouth Disease (FMD), the Classical Swine Fever (CSF) and post-vaccination monitoring of the H5N1 Avian Influenza (AI) and FMD; and quality control of vaccines against AI, FMD and avian coccidiosis...

The Plant Protection Research Institute (PPRI)

PPRI was established in 1968 by the Government and re-organized in 2006. It has the mandate to (i) Study and transfer science and technology in terms of diagnosis, identification of plant pests, natural enemies and their biology, ecology; plant quarantine objects and pesticides, (ii) Conducting field trials of pesticides, (iii) Carrying out activities in agro-forestry extension related to plant protection, (iv) Collaborating with international organizations in research, technological transfer, information exchange, education and training human resource; (v) Contracting with organizations/businesses on research and technical development, testing new techniques; and (vi) Study, development and commercialization of products.

Entomology Division, Plant Protection Research Institute

Entomology Division, of the Plant Protection Research Institute, has the mandate to (i) Studies on biology, ecology of insect pests, their prediction and control measures based on the principles of integrated pest management (including insects and mites). (ii) Selection of insect resistant crop varieties. (iii) Assessment of crop losses by insect pests; the technical, economic, social and environmental impacts of scientific and technological control measures. (iv) Preservation and identification of insect and mite specimens on various crops, and (v) Training and transferring advanced technologies in insect pest management: National and international cooperation in related fields.

Agricultural Genetics Institute (AGI)

AGI was established in 1984 (as the Department for Genetics, under the National Center of Natural Science and Technology) and it was reorganized in 2005.AGI is the national institute, under the Viet Nam Academy of Agricultural Sciences (VAAS), commissioned to carry out research and application on agricultural biotechnology, mutation breeding, conventional breeding and technology transfer. It is assigned to build up the strategies, projects, planning of scientific research and technology transfer in the field of genetics and biotechnology in long term period, 5 year period or yearly for the purpose of socio – economic development, to propose to competent authorities and implementing organization, (ii) implement scientific research & technology transfer in the fields of: a) Variation & Genetic rule at the level of molecule, cell, individuals, population on crops and micro-organisms; b) Application of Nano& recombinant DNA technologies to analyze plant genomic; c) Application of genetic & Biotechnology methods to diversify genetic resources, to create primary materials for selecting and breeding of crops and micro-organism; d) Development & application of Bioinformatics to build up genomic database of crops

and micro-organism as: gene map, gene sequence, gene function, genetically modified crops, genetically modified products, and Application of technology solution to protect agricultural biology environment, biological diversification and biotechnology.

It is also responsible for implementation of technology transfer, agricultural encouragement in genetic and biotechnology fields, international cooperation on scientific research, expert cooperation, human resource training in genetic & agricultural biotechnology fields with foreign organizations and individuals, linkages and cooperation of scientific research and technology development, new techniques test, and human resource training in assigned fields with local organizations, etc.

National Center for Animal Diagnosis (NCAD)

The Veterinary Diagnosis Division was established in Ha Noi in 1953 and reorganized as the National Center for Veterinary Diagnosis (NCVD). The NCVD has been recognized as a leading veterinary diagnostic laboratory in Viet Nam. The NCVD has five scientific sections including Pathology-Parasitology, Biology-Toxicology-Immunology, Bacteriology, Virology, Aquatic sections.