Instrument for Nuclear Safety Cooperation

Evaluation of the Instrument for Nuclear Safety Cooperation 2014-2020

Expert Facility for the Instrument for Nuclear Safety Cooperation

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EXPERT FACILITY FOR THE INSTRUMENT FOR NUCLEAR SAFETY COOPERATION

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EXECUTIVE SUMMARY

This report contains a review of the status of cooperation provided under the Instrument for Nuclear Safety Cooperation for the period from the beginning of 2014 until the end of 2020 (INSC-II). It sets out an evaluation, as of June 2021, of its actual and expected outcomes for, and impact on, partner countries or regions; *inter alia*, it is intended to inform or underpin the report the European Commission is required to submit to the European Parliament and Council on the implementation of the Instrument.

The Regulation establishing the Instrument, the strategy for its implementation, and the two multi-annual indicative programmes set out the priorities for the Instrument; more specific implementation plans are described in annual action programmes. These have been reviewed in this report. However, while some projects in INSC-II have been completed, most are ongoing and some have yet to be contracted. A definitive and comprehensive review and evaluation of the whole of INSC-II would need to await completion of all approved cooperation projects.

The **objectives** of cooperation are: the promotion of an effective nuclear safety culture and implementation of the highest nuclear safety and radiation protection standards; the responsible and safe management of spent fuel and radioactive waste; and the establishment of frameworks and methodologies for the application of efficient and effective safeguards for nuclear material. The more significant **criteria and priorities** applying to cooperation are that: cooperation may cover all third countries worldwide; priority should be given to cooperation with EU pre-accession countries and countries in the European Neighbourhood area; and countries should fully subscribe to the principles of non-proliferation and be parties to relevant Conventions within the framework of IAEA, or have taken steps demonstrating a firm undertaking to accede to such Conventions.

The report builds on the findings of an external Mid-Term Review (MTR) of INSC-II, carried out as part of a broader, common evaluation of the EU's nine External Financing Instruments over the period 2014-2017. The MTR of INSC-II focused on the evaluation of the mechanisms and processes of the Instrument and its fitness for purpose. The current report considers measures that have been taken in response to recommendations made in the MTR, and assesses the continuing validity of its main findings in the light of further information now available, but focuses more on the scope, content and impact of the cooperation under INSC-II as well as its efficiency and effectiveness.

As well as the findings of the MTR, the current evaluation has been further informed by the following:

- a review of programme and project documentation
- a review of external evaluations carried out on one or another element of the programme since, or in parallel with, the mid-term review
- interviews with key players in the formulation, implementation and monitoring of the Instrument
- responses from partner countries to a questionnaire on the impact or outcomes of the cooperation, in particular what use they had made, or expect to make, of the project outputs.

The evaluation has found that implementation of the Instrument has been successfully achieved. The specific objectives of the Instrument are well aligned with EU policies and priorities and are relevant to partners' needs and priorities. It is effective in enhancing radiation and nuclear safety and safeguards and bringing operations in partner countries worldwide into line with best European/international standards and practice. It operates efficiently using mechanisms and resources generally appropriate to support the delivery of outputs. It fosters unique added value to engagement in nuclear safety cooperation with third countries, well beyond the capacities of Member States and other donors. It supports leveraging of both political engagement and financial resources for the nuclear safety sector. Internal coherence and complementarity of actions are ensured through the adopted mechanisms and management processes. Cooperation has been successfully established with a large number of countries and several regions, the budget has been committed, and significant improvements have been made in enhancing nuclear safety, waste management and safeguards.

Perhaps **the greatest achievement** that occurred during the period of INSC-II, but which was the culmination of support under previous programmes as well as under INSC-II and which involved many other donors within the international community, was the completion of the construction of the Chernobyl New Safe Confinement in 2019. This has contributed significantly to making the site of the world's worst nuclear disaster environmentally safe. Other major achievements include: the considerable cooperation with Iran in the context of the Joint Comprehensive Plan of Action, which has strengthened the regulatory authority in Iran in discharging its responsibilities and enhanced the capabilities of safeguards inspection; the development of a strategic master plan for remediation of uranium legacy sites in Central Asia and the establishment of an EBRD account to support its implementation which is well underway; support for carrying out 'stress tests' and responding to their outcomes; and the Training and Tutoring programme that has met with widespread support and trained thousands of individuals from regulatory organisations and their TSOs in best practice in nuclear safety, radioactive waste management and safeguards.

Other significant impacts of cooperation include: improved arrangements for emergency preparedness and response supported by early warning monitoring and decision support systems in several countries and regions; and improved management of radioactive wastes in several countries, particularly pre-accession and neighbourhood countries.

The Instrument and its implementation have therefore fulfilled its objectives. Nevertheless, implementation and outcomes could be improved. **Recommendations for improving cooperation in the future** include:

- Ensuring the availability of sufficient human resources. The continued successes of the Instrument and the considerable added value and political leverage that it provides are being put at risk because sufficient human resources are not being provided to support it, both in INTPA and EEAS. This was a conclusion of the mid-term review and the situation has not improved since, rather the contrary. The resources within INTPA are barely sufficient to fulfil the core functions of project contracting and follow up. Other important, but less essential, activities for the effective implementation of the Instrument (e.g., quality, visibility, engagement with other actors in the European Commission and beyond, continuing improvement, etc.) have, as a consequence, been neglected or given less attention than they merit. This is not sustainable and must be remedied in the transition to the new European Instrument for International Nuclear Safety Cooperation (hereinafter denoted INSC-III).

  INTPA has also had to assume greater responsibility for policy matters than in the past, adding to the pressures on resources. Either INTPA should be given the resources necessary to carry out both policy and operational functions effectively, or, preferably, a clear separation should be restored between the development by EEAS of policy for, and implementation by INTPA of, the Instrument. In the latter case, EEAS would need increased and knowledgeable resources to fulfil its designated role and responsibilities.

- Reducing the times between requests for cooperation and project implementation/completion. These times are long (sometimes as long as 10 years) and are a serious impediment to the effectiveness of cooperation and how it is perceived by partner countries. Such long timescales are not compatible with criteria in the Regulation such as "intervention at the appropriate moment" when considering cooperation with countries wishing to develop nuclear generating capacity. The increase in the 'time to contract' in INSC-II, despite efforts to reduce it, provides compelling evidence in support of the judgement that the resources for implementing the Instrument within INTPA are insufficient. Further efforts need to be made to reduce the 'time to contract' significantly. At the same time, partner countries need to be aware of the timescales involved so that they are better able align their needs and priorities with realistic time periods for implementation.

- Reviewing the best location for the Instrument within the European Commission. Consideration should be given to whether the Instrument could be located elsewhere where the necessary resources, of sufficient quality and quantity, can be provided, greater synergies can be

exploited, and where the profile of the Instrument may be further enhanced, not least at a political or policy level (e.g., within the Service for Foreign Policy Instruments (FPI), in DG ENER, etc). A careful analysis should be carried out of the pros and cons of the potential options.

- Role of JRC. The JRC provides essential technical support to INTPA in the implementation of the Instrument, the need for which is expected to increase in the future with the larger budget of INSC-III. It has also carried out a number of INSC projects in areas where it has particular expertise. Despite assurances by JRC that it will have the capacity and capabilities to service INTPA's future requirements, doubts remain over whether it will be able to provide the requisite expertise in the regulation of nuclear safety and/or carry out projects where it has unique competence. INTPA should, therefore, consider: firstly, building greater resilience into how it accesses technical support in future (e.g., complementing the support provided by JRC by making greater use of external expertise and that available elsewhere within the European Commission); and, secondly, using JRC to carry out projects only where it has demonstrable capacity to do so and where it has given firm assurances that its resources will be deployed for such purposes.

- Ensuring cooperation with Ukraine is sustainable. Cooperation with Ukraine, by far the largest recipient of support from the INSC, has been ongoing for almost three decades and has made a major contribution to addressing the challenges faced in the aftermath of the Chernobyl accident and as a result of the break-up of the former Soviet Union. Questions arise, however, over the sustainability of the outcomes of the cooperation and how effectively they are being exploited more widely. Future cooperation is likely to be more effective if it is strategically focused with the aim of achieving 'self-sufficiency' in the next five to ten years, in terms of both achieving high standards of nuclear safety and addressing legacy waste management issues, including ensuring the sustainability of the major Chernobyl projects. Greater engagement by the European Commission at a political level with relevant Ministers in Ukraine will be instrumental in this respect.

- Working with IAEA. Institutional arrangements for achieving effective cooperation with IAEA are in place and should be maintained. However, implementation, by IAEA, of INSC projects should be limited to activities where IAEA has unique expertise or capabilities (e.g., in safeguards), or where they are demonstrably able to bring added value to the process and/or achieve outcomes in a more cost-effective manner. Greater use of IAEA (and other international organisations, e.g., ISTC, STCU, EBRD) reduces resource needs in INTPA but not overall; more importantly it decreases control, visibility and flexibility.

- Evaluating use made of ISTC and STCU. Increasing use over time has been made of ISTC and STCU to implement INSC projects. While these arrangements appear to be working well, it would be prudent to carry out an evaluation of projects implemented by ISTC and STCU at an appropriate time, in particular to establish strengths and weaknesses, opportunities for improvement, and where the organisations can be best used in future.

- Cooperation with NPP operators. Consideration should be given to increasing cooperation on enhancing nuclear safety culture with those organisations that design, construct and operate nuclear installations, given their responsibility for nuclear safety and its achievement and that major accidents in the past resulted mainly from design deficiencies and/or poor safety culture. Such cooperation, if properly targeted and delivered (e.g., to avoid distorting competition), would make more effective and efficient use of resources available for enhancing nuclear safety.

LIST OF ACRONYMS

Acronym	Meaning
AAP	Annual Action Programme
ABAC	Information system for control/follow-up of accounting and financial transactions
AD	Action Document
AFCONE	The African Commission on Nuclear Energy
AIDCO	EuropeAid Cooperation Office (in the EC)
AM	Armenia
AMSSNuR	Moroccan Agency for Nuclear and Radiological Safety and Security
ANNETTE	Advanced Networking for Nuclear Education and Training and Transfer of Expertise
ANPP	Armenian Nuclear Power Plant
ANRA	Armenian Nuclear Regulatory Authority
ANRS	Agency of Nuclear and Radiation Safety (in Georgia)
AOSA	Armenian On-Site Assistance programme
ARGOS	Decision Support System for crisis and emergency management
ASEAN	Association of South East Asian Nations
ASEAN-RDEP	ASEAN Radiation Data Exchange Platform
ASEANTOM	ASEAN Network of Regulatory Bodies on Atomic Energy
BA	Bosnia and Herzegovina
BelNPP	Belarusian Nuclear Power Plant
BEPU	Best Estimate Plus Uncertainty
BNPP	Bushehr Nuclear Power Plant
BSS	Basic Safety Standards
BY	Belarus
CAP1400	1400 MWe PWR developed in China based on the Westinghouse AP1000 PWR
CBRN	Chemical, Biological, Radiological and Nuclear
CERWM	Central Enterprise for Radioactive Waste Management
CGULS	Coordination Group for Uranium Legacy Sites
ChEZ	Chernobyl Exclusion Zone
ChNPP	Chernobyl Nuclear Power Plant
CIAE	China Institute of Atomic Energy
CIR	Common Implementing Regulation
CIS	Commonwealth of Independent States
CN	China
CNS	Convention on Nuclear Safety
CONNECT	Online platform for enhanced communication and training on RWM
CRIS	Information system supporting the management of external actions (in the EC)
CSF	Chernobyl Shelter Fund (of EBRD)
DEVCO	DG for International Development and Cooperation (in the EC)
DG	Directorate General (of the EC)
DRWM	Department for Radioactive Waste Management (in Georgia)
DSS	Decision Support System
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECURIE	European Community Urgent Radiological Information Exchange
ECVET	European Credit System for Vocational Education and Training
EEAS	European External Action Service
EFI	External Financing Instrument
EIA	Environmental Impact Assessment

ENEN	European Nuclear Education Network
ENER	Energy (DG of EC)
ENSREG	European Nuclear Safety Regulators Group
ENSTTI	European Nuclear Safety Training and Tutoring Initiative
EP&R	Emergency Preparedness and Response
EPREV	Emergency Preparedness Review Service (of IAEA)
ERA	Environmental Remediation Account (of EBRD)
ERC	Emergency Response Centre
ESARDA	European Safeguards Research and Development Association
ETSON	European Technical Safety Organisations Network
EU	European Union
EURDEP	EU Radiological Data Exchange Platform
EWRMN	Early Warning Radiation Monitoring Network
F1	Unit in INTPA for "Climate Change and Sustainable Energy; Nuclear Safety"
FA	Financial Agreement
FAFA	Financial and Administrative Framework Agreement
FORO	Ibero-American Forum of Radiological and Nuclear Regulatory Agencies
FPI	Service for Foreign Policy Instruments (DG of EC)
FSAR	Final Safety Analysis Report
G7	Inter-governmental political forum comprising Canada, France, Germany, Italy, Japan, UK and the US
GAEC	Ghana Atomic Energy Commission
GAN	Gosatomnadzor (Department on Nuclear and Radiation Safety) within MES
GCC	Gulf Cooperation Council
GCC-RDEP	Gulf Cooperation Council Radiation Data Exchange Platform
GE	Georgia
GH	Ghana
HERCA	Heads of the European Radiological protection Competent Authorities
HLW	High Level Waste
IAEA	International Atomic Energy Agency
IcSP	Instrument contributing to Stability and Peace
IEC	International Electrotechnical Commission
INIR	Integrated Nuclear Infrastructure Review (of IAEA)
INRA	Iranian Nuclear Regulatory Authority
INSC	Instrument for Nuclear Safety Cooperation
INSC-I	INSC 2007-2013
INSC-II	INSC 2014-2020
INSC-III	European Instrument for International Nuclear Safety Cooperation
INSSP	Integrated Nuclear Security Support Plan (of IAEA)
INTPA	International Partnerships (DG of EC)
IPA	Instrument for Pre-Accession Assistance
IPPAS	International Physical Protection Advisory Service (of IAEA)
IQ	Iraq
IR	Iran
IRRS	Integrated Regulatory Review Service (of IAEA)
IRWA	Iran Radioactive Waste Management Company
ISF-2	Interim nuclear Fuel Storage Facility (ISF-2)
ISSAS	International SSAC Advisory Service (of IAEA)
ISTC	International Science and Technology Centre

ITER-Consult	Independent Technical Evaluation and Review
JC	Joint Convention (Safety of Spent Fuel and Radioactive Waste Management)
JCPoA	Joint Comprehensive Plan of Action
JRC	Joint Research Centre (of EC)
JRODOS	Java version of RODOS
JSO	Joint Support Office (in Kiev)
KIT	Karlsruhe Institute of Technology
LBLOCA	Large Break Loss of Coolant Accident
LRTP	Liquid Radwaste Treatment Plant
LTE	Life Time Extension
LUHS	Loss of Ultimate Heat Sink
MC	Multi-country
MD	Moldova
MECI	Ministry of Energy and the Coal Industry (in Ukraine)
MENR	Ministry of Environment and Natural Resources (in Ukraine)
MES	Ministry of Emergency Situations (in Belarus)
MIP	Multi-annual Indicative Programme
MO	Morocco
MoST	Ministry of Science and Technology
MoU	Memorandum of Understanding
MTI	Ministry for Territorial Administration and Infrastructure (in Armenia)
NDK	Nükleer Düzenleme Kurumu (Turkish nuclear regulatory authority)
NE	Nuclear Energy (Department of IAEA)
NEAR	European Neighbourhood Policy and Enlargement Negotiations (DG of EC)
NEMMS	Non-EU Mediterranean Member States
NNEGC	National Nuclear Energy Generating Company of Ukraine (Energoatom)
NNSA	National Nuclear Safety Administration (of China)
NPP	Nuclear Power Plant
NRA	National Regulatory Authority (of Ghana)
NRSC	Nuclear and Radiation Safety Centre
NRWMPS	National Radioactive Waste Management Policy and Strategy (of Iran)
NSA	Nuclear Safety Account (of EBRD)
NSC	National Safety and Radiation Centre (of China)
NSC	New Safe Confinement (at Chernobyl)
NSC	Nuclear Safety Centre (Iran)
NSS	Nuclear Safety and Security (Department of IAEA)
NSSG	Nuclear Safety and Security Group (of G8)
NSTC	Nuclear Security Technology Centre (in China)
NÜTED	Nükleer Teknik Destek Anonim Şirketi (a TSO of NDK)
OECD	Organisation for Economic Cooperation and Development
OJT	On the Job Training
OSART	Operational Safety Review Team (of IAEA)
PChP	Prydniprovskiy Chemical Plant
PCNFS	Nuclear Facilities of Serbia
PHARE	Poland and Hungary: Assistance for Restructuring their Economies (extended subsequently to all 10 countries in Central and Eastern Europe
PSA	Probabilistic Safety Analysis
PSAR	Probabilistic Safety Analysis Report
R6	Unit in INTPA for “Finance and Contracts for Centralised Operations”

R&D	Research and Development
RA	Regulatory Authority
Radon	State Corporation Ukrainian State Association “Radon”
RCF	Regulatory Cooperation Forum
RDEP	Radiation Data Exchange Platform
REG	Regional
RELEX	DG for External Relations (in the EC)
RODOS	Real-time On-line DecisiOn Support system
ROM	Results Oriented Monitoring
Rosatom	Russian State Atomic Energy Corporation
RPC	Radiation Protection Centre (Iraq)
RS	Serbia
RTD	Research and Innovation (DG of EC)
RWM	Radioactive Waste Management
SADC	Southern African Development Community
SALTO	Safety Aspects of Long-Term Operation (of IAEA)
SAR	Safety Analysis Report
SAUMEZ	State Agency of Ukraine for the Management of the Exclusion Zone
SBO	Station Black Out
SFP	Spent Fuel Pool
SGVI	Office for Safeguards Verification in Iran
Sida	Swedish International Development Cooperation Agency
SIP	Shelter Implementation Plan
SMP	Strategic Master Plan
SMRC	Site Monitoring and Reporting Contractor
SNG-ATOM	Commission of CIS Member States on the Peaceful Use of Atomic Energy
SNRIU	State Nuclear Regulatory Inspectorate of Ukraine
SOLC	Senior Officials Liaison Committee
SRBATOM	Serbian Radiation and Nuclear Safety and Security Directorate
SRM	Strategic Road Map
SSAC	States’ Systems of Accounting and Control of Nuclear Materials
SSM	Swedish Radiation Safety Authority
SSTC	State Scientific Technical Centre, Ukraine (for radiation and nuclear safety
STCU	Science and Technology Centre in Ukraine
TACIS	Technical Assistance for the Commonwealth of Independent States
TAEC	Tanzanian Atomic Energy Commission
TAEK	Turkish Atomic Energy Authority
T&T	Training and Tutoring
TC	Technical Cooperation (Department of IAEA)
TIPINS	TACIS-INSC-PHARE-IPA-Nuclear-Safety
TJ	Tajikistan
ToR	Terms of Reference
TR	Turkey
TS	Technical Specification
TSO	Technical Support Organisation
TZ	Tanzania
UA	Ukraine
UK	United Kingdom
ULS	Uranium Legacy Site

UNDP	United Nations Development Programme
UPSAT	Uranium Production Site Appraisal Team (of IAEA)
US	United States of America
VO “Safety”	Federal State Unitary Enterprise of Gosatomnadzor in Russian Federation
VVER	Vodo-Vodyanoi Energetichesky Reaktor (PWR of Soviet design)
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association

1 INTRODUCTION

The European Union has a long-established history in providing support to third countries in improving nuclear safety [1]. Between 1991 and 2006, the Technical Assistance to the Commonwealth of Independent States (TACIS) Nuclear Safety Programme provided assistance to improve the safety of nuclear plants in the former Soviet Union. Similar assistance was provided to then pre-accession countries of Central and Eastern Europe under the PHARE (Poland and Hungary: Assistance for Restructuring their Economies (extended subsequently to all 10 countries in Central and Eastern Europe)) programme. In 2007, the Instrument for Nuclear Safety Cooperation (INSC) was established to continue the cooperative assistance for the period 2007-2013 with an expanded, worldwide geographical scope (1). A second INSC was then established (2) to cover the period from the beginning of 2014 until the end of 2020, and included, for the first time, countries previously covered by the Instrument for Pre-accession Assistance (IPA).

The assistance provided under the INSC is based on cooperation between the EU and partner countries which takes advantage of the considerable experience of the EU and its Member States in nuclear safety. In the same way as for the first Instrument (henceforth referred to as INSC-I), the scope and nature of the cooperation during the second (INSC-II) are set out in a strategy (3) and multi-annual indicative programmes (4) (5), and further detailed in annual action programmes approved by implementing decisions of the European Commission (EC) (see (6) (7) (8) (9) (10) (11) (12) for those relevant to the INSC-II). Cooperation is effected through projects either directly with partner countries or regions, or with international organisations.

With the end of the period of applicability of the Regulation on INSC-II, it is timely to review the status of the cooperation it is supporting, and evaluate the extent to which it has achieved, or is expected to achieve, the objective of "supporting the promotion of a high level of nuclear safety, radiation protection, and the application of efficient and effective safeguards of nuclear material in third countries". This report contains a review of the status of cooperation as of June 2021, and an evaluation of its actual and expected outcomes for, and impact on, partner countries or regions; *inter alia*, it is intended to inform or underpin the report the EC is required to submit to the European Parliament and Council on the implementation of the cooperation (13).

It should be noted, however, that the implementing Regulation and the annual action programmes represent the starting point for cooperation and that there is an inevitable time lag before projects can commence, let alone be completed. Thus, while some projects in INSC-II have been completed, most are ongoing and some have yet to be contracted, in particular many of those approved in the annual action programmes of 2019 and 2020. A definitive and comprehensive review and evaluation of the whole of INSC-II would need to await completion of all approved cooperation projects – something that may not occur until the second half of the 2020s.

The report builds on the findings of an external Mid Term Review (MTR) of INSC-II (14), carried out as part of a broader, common evaluation of the EU's nine External Financing Instruments (EFI) over the period 2014-2017. The MTR of INSC-II focused on the evaluation of the mechanisms and processes of the Instrument and its fitness for purpose, given that few project results were available from INSC-II at the time the review was conducted. The current report considers measures that have been taken in response to recommendations made in the MTR, and assesses the continuing validity and robustness of its main findings in the light of further information now available; it focuses more on the scope, content and impact of the cooperation under INSC-II as well as its efficiency and effectiveness.

The form of the report is similar to that of the comparable review and evaluation of cooperation implemented under INSC-I carried out in March 2014 (15). It comprises the following sections: the Instrument and its programming; the status of its implementation, its achievements and its impacts on

[1] Throughout, the term nuclear safety is understood to include radiation protection and the safe management of nuclear waste and radioactive waste more generally.

partner countries and regions; an evaluation of the cooperation including responses to recommendations made in the MTR; and conclusions and recommendations.

2 THE INSTRUMENT FOR NUCLEAR SAFETY COOPERATION 2014-20 AND ITS PROGRAMMING

2.1 The Regulation

The Instrument for Nuclear Safety Cooperation, 2014-20, was established by Council Regulation (Euratom) No 237/2014 of 13 December 2013 (2) and was applicable from the beginning of 2014 until the end of 2020. The specific objectives of cooperation as set out in the Regulation were:

- the promotion of an effective nuclear safety culture and implementation of the highest nuclear safety and radiation protection standards, and continuous improvement of nuclear safety
- the responsible and safe management of spent fuel and radioactive waste, namely transport, pre-treatment, treatment, processing, storage and disposal, and the decommissioning and remediation of former nuclear sites and installations, and
- the establishment of frameworks and methodologies for the application of efficient and effective safeguards for nuclear material in third countries.

The Regulation further specified the measures to be pursued in order to achieve the objectives as comprising:

Objective a) Nuclear Safety Culture:

- support for regulatory bodies and their technical support organisations
- promotion and reinforcement of effective regulatory frameworks for radiation and nuclear safety (including review and assessment, licensing and oversight activities for nuclear power plants and other nuclear installations and high activity radioactive sources including their safe disposal)
- establishment of effective arrangements for the prevention of accidents and mitigation of their radiological consequences should they occur (i.e., emergency-planning, preparedness and response including rehabilitation measures) and
- support for ensuring the safety of nuclear installations and sites regarding practical protective measures designed to reduce existing radiation risks to the health of workers and of the general public.

Objective b) Radioactive Waste Management:

- support for regulatory bodies and their technical support organisations[2]
- reinforcement of regulatory frameworks, in particular with regard to the responsible and safe management of spent nuclear fuel and radioactive waste
- development and implementation of specific strategies and frameworks for the responsible and safe management of spent nuclear fuel and radioactive waste
- development and implementation of strategies and frameworks for decommissioning existing installations, for the remediation of former nuclear sites and legacy sites related to uranium mining, and for the recovery and management of sunken radioactive objects and material at sea.

Objective c) Nuclear Safeguards:

- the establishment of the necessary regulatory framework, methodologies, technology and approaches for the implementation of nuclear safeguards, including for the proper accounting and control of fissile materials at State and operators' level and

[2] This measure and the following one under the radioactive waste management objective inevitably overlap with measures under the nuclear safety culture objective and, as a result, there has been some ambiguity in the attribution of projects to the INSC objectives

- support for the infrastructure and training of personnel.

Cooperation under the Regulation was to be implemented on the basis of a strategy paper (3), multi-annual indicative programmes (4) (5), and annual action programmes (6) (7) (8) (9) (10) (11) (12); the main features of these are summarised in sections 2.2 and 2.3 below. The criteria and priorities which apply to the cooperation are set out in an Annex to the Regulation. The more significant of these are that:

- cooperation may cover all third countries worldwide with some limitations on the nature of cooperation with high income countries
- priority should be given to cooperation with EU pre-accession countries and countries in the European Neighbourhood area, preferably using a country approach; a regional approach is preferred for countries in other regions
- third countries should fully subscribe to the principles of non-proliferation and be parties to relevant Conventions within the framework of IAEA, or have taken steps demonstrating a firm undertaking to accede to such Conventions.

The Instrument also introduced the requirement for performance indicators to assess the progress towards the achievement of the specific objectives. These performance indicators are set out in the multi-annual indicative programmes.

The budget for the new Instrument was significantly reduced compared with INSC-I (from 524 M€ to 225 M€). This was due to an overall reduction of the EC's budget at the time, and the fact that no further contributions were expected to be made to the Chernobyl funds. In the event, the Chernobyl funds required an additional 89.1 M€[3], which were provided from the EC's reserve (see Annex 2, section A2.2.2.2 for further details). The reduction in budget took no account of the increased geographical scope of the Instrument to cover cooperation with pre-accession countries previously provided under the Instrument for Pre-accession Assistance (IPA).

2.2 The Strategy and Multi-annual Indicative Programmes

2.2.1 Strategy

The strategy for INSC-II was approved by the EC in an implementing decision on 13 June 2014 (3). It built on experience of implementing INSC-I and the earlier TACIS programme and expanded on the key issues covered by the Regulation. In the light of lessons learnt after the Fukushima Daiichi nuclear accident, the main focus was the promotion and implementation of the highest nuclear safety and radiation protection standards, working with the nuclear regulatory authorities active in third countries; support was also to be given to build and develop nuclear safety capacities. In the first half of INSC-II, activities on waste management, including environmental remediation and decommissioning, were to be scaled down relative to those in INSC-I, but this was to be revisited during the second half of the programme. The indicative allocation of resources of the Instrument between the three priority areas was accordingly: 50% for the promotion of nuclear safety culture and highest safety standards; 35% for the responsible and safe management of spent fuel and radioactive waste; and 10% for safeguards; the remaining 5% was allocated to support measures.

The allocation of funds among the three objectives in INSC-II and to support measures is shown in Figure 1 below.

Cooperation was to be primarily directed at the regulatory authorities in third countries dealing with nuclear safety; cooperation with operators of nuclear installations was limited to specific situations in the framework of follow-up measures of the 'stress tests', but excluding the supply of equipment, in particular.

[3] 19.1 M€ for the Nuclear Safety Account and 70 M€ for the Chernobyl Shelter Fund, which originated from a different EU budget line.

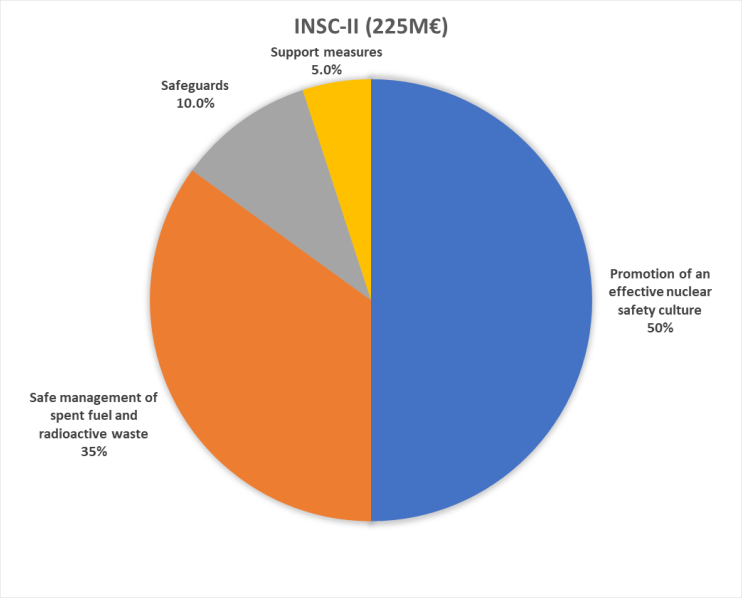

Figure 1. Allocation of funds in INSC-II[4]

Cooperation and coordination with relevant international organisations, notably IAEA and especially its Regulatory Cooperation Forum (RCF), was foreseen in order to optimise the use of resources and avoid duplication. Regional cooperation was encouraged where possible, making use of existing networks, e.g., FORO, AFCONE, ASEANTOM, etc. Coordination was also foreseen within the G8/G7[5] Nuclear Safety and Security Group (NSSG) and the Global Partnership Programme[6]. Synergies were also to be sought between the implementation of the INSC and the Instrument contributing to Stability and Peace (IcSP) (16), in particular on cooperation addressing global and trans-regional and emerging threats.

In implementing INSC-II, advantage would also be taken of the experience of competent authorities and organisations in the Member States in order to make the best use of European expertise, in particular through the European Nuclear Safety Regulators Group (ENSREG), the Western European Nuclear Regulators Association (WENRA), the Heads of the European Radiological protection Competent Authorities (HERCA), and the Council Working Party on Atomic Questions. Co-funding projects with Member States, and/or regional/multi-national entities would also be explored.

2.2.2 Multi-annual Indicative Programme (MIP) for 2014-17

The first MIP for INSC-II was approved by the EC in an implementing decision on 13 June 2014 (4) and took account of the outcome of consultations with ENSREG. The priorities under each of the objectives set out in the Regulation were as follows:

<u>Nuclear Safety Culture</u>

- Cooperation with regulatory bodies on actual licensing and supervision processes relating to nuclear facilities and radiological practices
- Support to regulatory authorities on periodic safety reviews and other assessments and the subsequent implementation of recommendations, for example carrying out ‘stress tests’ and follow up measures in light of the Fukushima-Daiichi nuclear accident. In this specific context,

[4] Excluding additional funds to support the EBRD Chernobyl Shelter Fund and Nuclear Safety Account which originated from a different EU budget line

[5] In March 2014 Russia was suspended indefinitely following the annexation of Crimea, as a result the name of the inter-governmental political forum reverted to G7.

[6] The Global Partnership against the Spread of Weapons and Materials of Mass Destruction was established at the G8 Summit in Kananaskis, Canada, in 2002 in response to the 9/11 terrorist attacks. Its aim is to reduce chemical, biological, radiological and nuclear proliferation risks.

cooperation with operators of nuclear installations would also be considered, but would exclude the supply of equipment
- Training services, including participation in inspection activities and emergency exercises, in particular through the 'Training and Tutoring projects', which offer to the regulatory authorities of the partner countries an opportunity to train their staff in the European Union
- Support to regional nuclear safety education programmes.

Radioactive Waste Management

- Support with the development of waste management regulatory frameworks[7], national strategies and feasibility studies and, in some cases, the implementation of the strategies, with a focus on projects considered as viable following evaluations and feasibility studies initiated during the previous period, particularly in countries in the European Neighbourhood area such as around Chernobyl; new projects to be considered on a case-by-case basis within the limits of the available budget
- Continuation of the considerable work already carried out to address the uranium mining sites legacy in Central Asia, including remediation activities
- Development and implementation of regulatory frameworks for mining activities and management of radioactive sources in Africa, including guidelines and regulatory frameworks, preparation of strategies for existing and new uranium mines and/or processing sites, and feasibility studies for the rehabilitation of former mines and/or processing sites which ceased operating and are not covered by commercial commitments
- Development and implementation of regulatory frameworks and strategies in partner countries/regions where spent fuel and nuclear waste is managed and stored in unsatisfactory and potentially dangerous conditions.

Nuclear Safeguards

- Strengthening and enhancing technical and organisational measures for nuclear material accountancy and control in relevant nuclear fuel cycle facilities based on recommended international standards and EU expertise
- Development and implementation of regulatory frameworks for nuclear safeguards to improve control over nuclear and radioactive materials in Africa, including natural uranium production and transport
- Support to regional nuclear safeguards education programmes.

The MIP reiterated the criteria set out in the Annex to the Regulation in relation to geographical scope. It also indicated that:

- support to African countries with uranium mining industries or engaging in such activities would be expanded where possible and appropriate, with a focus on regulatory frameworks and nuclear safeguards, with the aim at preventing situations requiring later costly remediation;
- in Central Asia, the cooperation under the previous programme would be continued and would be coordinated with international donors;
- in Latin-America, cooperation in line with the objectives of the Instrument would continue where possible and appropriate; and
- initiatives to improve the health and environmental situation of the population in and around Chernobyl would continue where possible and appropriate.

[7] In line with the description of the objectives in the Regulation, there is some overlap between the priorities under the radioactive waste management objective and the priorities under the nuclear safety culture objective, and there has been some resulting ambiguity in the attribution of projects to objectives, not least where projects contained activities relevant to more than one objective.

2.2.3 Multi-annual Indicative Programme (MIP) for 2018-20

The second MIP for INSC-II was approved by the EC in an implementing decision on 6 November 2017 (5) and also took account of the outcome of consultations with ENSREG. The main priorities in this MIP remained broadly as set out in the first MIP, but the balance between the objectives and priority areas was slightly modified to take account of consultation with the partner countries and the evolving challenges they were facing regarding nuclear and radioactive wastes. In particular, the cooperation supported under previous projects to address the uranium mining legacy sites in Central Asia had led to the preparation of a Strategic Master Plan (SMP) (17) for the region in cooperation with the IAEA and established a sound technical basis and cost for future works. A dedicated fund: the Environmental Remediation Account (ERA) for Central Asia had been established at the European Bank for Reconstruction and Development (EBRD), and the European Commission was the first contributor to the ERA. Accordingly, relatively more funds were allocated to radioactive waste management, and relatively fewer to nuclear safety culture.

The allocation of funds among the three objectives and to support measures in the two MIPs is summarised in Figure 2 below.

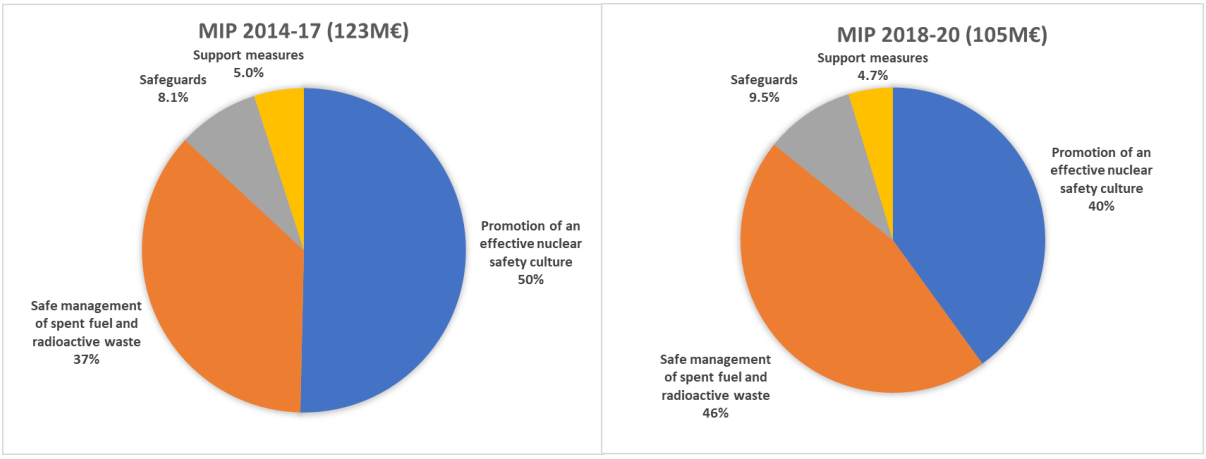

Figure 2. Allocation of funds in MIP 2014-17 and in MIP 2018-20[8]

The geographical scope set out in the second MIP was also broadly similar to that in the first MIP. However, the second MIP additionally highlighted that the programme would continue cooperation with Iran, in line with the EU commitments in the Joint Comprehensive Plan of Action (JCPoA) to ensure the exclusively peaceful nature of Iran's nuclear programme (see Annex 2).

2.3 The Annual Action Programmes

The Multi-annual Indicative Programmes (MIP) have been implemented through Annual Action Programmes (AAP), each of which was approved by an EC Implementing Decision (6) (7) (8) (9) (10) (11) (12). Each AAP contained a number of actions to enhance radiation and/or nuclear safety in partner countries, and the scope and content of each action was set out in a so-called Action Document. For AAP2014, 2015 and 2016, an Action Document (AD) for each action was annexed to the Implementing Decision, with each being assigned an identifier that uniquely identified the partner country or countries, the objective being addressed by the cooperation, and the year of the AAP[9]. In subsequent AAPs (i.e.,

[8] Note that, because the allocation of funds in MIP 2018-20 will have taken account of actual funding commitments made during the first four years of the programme, the total of the allocations made in the two MIPs is not equal to the total funding allocated to the programme. Note also that these figures do not include additional funds to support the EBRD Chernobyl Shelter Fund and Nuclear Safety Account which originated from a different EU budget line (see section A2.2.2.2)

[9] Codes took the form XXn.mm/yy, where: XX is the two-digit ISO country code other than multi-country or regional actions referred to as MC; n refers to different priority areas where 1 and 3 refer to nuclear safety culture with support to the operator and regulatory authority respectively, 4 to radioactive waste management and 5 to nuclear safeguards; mm refers to the number of an action in one or other priority area; and yy are the last two digits of the AAP year

AAP2017 to 2020), the form of the annexes was changed from a separate AD for each action to a consolidated AD (i.e., each containing several actions for different countries or regions) for each of the three objectives of the Instrument, and for support measures for its management (thereby reducing the number of action documents needing to be prepared and approved, and allowing greater flexibility in the allocation of funding); unique identifiers of actions were no longer used. For ease of identification and clarity of presentation within this report, the actions in AAP2017 to 2020 have been assigned identifiers following the same convention as was used in the earlier AAP.

Over the seven years of the Instrument, a total of about 60 actions were approved[10], involving 14 individual countries and 18 multi-country (or regional) actions, as well as contributions to European Bank for Reconstruction and Development (EBRD) ERA fund. In addition, there was one action document per year covering measures supporting the implementation of the programme.

2.3.1 Distribution of Actions and Resources between Objectives

Figure 3 shows (i) the number of actions and (ii) the funding allocated to actions included in the AAP2014 to AAP2020 according to the three objectives of the Instrument and to support measures. In each case, a breakdown is given for each AAP year. While many more actions addressed nuclear safety culture than radioactive waste management, almost the same amounts of funding were allocated to actions addressing the two objectives. The AAP for 2018 contained the largest number of actions (fifteen), whereas the largest allocation of funding (32 M€) was in the 2019 AAP.

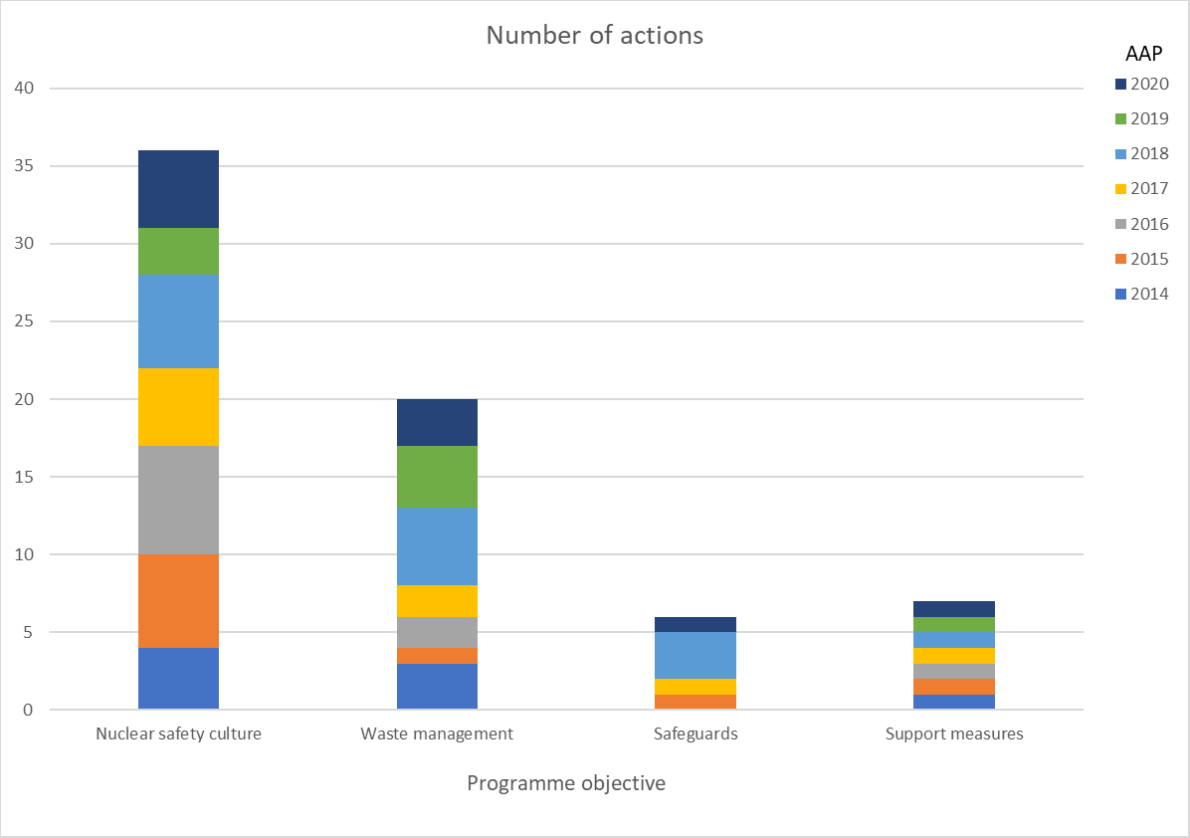

Figure 3(i) Number of actions included in AAP 2014 to AAP 2020 addressing each programme objective

[10] Excluding support actions

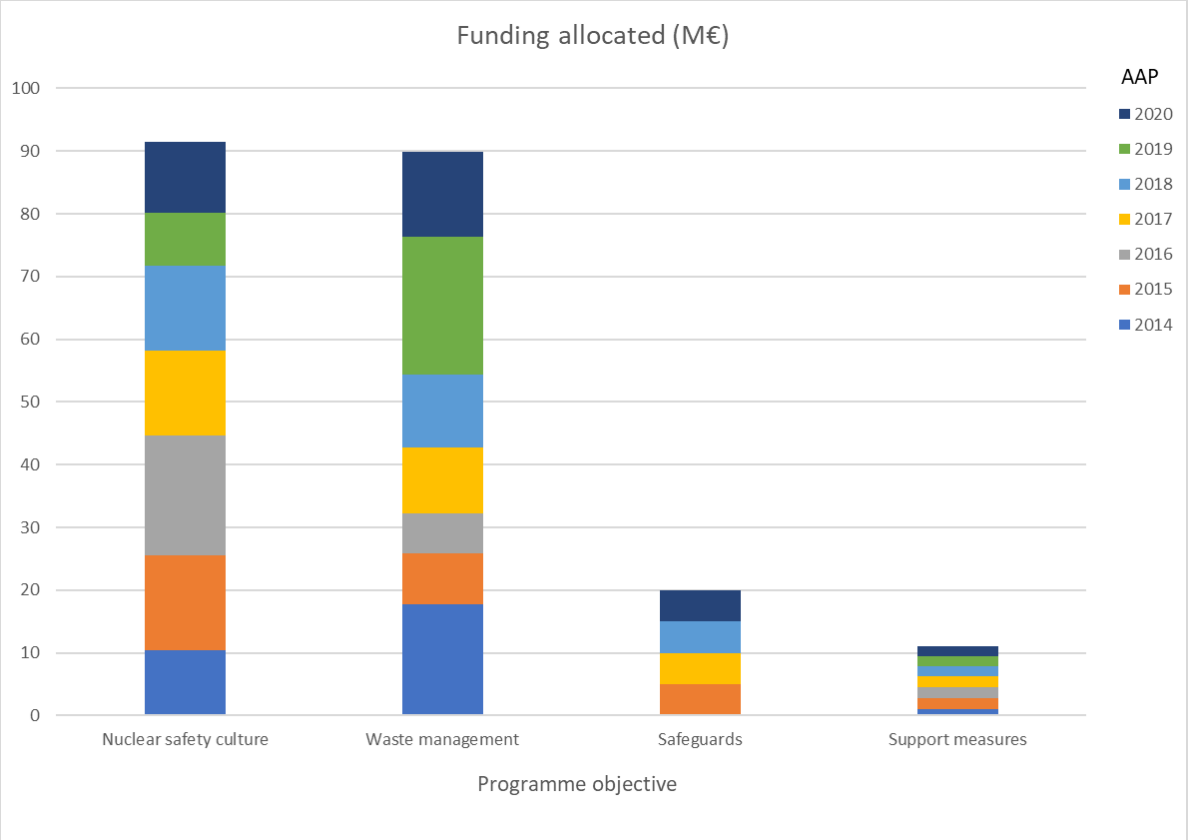

Figure 3 (ii) Funding allocated in AAP2014 to AAP2020 allocated to actions addressing each programme objective[11]

Figure 4 compares the funding allocated to actions addressing each objective and to support measures with the funding allocations set out in the two MIPs (for 2014-17 and for 2018-20) and in the Strategy for the programme as a whole. The comparison indicates that funding allocated to each objective in the annual action programmes differs a little from that set out in the Strategy, with slightly less funding allocated to actions addressing nuclear safety culture (91 M€ versus 113 M€) and slightly more to actions addressing radioactive waste management (90 M€ versus 79 M€)[12]. Similar minor differences are apparent when comparing the funding allocated in the AAPs with that in the two MIPs: the funding allocated to actions addressing nuclear safety culture was 58 M€ versus 62 M€ in the first MIP, and 33 M€ versus 42 M€ in the second MIP; that for actions addressing radioactive waste management was 43 M€ versus 45 M€ in the first MIP, and 47 versus 48 in the second MIP. The allocation of funds among the objectives in first MIP was similar to that in the Strategy. The comparatively lower demand for cooperation on nuclear safety culture during the first half of the programme then led to the reallocation of funds in the second MIP for the period 2018-20. This demonstrates that the programme is responsive to the needs of partner countries or regions (i.e., is demand driven). Notwithstanding these differences, and the fact that the programme is demand driven, the programming in the annual action documents conforms closely with distribution of the available funds among the three objectives envisaged in the strategy and the MIPs.

[11] Excluding additional funds to support the EBRD Chernobyl Shelter Fund and Nuclear Safety Account, which originated from a different EU budget line (see section A2.2.2.2).
[12] Although there is some overlap between these two objectives in the Regulation – see section 3.

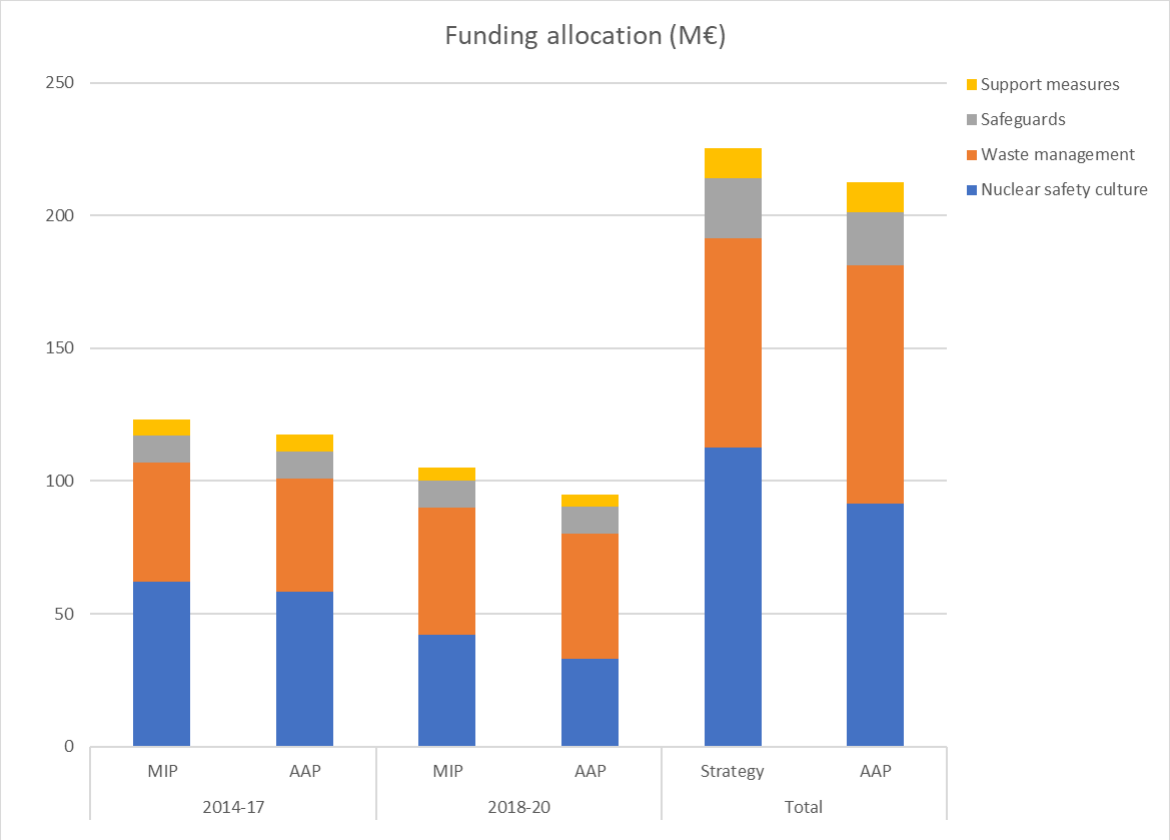

Figure 4. Comparison of funding allocations in the MIPs with the allocations in the AAPs[13].

2.3.2 Distribution of Actions and Funding between Countries and Regions

The map shown in Figure 5 identifies the countries that have taken part in cooperation in the INSC-II programme, and distinguishes between EU pre-accession countries, countries in European neighbourhood-east and neighbourhood-south and other countries. Cooperation has been mainly on a country-specific basis in pre-accession and neighbourhood-east and -south countries, with the exception of two regional actions involving the Western Balkan countries.

In INSC-II, there were no partner countries in the Americas, but there was cooperation with countries in Africa, the Middle East, and in Central, East and South-East Asia. This took the form of country-specific cooperation in Ghana and Tanzania in Africa, in Iran and Iraq in the Middle East, and in China and Kyrgyzstan in Asia. It took the form of regional cooperation with countries in the Association of South East Asian Nations (ASEAN), with countries in the Gulf Cooperation Council, with countries in the Southern African Development Community (SADC), and with the Central Asian countries of Kyrgyzstan, Tajikistan and Uzbekistan which have endorsed the Strategic Master Plan (17) for remediation of the legacy of uranium mining activities in the region.

[13] Excluding additional funds to support the EBRD's Chernobyl Shelter Fund and Nuclear Safety Account, provided under a different EU budget line.

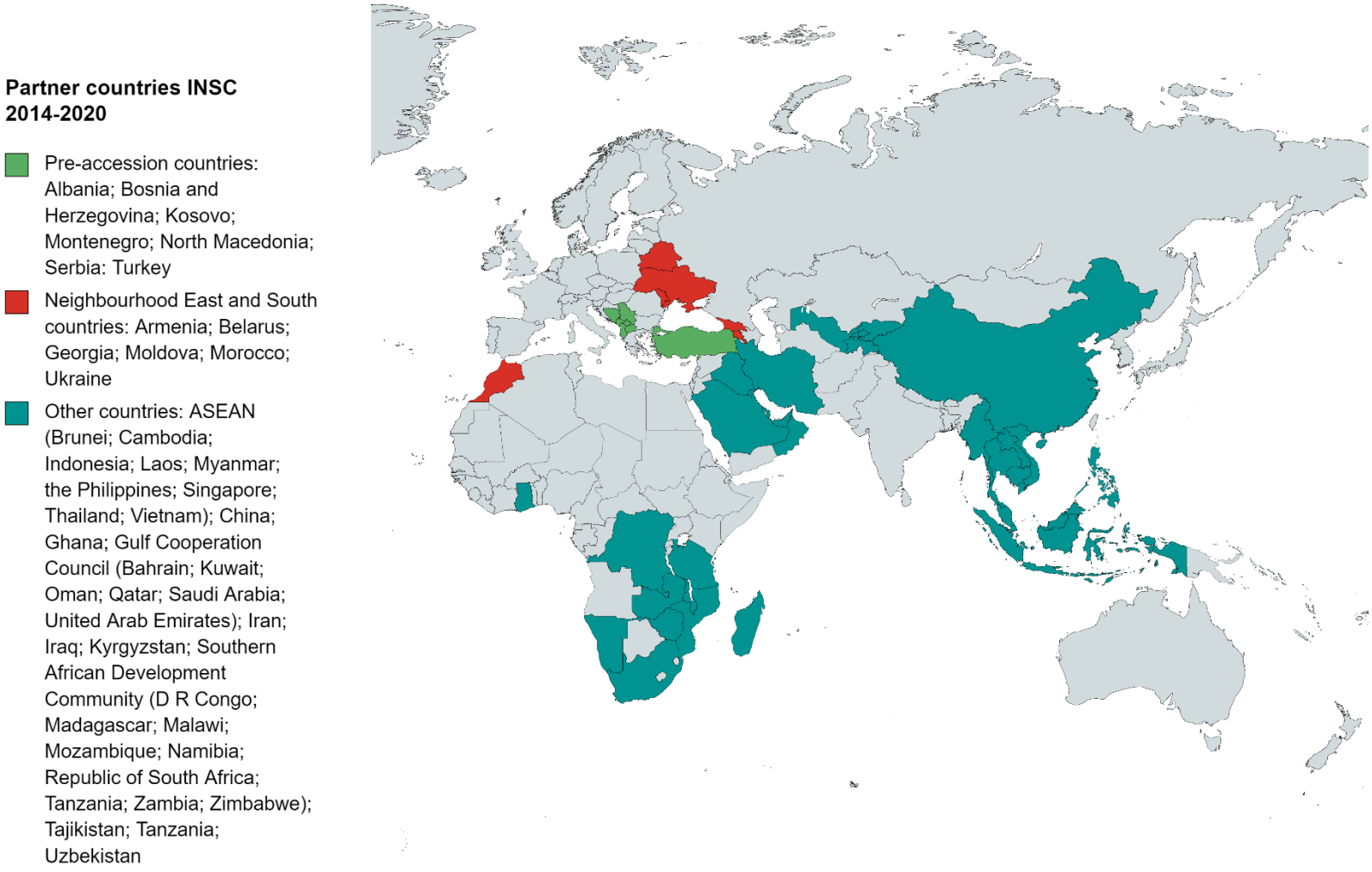

Figure 5. Map showing partner countries and regions in INSC-II

Support will also have been provided to a larger number of countries than shown in Figure 5 as a result of INSC actions that have been implemented by the International Atomic Energy Agency (IAEA) (i.e., in those cases where the support per country is modest but has wide geographical coverage (e.g., management of sealed and disused sealed radioactive sources through an inter-regional project implemented globally; strengthening coastal emergency preparedness and response arrangements in non-EU countries in the Mediterranean area, etc)).

There has been a number of changes between INSC-I and INSC-II in the countries or regions where cooperation has taken place. In INSC-I, cooperation was implemented on a country basis with several countries in ASEAN (Indonesia, Malaysia, Thailand, the Philippines, Vietnam). At the time, each of these countries was planning to develop and use nuclear power as part of their energy mix and were seeking support to enhance their regulatory capabilities and infrastructure. Following the accident at Fukushima Daiichi NPP in 2011, these developments were stopped or postponed and, with them, the pressing need to enhance the capabilities of their respective regulatory authorities. Cooperation, at a country level, within ASEAN was, therefore, not continued in INSC-II, but cooperation at regional level was established with all 10 ASEAN Member States in the area of EP&R. Cooperation with regulatory authorities in the Middle East (i.e., Egypt, Jordan) also took place in INSC-I in the context of their plans to use nuclear energy; this has not continued in INSC-II for much the same reasons as those in several of the ASEAN countries. Cooperation in INSC-I also took place with countries in Latin America (i.e., Brazil, Mexico), mainly with regulatory authorities but also with a waste management organisation; this cooperation did not continue in INSC-II, mainly because the region was no longer a priority.

Cooperation in INSC-II was requested by, and established with, several other 'new' countries that had not previously been supported by INSC-I[14], namely, Moldova, Ghana, Morocco, Tanzania, Iraq and Iran.

Figure 6 provides more detail on the distribution of actions and funding among the different countries and regions involved in INSC-II. The largest number of country-specific actions and the largest allocation of direct funding have involved cooperation with Ukraine (10 specific actions totalling 45 M€[15], with further funding provided through EBRD funds for Chernobyl). There were several actions with Armenia (seven) and Iran (five) with allocated funding of 14 M€ and 25 M€, respectively.

The large number of cooperation actions and the large amount of funding allocated in Ukraine are due to the continuing legacy of the Chernobyl accident and the subsequent break-up of the former Soviet Union. As well as final contributions to the EBRD funds established to address major legacy issues of the accident, cooperation has continued with the organisations responsible for the many sources of radioactive wastes in Ukraine, including, in particular, those resulting from the Chernobyl accident in 1986, wastes stored at disposal facilities or temporary locations both within and outside the Chernobyl Exclusion Zone, and wastes arising from future remediation activities at the destroyed Chernobyl Nuclear Power Plant (ChNPP) Unit 4 and decommissioning of Units 1-3 of the shutdown plant. There has also been cooperation with the regulatory authority and its technical support organisation.

Cooperation with Armenia has focused on issues arising from the continued operation of its Soviet-era nuclear power plant (NPP). Cooperation under previous programmes addressed deficiencies identified in the NPP and, more recently, implementation of the 'stress tests'. Cooperation has continued, with both the NPP operator and the regulatory authority and its technical support organisation, on *inter alia*, addressing measures to improve safety in response to the 'stress tests'.

For many years Iran was in a situation of non-compliance, or not fully complying, with IAEA safeguards agreements and as a result incurred severe sanctions, mainly by the US and the EU. After extensive negotiations, with the aim of reaching a mutually-agreed long-term solution that would ensure

[14] In addition, Turkey, Serbia and Bosnia and Herzegovina (and the Western Balkans as a whole) were new to INSC, having been supported under IPA rather than INSC-I

[15] Excluding funding for management of INSC in Ukraine provided by the JSO.

that Iran's nuclear programme would be exclusively peaceful, on 14 July 2015, the P5+1[16] and Iran concluded the Joint Comprehensive Plan of Action (JCPoA), which was subsequently endorsed by a UN Security Council Resolution. This opened the way for lifting of some of the sanctions and cooperation between the EC and Iran on nuclear safety. Under Annex III of the JCPoA, concerning Civil Nuclear Cooperation, it provides specifically for cooperation on nuclear safety and safeguards.

There were four actions involving EU pre-accession countries (Turkey, Serbia and Bosnia and Herzegovina), of which two were in Serbia. These actions were allocated around 7 M€, about 3% of the total funding. There were 24 actions in total in European Neighbourhood-East and -South countries, including the 10 in Ukraine and the 7 in Armenia. These actions were allocated around 76 M€, a little over a third of the total funding. In the rest of the world, there were 9 country-specific actions, allocated around 35 M€, about 16% of the total. There were 18 multi-country or regional actions, mainly involving countries other than the pre-accession and European Neighbourhood countries, but also including some implemented by the IAEA that would have wider geographical reach. These multi-country or regional actions were allocated around 44 M€, about 21% of the total. Contributions to the EBRD towards the Environmental Remediation Account (ERA) totalled around 32 M€, about 15% of the total funds allocated[17].

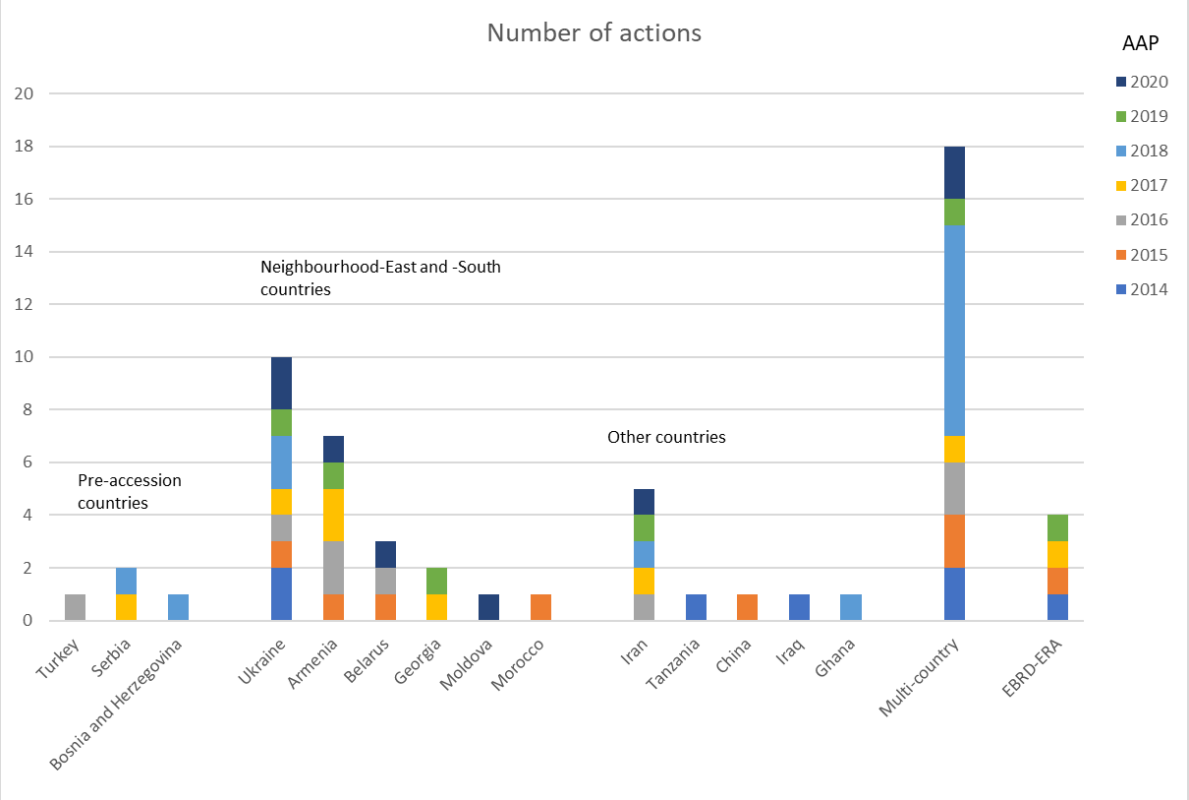

Figure 6(i). Number of actions in each AAP on: country-specific actions, by partner country; multi-country/regional actions; and for contributions to EBRD funds

[16] The five permanent members of the United Nations Security Council (China, France, Russia, United Kingdom, United States—plus Germany) together with the European Union

[17] In addition 70 M€ was provided to the EBRD Chernobyl Shelter Fund and 19.1 M€ to the EBRD Nuclear Safety Account, albeit originating from a different EU budget line (see section A2.2.2.2)

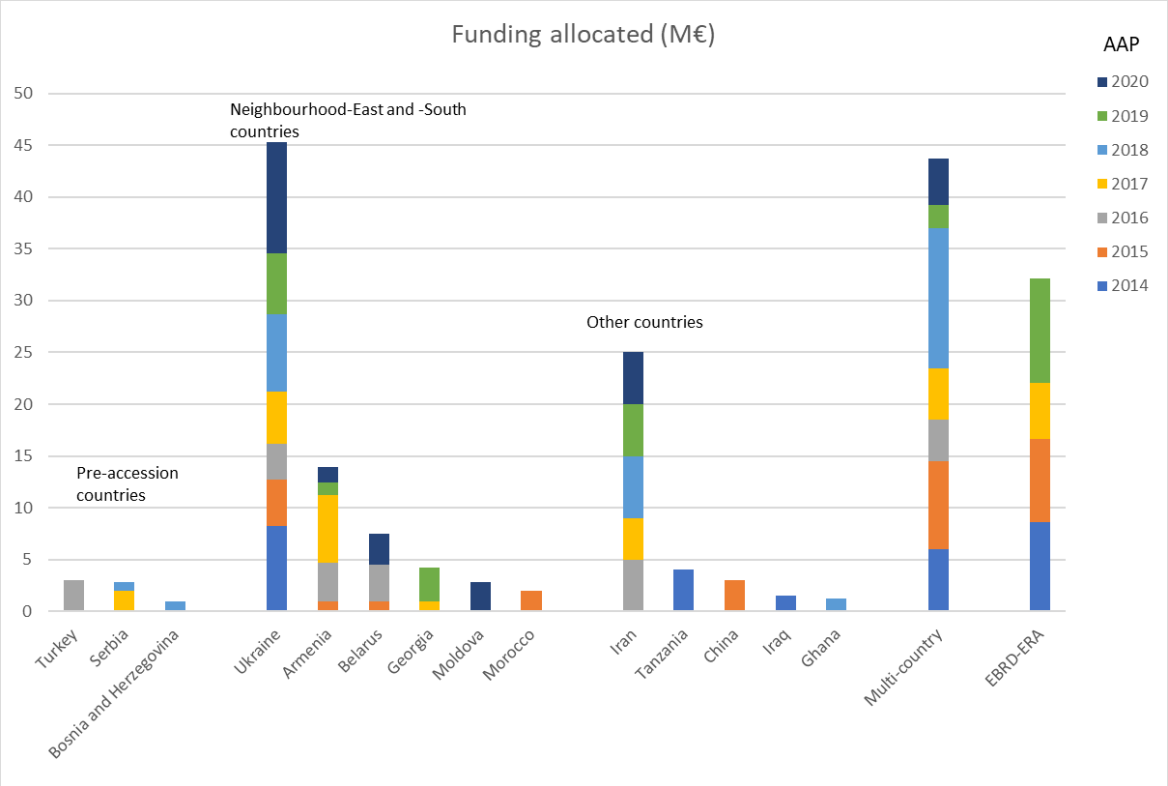

Figure 6(ii) Funding allocated in each AAP to: country-specific actions, by partner country; to multi-country/regional actions; and as contributions to EBRD funds[18]

In addition to the approximately 20% of the INSC-II funding that has been allocated to actions in Ukraine, 70 M€ were contributed to the EBRD's Chernobyl Shelter Fund (CSF) and 19.1 M€ to the EBRD's Nuclear Safety Account (NSA); these contributions were from a different EU budget line.

The high proportion of the actions and the allocated funding directed towards cooperation with European Neighbourhood countries reflects the priority set out in the Annex to the Regulation. The focus on Ukraine and Iran and the contributions to the EBRD-ERA fund for remediation projects in Central Asia are also in line with the geographical scope envisaged in the two MIPs. However, the AAPs include no actions/projects in Latin America, and only two country-specific actions in Africa outside of the European Neighbourhood-South.

2.3.3 Support Measures

The INSC Regulation stipulates that it shall be implemented in accordance with a number of specific articles in EU Regulation No 236/2014 (usually referred to as the Common Implementation Regulation (CIR)). In accordance with article 3 of the CIR on 'support measures', the 'Union financing may cover expenditure for the implementation of the Instruments and for the achievement of their objectives, including administrative support associated with the preparation, follow up, monitoring, auditing and evaluation activities directly necessary for such implementation, as well as expenditure at Union delegations on the administrative support needed to manage operations financed under the Instruments'. Each AAP accordingly includes one action to fund various activities supporting the management of the Instrument in fields such as:

- administrative support associated with the preparation, follow-up, monitoring, audit and evaluation activities directly necessary for the implementation of INSC-II;
- technical assistance for projects funded by INSC-II;

[18] Excluding additional funds to support the EBRD Chernobyl Shelter Fund and its Nuclear Safety Account, provided under a different EU budget line.

- studies, meetings, information, awareness-raising, training, preparation and exchange of lessons learnt and best practices, publication activities and any other administrative or technical assistance expenditure necessary for the management of actions;
- research activities and studies;
- expenditure related to the provision of information and communication actions, including the development of communication strategies and corporate communication materials.

In general, each action for support measures has been implemented through several projects or contracts addressing one or more of the activities listed above.

In addition to these support measures, there were two actions for the Joint Support Office (JSO) in Kiev to coordinate the implementation of the INSC programme and provide administrative, logistical and technical support to the partners and End Users in Ukraine. And, there was one action for the Joint Research Centre (JRC) to assist in project preparation, project tendering and contracting and successful resolution of technical problems arising during project implementation. Funding for these specific measures (for JSO and JRC) has been attributed, respectively, to the waste management and nuclear safety culture objectives of the Instrument (see Annex I).

3 STATUS OF IMPLEMENTED COOPERATION PROJECTS

As previously noted, the AAPs represent the starting point for cooperation and there is an inevitable time lag before projects[19] (through which the actions are implemented) can commence, let alone be completed. Thus, while some projects in INSC-II have been completed, many are ongoing and some have yet to be contracted, in particular many of those approved in the annual action programmes of 2019 and 2020. A total of 57 projects have been contracted, excluding support measures and the contributions made to the EBRD funds, of which 11 have been completed and 46 are still underway; 18 projects are yet to be contracted and two have been cancelled. A list of the projects[20] implemented, or to be implemented, under INSC-II is provided in Annex 1 along with information on some of their key features (i.e., brief description, budget, date of contract signature, whether completed, how implemented (i.e., by tendering or negotiated agreement, via a Financing Agreement, etc)). The list represents the status at the end of June 2021, and takes account of developments since the actions were approved in the AAPs, such as the cancellation of some actions or elements of them, and non-substantial modification of actions. In addition, a number of actions cover cooperation with both the regulatory authority and the organisation(s) responsible for radioactive waste management, and some projects have been re-attributed to the programme objective corresponding to where the majority of the cooperation has taken place. A summary description of each of these projects, by objective and partner country/region, and what they have achieved is provided in Annex 2. An overview is provided in this section of some general features of the projects and of some of the major achievements. Selected highlights of implementation of the Instrument are set out in Annex 3.

This evaluation encountered some difficulties in accessing project documents. Project management and follow-up within the responsible unit in INTPA uses the CRIS[21] database and this is the repository for all project documentation. However, access to CRIS is limited to EC staff and it is not accessible by external contractors undertaking evaluations. Consequently, much effort was needed by Unit F1 staff

[19] Some actions in the AAP were foreseen to be implemented through more than one project or contract (e.g.: an action involving the provision of both supplies and services that generally need to be contracted separately; an action providing support to different End Users (e.g., a regulatory authority and waste management agency), etc.). The number of projects is therefore larger than the number of actions.

[20] The same convention as used to identify the actions has been used to identify the projects. Where an action is implemented by more than one project, the component parts of a given action are distinguished by the addition of A, B, C, … to the project code or identifier.

[21] CRIS is the information system put in place by the EC to support the management of external actions. CRIS enables all EC staff involved in external action management to work on a common database. It provides data concerning the different phases of management and feeds financial data into the EC's accounting system ABAC.

to manually extract relevant documentation and make it available for this evaluation. Because the process was labour intensive, only essential documents were requested and made available, i.e., AD, ToR/TS, latest progress report (or final report for competed projects), ROM reports. In principle, the TIPINS (TACIS INSC PHARE INTPA Nuclear Safety) database should have been able to provide much of the information needed in evaluating the status of implementing the Instrument; but, limitations in the quality and completeness of its contents prevented its use for this purpose.

In addition, there is an obvious overlap between programme objectives on nuclear safety culture and radioactive waste management. In particular, the Regulation specified measures relating to support for regulatory bodies and their technical support organisations and to the reinforcement of regulatory frameworks under both objectives. This has led to some ambiguity and uncertainty as to which objective some actions should be attributed to. For example, an action with the Iraqi regulatory authority in the 2014 annual action programme was attributed to nuclear safety culture whereas a similar action in Bosnia and Herzegovina was attributed to waste management in the annual action programme for 2018. Both involve support to the regulatory authority on radioactive waste management. Other projects include elements that relate to both nuclear safety culture and radioactive waste management operations (for example, the actions with Serbia and with Georgia in the 2017 action document on nuclear safety culture) and, where the respective elements were significant, these projects have been addressed in both sections 3.1 and 3.2 below.

3.1 Nuclear Safety Culture

3.1.1 The Nature and Scope of Cooperation

Summary descriptions of the cooperation projects and their status are provided in Annex 2. The cooperation in this area has almost exclusively been with regulatory authorities for radiation and nuclear safety and their technical support organisations (TSO). The exception is support given to operators of NPP, in particular in performing ‘stress tests’ and responding to their outcomes through the provision of measures to further enhance safety. The cooperation has, in general, been implemented on a country-by-country basis but in some cases at a regional or even wider geographical level (e.g., cooperation implemented on behalf of the programme by IAEA (see also Section 3.4)).

Some 26 projects have been, or are in the process of being, contracted for cooperation with regulatory bodies in individual countries and 3 projects have been, or are in the process of being, contracted for cooperation with operators of nuclear installations. A further 12 have been contracted on a regional or multi-country basis, of which 2 are being implemented by IAEA (see Annex 1). The distribution of projects between countries and/or regions is shown in Figure 7.

Cooperation with EU pre-accession countries has built on previous cooperation under the IPA and has included developing legislation and the regulatory framework to align it fully with the EU a*cquis* and international standards and enhancing the capabilities of the regulatory authorities and their TSOs. In neighbourhood-east countries, cooperation generally began under previous programmes (TACIS and INSC-I) in order to address the legacy of the Chernobyl accident and the break-up of the Soviet Union; cooperation has continued under INSC-II with a focus on enhancing the capabilities of the regulatory authorities and their TSOs in regulating nuclear and radiation safety. In some other countries (Morocco, Ghana, Tanzania), cooperation has been a response to the plans of a partner country to develop nuclear technologies, either to produce nuclear energy, or to mine uranium for export. In two regional projects (with the Gulf Cooperation Council and with ASEAN), cooperation has been prompted by the Fukushima Daiichi power plant accident and awareness of the need for improved Emergency Preparedness and Response (EP&R) arrangements.

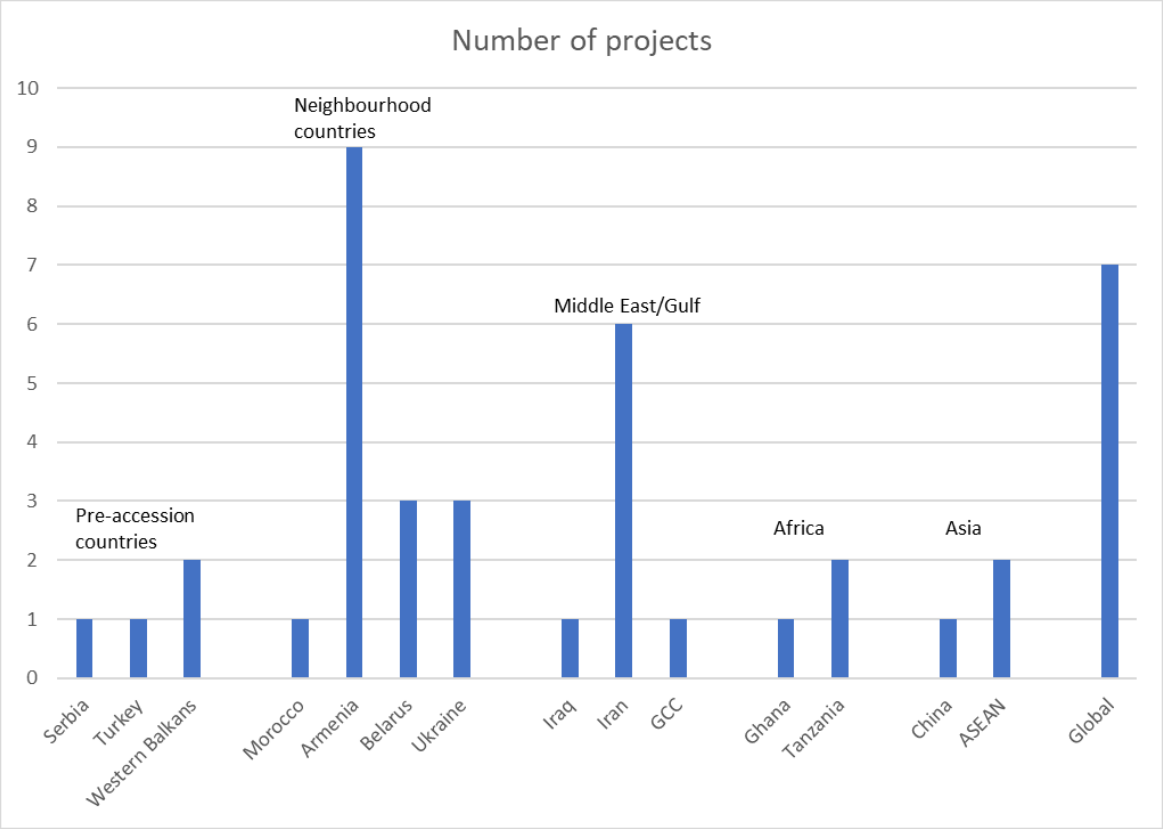

Figure 7 Geographical distribution of nuclear safety culture projects (see Annex 1)[22]

European knowledge and experience have been transferred in a number of ways, for example: workshops, training including extended periods of 'on the job training' in regulatory bodies (or their TSO); *in situ* presence of European experts working directly with partner country experts and/or senior management of regulatory authorities on a wide range of issues; a training and tutoring programme (see Section A2.1.7 in Annex 2); etc. Training *per se* was an important element in almost all projects.

The nature and scope of support provided are diverse. Figure 8 indicates the topics covered in the cooperation and the number of projects in which each topic has been, or will be, addressed. EP&R is the most frequent activity for which support has been provided and reflects the extensive efforts taken nationally and internationally to improve EP&R arrangements in the aftermath of the Fukushima Daiichi accident in 2011. Other activities for which support was requested and provided (in decreasing frequency) are: the development of regulatory frameworks; deterministic and probabilistic safety analyses; capacity building; development of regulations, standards, guides, etc; licensing and inspection; waste management regulation; development of management systems; regional cooperation; provision of supplies (e.g., equipment, software, laboratory consumables); development of strategies and action plans; 'stress tests'; laboratories; Early Warning Radiation Monitoring Networks (EWRMN); fuel cycle safety; training and tutoring/education; etc.

[22] The geographical distribution of funding differs from that of the number of projects – information on funding can be found in Annex 1.

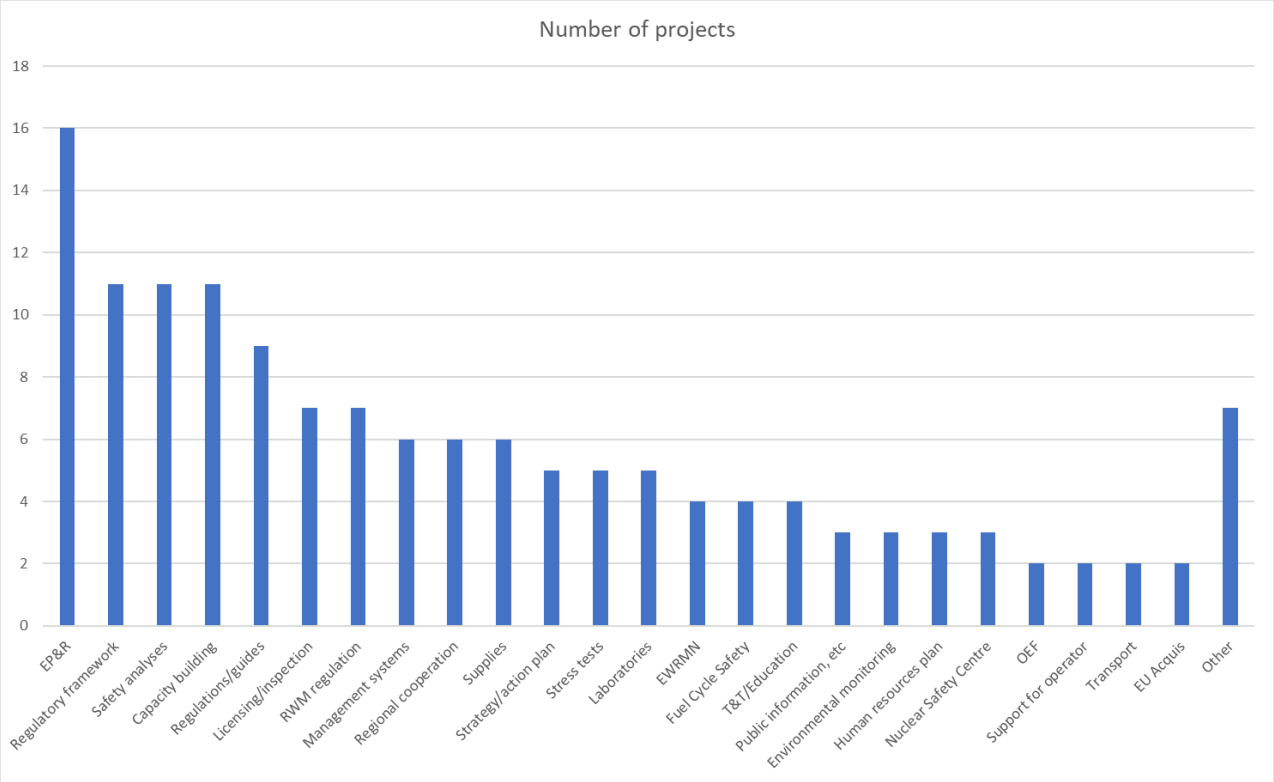

Figure 8. Distribution of topics included in nuclear safety culture projects

3.1.2 Achievements of Cooperation[23]

Many projects under INSC-II are still being implemented and some have not yet been contracted. The completion of many projects has been delayed because of restrictions on travel imposed because of the Covid pandemic. Nevertheless, several projects have successfully completed. Based on the review of project documentation summarised in Annex 2, their achievements include:

- Strengthened capabilities of the regulator and its technical support organisation in Ukraine in: licensing nuclear installations other than nuclear power plants, such as fuel fabrication facilities and interim storage facilities for spent fuel; assessing and reviewing provisions for severe accident management with a focus on spent fuel pools; the assessment and regulation of natural and man-made external hazards to nuclear facilities; and regulating radioactive waste management.
- A strengthened regulatory framework in Ukraine, with improved alignment of nuclear safety regulations with the EU *acquis* and WENRA reference levels and enhancements in the area of operating experience feedback.
- An improved legal and regulatory framework in Tanzania for uranium mining and milling and associated transport that is in accordance with international standards; improved cooperation among the various Tanzanian authorities with a role or responsibility for mining and processing of uranium; recommendations for improving the preparedness, including emergency preparedness, of Tanzanian ports to handle uranium ore concentrate; and enhanced knowledge, skills and competences of the regulatory body.
- Further enhancements and strengthening of the regulation of nuclear safety in China in the areas of: radioactive waste management and decommissioning; EP&R; transport of radioactive materials; safety principles for the reprocessing of nuclear fuel; seismic analyses and safety; and R&D facilities and infrastructure supporting the regulation of radiation and nuclear safety.

[23] The outputs and outcomes of the projects

- Enhanced capabilities of the regulatory authority in Iraq and improved framework for regulating radioactive waste management, decommissioning and remediation activities, particularly in the context of authorisations, inspection and enforcement and periodic safety reviews, and regulations and safety guides on decommissioning, waste management and waste disposal.
- Training, typically comprising one to three modules of a week each, provided to between 300 and 400 trainees per year and tutoring, typically comprising one to three modules of four weeks each, provided to about 15 to 20 persons per year, benefitting regulatory authorities from more than 20 countries.
- Establishing a registry of radiation exposures for radiation workers in Serbia.
- Provision of a mobile radiation laboratory to support the regulatory authority in Belarus in its nuclear licensing activities.

3.1.3 Impacts of Cooperation[24]

In order to better understand the impacts of the cooperation in the partner countries or regions, their views were sought (via a questionnaire) about impacts and how the outcomes of the cooperation were being or were expected to be used. The feedback provided by the partner countries or regions is summarised in Annex 4. For the nuclear safety culture objective, the main impacts reported were:

- In Armenia, the cooperation is assisting the operator of the Armenian NPP to implement the recommendations and measures identified in the 'stress tests', specifically in improving the leak-tightness of the confinement and the spent fuel pool. An intensive training programme has delivered more than 20 nuclear safety training courses and 70 sets of training material have been developed for the Full Scope Simulator (provided under a previous INSC project) for main control room operators. The nuclear power plant operator received missions from WANO in 2016 and in 2019 and actively participated with the Armenian regulatory authority in the peer reviews on implementation of the 'stress test' measures.
- The regulator in Armenia (ANRA) is using the results of cooperation to inform its regulatory decisions on requirements for the ANPP and improvements needed for its planned life time extension. A large number of Government Decrees and ANRA Orders have been revised taking account of EU standards and international best practice. ANRA has improved its emergency preparedness and response system, is installing an Early Warning Radiation Monitoring Network (EWRMN) and customising JRODOS to further improve its capabilities in EP&R and environmental radiation monitoring. The T&T programme has contributed significantly to capacity building and professional development. Cooperation has also contributed to preparation for and implementation of the recommendation of IRRS, IPPAS and INSSP missions and EC peer reviews.
- In Belarus, cooperation has been used to develop the organisational strategy, policy and integrated management system of the regulatory body (GAN) and revise the legislative framework. Knowledge gained via training and familiarisation with best European approaches and practices have been used to improve the regulatory and legal framework including on licensing of nuclear facilities. The mobile radiation monitoring laboratory was used to monitor around sports facilities in Belarus prior to their use during the 2019 European football championship and as well as around nuclear facilities. Cooperation has also supported implementation of recommendations of INIR, IRRS and EPREV missions.
- In Ukraine, cooperation with European experts has enabled the SNRIU's regulators to become more familiar with best European practice and apply it in Ukraine. Regulatory documents on nuclear power plant safety have been developed to improve national legislation and align it with the EU *acquis* and WENRA reference levels: nine regulatory radiation safety acts have been approved and a further two are being finalised. Cooperation is similarly being used to improve the regulatory framework for radioactive waste treatment and disposal facilities and to

[24] The uses to which the partners have put and are putting the outputs and outcomes of the projects and the benefits they have derived.

develop or improve relevant legislation, regulatory standards and guidelines and align them with international best practice. Over 100 SNRIU staff have attended training courses since 2012 on safety culture, EP&R, periodic safety reviews, radioactive waste management, decommissioning, nuclear security, safeguards, radiation protection and quality management systems. Workshops have been held in SNRIU to disseminate more widely the knowledge and skills gained by those attending training courses.

- Cooperation with the Kingdom of Morocco has enabled the regulatory authority to achieve all of the objectives in its strategic plan for 2017-21, including upgrading its nuclear safety and security regulatory framework and enhancing nuclear and radiological safety and security at the national level. A total of 56 regulations, comprising 15 decrees, 19 ordinances and 22 technical prescriptions have been drafted and submitted to the Head of Government for approval. The workforce of the regulatory authority has grown from a single person in 2016 to 84 employees in 2021. Around 2,300 days of training have been delivered, more than 10% of which was contributed under INSC cooperation in the last four years.
- As a result of the cooperation, the nuclear regulatory authority of Ghana expects to have developed a strategy and action plan for enhancing its capacity and effectiveness and have prepared regulations in line with the international nuclear safety framework. The cooperation is assisting Ghana in addressing recommendations from an INIR mission. A total of 174 individuals have received training.
- The on-going cooperation in Iran has strengthened the regulatory authority in discharging its regulatory responsibilities. It has enabled the regulatory authority to draft and finalise several regulations in line with the highest safety standards, including general principles and regulations for nuclear facilities and radiological activities, and regulations on the safe design of research reactors and on pre-disposal management of radioactive wastes. Cooperation on safety assessment reviews, and particularly the collaborative review of the PSAR of the Bushehr NPP Unit 2, enabled experts from the regulatory authority to enhance their capabilities and led to a considerable reduction in the regulatory authority's reliance on its foreign consultant. Inviting operators of nuclear facilities to technical support events and holding nuclear safety schools have enhanced safety culture in other sectors of society.
- As a result of cooperation, Iraq has enhanced its capabilities to monitor different regions for radioactive contamination and take appropriate action. It is also dealing with radioactive waste from demolition of nuclear facilities in accordance with IAEA standards.
- Cooperation in ASEAN on EP&R has provided an enhanced understanding in the region of the needs for cross-border arrangements. The development of early warning radiation monitoring networks and a regional data exchange platform has provided a platform to enable ASEAN Member States to work towards greater inter-comparability of monitoring data.
- Tanzania is using the results of the cooperation to strengthen its regulatory frameworks to be in line with IAEA recommendations and EU best practice, including reviewing its regulations and developing licensing procedures and inspection guidelines. The Atomic Energy Act of 2003 and six regulations have been reviewed and revised and are awaiting approval by the responsible Minister. In addition, four guidelines and two procedures have been developed in draft form and are awaiting approval or endorsement from the national authority. The cooperation assisted Tanzania in implementing a recommendation from an IAEA Uranium Production Site Assessment Team (UPSAT) mission.

An external assessment of support to the regulatory authority in Ukraine (18), summarised in Annex 5, concluded that the impact of the INSC cooperation was evident in the progress being made on the transposition of EU Directives into national legislation, by the regulatory authority becoming a full member of WENRA and taking part in the ENSREG 'stress tests', and by the TSO becoming an associate member of ETSON and active in commercial consultancy.

An external assessment of nuclear safety cooperation with Armenia (19), also summarised in Annex 5, found that the INSC projects were of high quality, and, together with the work of other donors, enabled substantial progress to be made towards resolving outstanding safety issues at the nuclear power plant and in following up 'stress test' issues. On-site assistance to the nuclear power plant operator (provided

as follow-up to the 'stress tests') proved to be a highly effective mechanism in fostering a mutual understanding on introducing and consolidating a real safety culture and in preparing and supporting a large number of service and equipment supply projects. Support to the regulator and its TSO facilitated high-level license reviews and capacity building on various relevant topics. Assistance to the responsible Ministry was essential in establishing a strategy on the safe management of radioactive waste, spent nuclear fuel, and decommissioning. The impacts of these achievements have been substantiated in the 2017 Armenian National Reports to the Convention on Nuclear Safety and the Joint Convention.

An external assessment of the training and tutoring (T&T) projects (20) (see Annex 5) found that their impact was recognised as favourable by participants and their regulatory authorities and technical support organisations world-wide. The attention given in training and tutoring to regulatory responsibilities was fully in line with the objectives of the INSC Regulation and provided added-value as compared to other courses. The T&T projects were able to attract staff from nuclear regulatory authorities and technical support staff from all regions of the world. In addition, the training and tutoring progamme was identified as one of the four good practices praised by the 2017 meeting of the Convention on Nuclear Safety.

3.2 Management of Radioactive Waste and Spent Fuel, Decommissioning and Remediation

3.2.1 Nature and Scope of Cooperation

The cooperation in this area has included that with regulatory authorities[25], but has mostly been with organisations responsible for radioactive waste management, in many cases governmental organisations. The cooperation has, in general, been implemented on a country-by-country basis with some cooperation, particularly in Central Asia at a regional level. Summary descriptions of the cooperation projects and their status are provided in Annex 2. The distribution of projects between countries and/or regions is shown in Figure 9. The separate contributions made to EBRD accounts (see Annexes 1 and 2) under INSC-II are also indicated; contributions to the CSF and NSA have supported waste management projects in Ukraine and contributions to the ERA have supported remediation projects in Central Asia. The largest number of projects has been in Ukraine.

[25] As explained previously, there is a clear overlap between the nuclear safety culture and radioactive waste management objectives in the Regulation with regard to support to regulatory authorities and reinforcement of regulatory frameworks. This evaluation has generally followed the attribution of projects to objectives in the action documents unless the majority of the project or its elements are clearly related to the other objective, in which case the project or the elements have been considered under that (i.e., the other) objective.

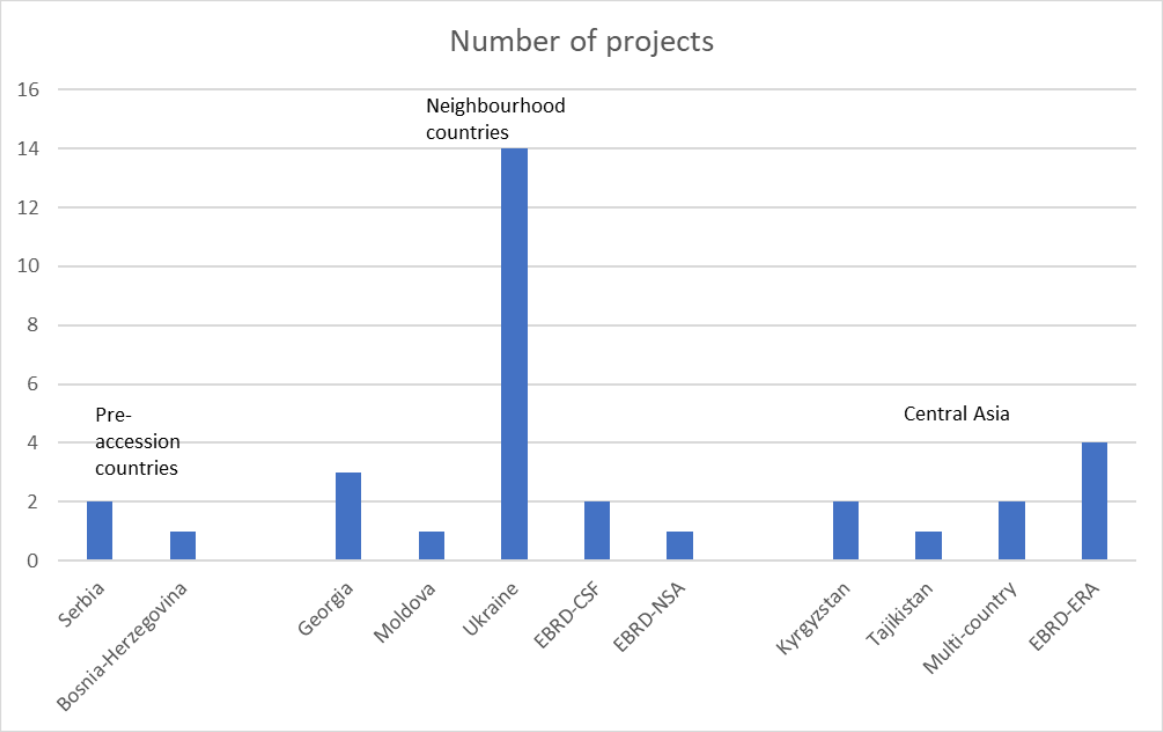

Figure 9. Geographical distribution of waste management projects (see Annex 1)[26, 27]

Figure 10 indicates the topics covered in the cooperation on radioactive waste management and the number of projects in which each topic has been, or will be, addressed. The most frequent type of activity, featuring in six projects, has been treatment, storage and disposal of legacy wastes which have been accumulated, stored or disposed of in an inappropriate manner in the past. Also frequent, featuring in five projects, has been implementation of a strategy and action plan, often developed as part of cooperation under previous programmes, for treating, storing and/or disposing radioactive wastes, in many cases also legacy wastes. The legacy wastes being addressed in these projects include those from uranium mining, milling and processing operations in the past, in particular in Central Asia and in Ukraine, as well as radioactive waste and disused sealed sources from the use of radioactive material, not only in the nuclear industry, but also in research, industry, medicine and agriculture. The development of strategies and actions plans features in four projects. The specification and supply of monitoring and waste treatment equipment feature in five and three projects, respectively. Other activities, feature in three or fewer projects each.

[26] In this figure, the separate contributions to EBRD funds have been counted as separate projects
[27] The geographical distribution of funding differs from that of the number of projects – information on funding can be found in Annex 1.

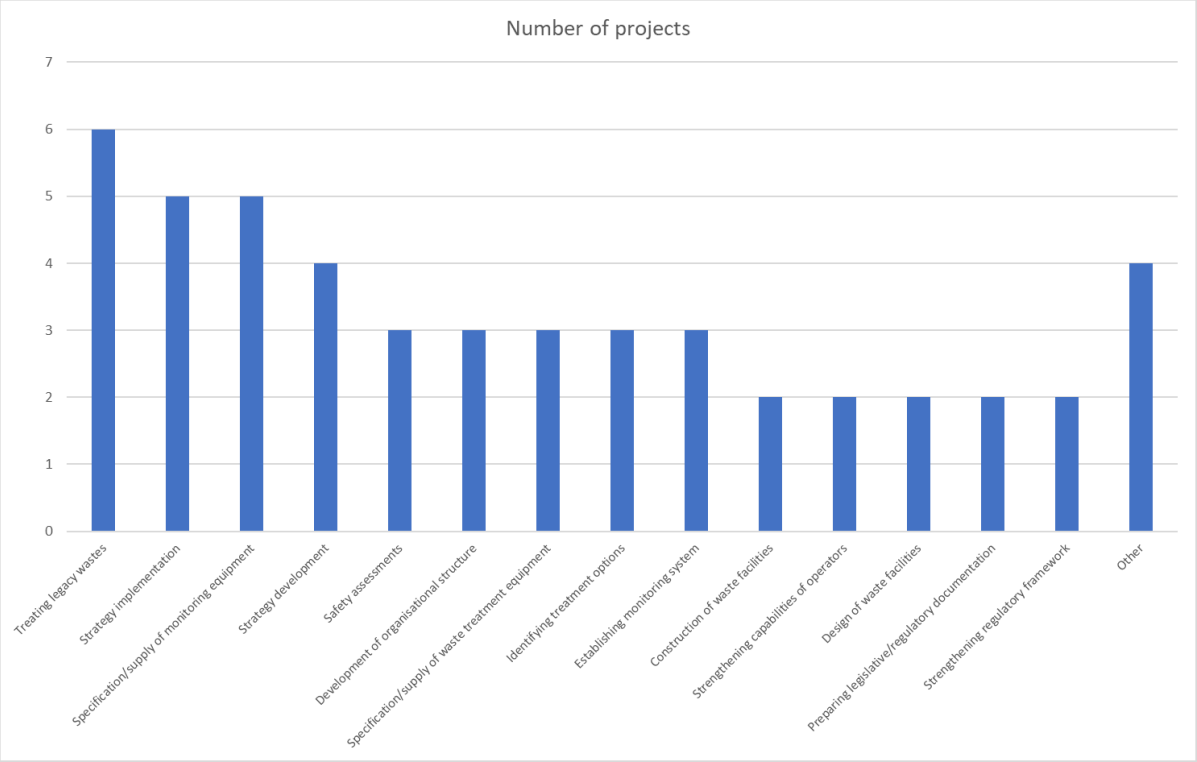

Figure 10. Distribution of topics included in radioactive waste management projects

In terms of the MIP priorities, there are some projects addressing the development of waste management regulatory frameworks, national strategies and feasibility studies. But many projects have been concerned with implementation of improved waste management, either as part of implementation of an established national strategy or to address situations where waste "is managed and stored in unsatisfactory and potentially dangerous conditions". There was one project addressing the development and implementation of regulatory frameworks for mining activities and management of radioactive sources in Africa; this was the cooperation project with Tanzania classified as a nuclear safety culture project (see Section 3.1 above). There may have been interest in this topic elsewhere in Africa at the time the MIPs were prepared that then did not materialise. Also, the absence of further projects does not necessarily indicate no interest in cooperation and proposals for cooperation may be forthcoming under the INSC-III.

3.2.2 Achievements of Cooperation

Many waste management projects are still being implemented and some have not yet been contracted. The completion of many projects has been delayed because of travel restrictions imposed because of the Covid pandemic. Nevertheless, several projects have been successfully completed. Based on a review of project documentation summarised in Annex 2, their achievements include:

- A major achievement that occurred during the period of INSC-II, but which was the culmination of support under previous programmes as well as under INSC-II, was the completion of the construction of the Chernobyl New Safe Confinement in 2019. This has contributed significantly to making the site of the world's worst nuclear disaster environmentally safe. Equipment has also been provided inside the shelter to dismantle, in the future, the structures and the remains of the destroyed reactor. The contribution to the EBRD Nuclear Safety Account supported the completion of the construction of major radioactive waste management facilities at Chernobyl, specifically the Liquid Radwaste Treatment Plant (LRTP) and the Interim Spent nuclear Fuel storage facility (ISF-2).
- Also in Ukraine, a national action plan has been developed for the establishment, operation and closure of a geological disposal facility for high-level waste and intermediate-level waste that could be co-disposed with the high-level waste.

- In Georgia, an inventory was completed of the radioactive wastes that have accumulated in the country and appropriate means for their management were defined, an assessment was made of the suitability of a site for a national radioactive waste management facility, the functional requirements for the design of the waste management facilities were developed, and proposals were prepared for approval. The Georgian Government has subsequently approved the use of the site and regulatory approval has been granted, in principle, to the design of the facilities.
- In Central Asia, cooperation under INSC-I, which has continued in INSC-II, has helped to lay the foundations for the preparation of the Strategic Master Plan (17) for the remediation of priority uranium mining and milling legacy sites and the establishment of the EBRD ERA to fund remediation work.
- In the Kyrgyz Republic, an integrated EIA and feasibility study was completed at the priority legacy sites at Mailuu-Suu and fixed and mobile equipment has been installed for early warning monitoring of landslide risks at all of the uranium legacy sites.

An external review of nuclear waste projects in Ukraine under INSC-I and INSC-II (21), summarised in Annex 5, found that the achievements of the INSC projects were of high quality, with substantial progress towards the provision of essential facilities, equipment, and procedures.

3.2.3 Impacts of Cooperation

Feedback provided by the partner countries in response to a questionnaire which is summarised in Annex 4 indicates that, for the waste management objective, the main impacts of the cooperation were as follows:

- The governmental organisations in Bosnia and Herzegovina expect to use the results of the cooperation to: complete the procedures to be used for licensing the proposed radioactive waste storage facility; upgrade the safety assessment of the radioactive waste storage facility; and implement the option chosen for radioactive waste storage to upgrade the existing temporary waste storage facility to meet international standards and to serve as the country's central waste storage facility.
- In Ukraine, the Chernobyl Nuclear Power Plant organisation (ChNPP), which is responsible for the decommissioning of the closed plant, is making use of the outcomes of support under previous programmes and expects to apply techniques developed under INSC-II to deal with some problematic waste to the processing of all such wastes. It will use the upgraded dosimetric control system to better quantify and reduce the risks to staff, visitors and the environment around the power plant.
- Also in Ukraine, the Central Enterprise for Radioactive Waste Management (CERWM) has used and will use the outcomes of cooperation under INSC-I and INSC-II to: carry out safety assessments of radioactive waste disposal and storage facilities around the Chernobyl NPP; and use these in order to identify and evaluate options for managing the facilities and the wastes they contain and reducing the associated risks. Recommendations have been put forward regarding institutional control measures, inspection and monitoring, preventive maintenance activities, remediation activities and emergency preparedness and response.
- The Ukrainian State Association "Radon" intends to apply the process identified under the cooperation for removing radioactive waste from old storage facilities to storage facilities at its central production site and at other near-surface storage facilities at the central production sites of its affiliates. The standard technical solution identified for the retrieval of solid radioactive waste from storage facilities and the rehabilitation of the storage facilities is being used as a template for the development of a standard technical solution for all cases of radioactive waste removal at the five "Radon" sites.
- The Kyrgyz Republic has used the results of cooperation in the development of a strategy and action plan for regulating radiation safety and in preparing a human resources development plan, including a professional career structure with progression to improve staff retention. It now has up-to-date equipment enabling more efficient and effective regulation. Eleven people (all male) have been trained in the use of mobile equipment for monitoring landslides and twelve people (eight male and four female) in the use of equipment for measuring radon. It has

a strategy for remediation of its legacy sites which has enabled: better characterisation of the types and quantities of radioactive wastes requiring treatment, storage and disposal; better quantification of the risks posed; identification and assessment of alternative options and improved practices, including new facilities, for radioactive waste management; and stakeholder involvement.

- Tajikistan has used the outcomes of a regional cooperation project to develop important regulatory documents and laws. More than 12 TSO and regulatory staff participated in the T&T programme, four of whom were female. The knowledge obtained has been used in the department responsible for licensing, inspection and response to CBRN accidents. The Government of Tajikistan is supporting the establishment of a new TSO to cover topics including the development of legislation and regulatory requirements, and this new TSO will also benefit from knowledge obtained in the training.
- Tajikistan plans to use the water treatment plant to be implemented at Taboshar to clean-up water contaminated from uranium legacy sites in the area. Eight people (all male) from the TSO have been trained in relation to planned remediation activities, and they are then training staff of the organisations dealing with radioactive waste management at a regional training centre on nuclear and radiation safety operated by the TSO.

The external assessment of nuclear waste projects in Ukraine (21) (see Annex 5) found that INSC support had influenced recent changes in Ukrainian legislation which restored the financing of radioactive waste management from the radioactive waste management fund and in the structure of the waste management organisation, the State Agency of Ukraine for Management of the Exclusion Zone (SAUMEZ[28]). INSC support for radioactive waste management at two operating nuclear power plants has resulted in the treatment systems being rolled out to the other operating NPPs. The study also found, *inter alia*, that the role of the Joint Support Office (JSO) had been critical to the achievements and impact of the INSC.

3.3 Safeguards for Nuclear Material

3.3.1 Nature and Scope of Cooperation

According to the INSC Regulation, cooperation shall pursue, as one of the specific objectives, "the establishment of frameworks and methodologies for the application of efficient and effective safeguards for nuclear material in third countries". The strategy (3) for 2014-2020 specified that the following activities would be supported under this component:

- Establishment of the necessary regulatory framework and the development of methodologies for the implementation of nuclear safeguards, including for the proper accounting and control of fissile materials at State and operators' level;
- Support for the infrastructure and training of staff;
- Education initiatives in nuclear safeguards will be considered in third countries at a regional level.

Contributing to the above objective and activities, the Joint Research Centre (JRC) provided one week training courses on nuclear safeguards and non-proliferation that it had developed for the European Safeguards Research and Development Association (ESARDA). This training course was offered annually to students and young professionals worldwide. The JRC was to further provide the course in relevant regions to establish regional capacity that would sustain the nuclear safeguards and non-proliferation efforts. The JRC also provided technical support and equipment for the IAEA to deploy worldwide.

[28] Also referred to in documentation as SAUEZM (State Agency of Ukraine for Exclusion Zone Management) and SAMEZ (State Agency for Management of the Exclusion Zone).

Other actions to meet the above objective were addressed by funding the IAEA (indirect management) or contracted by the EC as appropriate.

Direct demand for safeguards support remained relatively low during the period 2014-2020, which is reflected in the budget allocation of 20 M€ (less than 10% of the reference amount for the implementation of the Regulation). In order to have a sufficiently large critical mass and avoid an excessive administrative burden, safeguards support was concentrated in four actions under AAPs 2015, 2017, 2018, 2020. The corresponding projects, summarised in Annex 2, aimed to support the establishment of effective and efficient nuclear materials safeguards in the partner countries through: training and education; strengthening States' Systems of Accounting and Control of Nuclear Materials (SSACs) through training and advisory services; and safety, security and safeguards of uranium mining and transport in African countries. Support to enhance safeguards capabilities in the partner countries was provided mostly under multi-country actions (including Serbia, China, Iran and Southern African countries involved in mining and transit of uranium), as well as under specific actions for Iran. Training and tutoring courses on safeguards were provided for a large number of students and relevant authorities' staff. Implementation of the projects was with the support of JRC, IAEA, ENSTTI, ENEN, ISTC and the STCU.

3.3.2 Achievements of Cooperation

Many of the actions addressing the safeguards objective of INSC-II are still being implemented. The respective projects have suffered delays because of the Covid pandemic. The achievements of the projects which have been completed, or at an advanced stage of completion (see Annex 2), include:

- In Serbia, training was provided in nuclear material accountancy and measurement, nuclear materials at the Vinča radioactive waste site have been characterised and essential equipment for identifying nuclear material and for transport and storage has been provided.
- In Iran, support has been provided to enhance the capabilities of the IAEA Department of Safeguards with regard to its verification and monitoring activities. The capabilities of the Safeguards Analytical Laboratories have been improved in terms of the performance, quality and timeliness of analyses of inspection samples, and essential equipment and training for effective inspection and other monitoring and verification activities have been provided to the Office for Safeguards Verification.
- Educational courses on nuclear safeguards and non-proliferation were held in South Africa and in Algeria by the JRC. Further courses were held on Strengthening States' Systems of Accounting for and Control of Nuclear Materials (SSACs) through training and advisory services
- Safeguards Training and Education continue to be provided by the IAEA and the JRC.
- In addition to the improvements in the legal and regulatory framework in Tanzania for uranium mining and milling and associated transport, as mentioned in Section 3.1 above, support was provided to harmonise the system of accountancy, control and transport of nuclear and radioactive materials, in Tanzania, Zambia, Malawi and Namibia, as well as the necessary nuclear material accountancy and control communication between the originating, transit and destination countries. The support was later extended to other Southern African Development Community (SADC) countries.

3.3.3 Impacts of Cooperation

Through the actions supported under INSC-II, a large number of individuals have been trained on nuclear safeguards. Where relevant and possible within the limits of the INSC budget, equipment has been provided to strengthen accounting for and control of nuclear materials, in particular in Serbia and Iran. The most notable impact of cooperation has been the improvement of the capabilities for safeguards inspection in Iran. These actions contribute significantly to the improvements in the early detection of the misuse of nuclear material or technology.

3.4 International Collaboration: IAEA

Close cooperation with the IAEA has continued under INSC-II in accordance with the Memorandum of Understanding (MoU) signed in September 2013 (22). The MoU formalised the cooperation between the two sides and defined the areas of cooperation, in particular on nuclear safety, and established a working mechanism based on that adopted for cooperation in the area of nuclear safeguards. It also provided for the creation of a Senior Officials Liaison Committee (SOLC) and Senior Officials Meeting (SOM) which hold consultations on the development and review of activities to be conducted, including future projects. Programmes and their financing would then be developed based on the consultations.

The IAEA has considerable experience in cooperation and assisting its Member States on nuclear safety, security and safeguards matters, and worldwide knowledge of the problems they face. Cooperation between the EC and the IAEA continued to take place in the form of joint projects, EU financing of projects implemented by the IAEA, and projects identified by the IAEA, but implemented by the EC with IAEA coordination (particularly when multiple donors were involved) (23).

The contributions from the INSC for projects to be implemented by the IAEA over the period 2014-2020 amounted to some 15.4 M€ which reflected the importance of the cooperation. INSC-II projects that are being, or are about to be, implemented by IAEA (via co-financing or joint management) focused on one or other of the following areas: developing a nuclear safety culture and the required capacities and expertise at global level; improving the management of radioactive waste and disused sealed sources at the Vinča site in Serbia; and supporting the adherence of third countries to international conventions and treaties and the implementation of international codes, standards, instruments and mechanisms, thereby strengthening the 'Global Nuclear Safety Regime' and nuclear safeguards.

The EC sponsored and participated in the IAEA's Regulatory Cooperation Forum (RCF), which brings together the nuclear regulators of countries with advanced nuclear power programmes and countries that are planning to expand or introduce the use of nuclear power. The RCF is an important instrument to develop cooperation among regulators, compare experiences, determine needs, and coordinate support to the regulators.

Mechanisms and procedures have been established between the EC and IAEA to review needs for cooperation, and to identify projects that could be considered for funding by INSC (partially or wholly) and how they might best be implemented (i.e., under joint EC/IAEA management or directly by INSC). The actual selection of projects for INSC support, however, follows the same procedures and management arrangements as for any other cooperation project.

In accordance with general conditions applicable to European Union contribution agreements with international organisations, the IAEA has undertaken measures to ensure that appropriate communication and visibility is given to the EU contributions during the implementation of the respective projects.

4 EVALUATION

4.1 The Approach Adopted

An in depth, mid-term, evaluation of INSC-II was carried out in 2016/17 (14). At that time, while the strategy and content of the multi-annual indicative programmes were clear, few projects had yet been contracted or were being implemented. Consequently, the mid-term evaluation focused on the Instrument's regulation, mechanisms and processes; assessment of the efficiency and effectiveness of its implementation were, of necessity, largely informed by an analysis of the implementation of INSC-I.

This evaluation builds on that carried out at the mid-term of the Instrument and makes no attempt to duplicate it. Rather, it examines the extent to which the main findings of the mid-term evaluation remain valid and/or whether they have been reinforced or challenged by new information or evidence.

Consideration is given to each of the same six Evaluation Questions, namely: relevance; effectiveness; efficiency; added value; coherence, consistency, complementarities and synergies; and leverage.

Particular attention is given to the questions of efficiency and effectiveness of INSC-II which received limited attention in the mid-term review owing to the early stage of implementation of the Instrument, with few results, external assessments or monitoring data available at that time.

While the mid-term review is the starting point for this evaluation, it has been further informed by the following:

- a review of programme and project documentation summarised in earlier sections of this report, in particular the Strategy and Multi-annual Indicative Programmes, the Annual Action Programmes comprising the Action Documents, and, for projects, Terms of Reference, Descriptions of the Action, or Technical Specifications, final (or latest progress) reports for contracted projects, and Results Oriented Monitoring (ROM) reports
- a review of external evaluations carried out on one or other element of the programme since, or in parallel with, the mid-term review, namely evaluations of: the training and tutoring (T&T) programme; cooperation with Armenia; cooperation with Ukraine in the area of waste management; and support to the Regulatory Authority of Ukraine. A summary of the main findings of these external evaluations can be found in Annex 5.
- interviews with key players in the formulation, implementation and monitoring of the Instrument, in particular personnel in INTPA F1[29], JRC Petten, JSO in Kiev and ROM Global
- responses from partner countries to a questionnaire on the impact or outcomes of the cooperation, in particular what use they had made, or expect to make, of the project outputs. A summary of these responses can be found in Annex 4

These sources of information have been used to examine some key aspects of the programme and how it has been implemented (section 4.2 below), in particular those pertaining to effectiveness and efficiency. The outcome of this examination has informed the findings of this evaluation which are set out in section 4.3 for each of the evaluation questions.

4.2 Implementation of the Instrument

Implementation of the Instrument has been successfully achieved. Cooperation has been successfully established with a large number of countries and several regions, the budget has been committed, and significant improvements have been made in enhancing nuclear safety, waste management and safeguards. Major factors that have significantly affected the effectiveness and efficiency with which the Instrument has been implemented are examined in this section, together with how implementation conforms with the provisions and constraints in the Regulation, the Strategy and MIPs.

4.2.1 Thematic and Geographical Scope

The objectives of the Instrument are well aligned with EU policies and priorities and the support provided for cooperation under each objective of the Instrument (nuclear safety culture, waste management and safeguards) is broadly in accord with that foreseen in the Strategy and the MIPs (see Figure 4). That for nuclear safety culture was about 10-20% less than foreseen, while that for waste management was about 10-20% greater[30], but the differences are modest and not surprising in view of the demand-led nature of the programme. The scope and nature of cooperation under each objective reflected the measures described in the Regulation and the Strategy and the priorities set out in the MIPs (see Sections 2.1 and 2.2.2). Given that the Instrument is demand driven (i.e., responsive to requests for cooperation from partner countries or regions), it clearly remains relevant to partners' needs.

By far the majority of the cooperation was with regulatory authorities and organisations responsible for waste management and remediation. The Regulation allows for cooperation with operators of nuclear installations (excluding the supply of equipment), but this was limited to providing support in carrying

[29] Interviews with personnel in INTPA R6 were also requested, but were not accepted.

[30] Because of overlap between the types of cooperation included under nuclear safety culture and radioactive waste management and a resulting lack of clarity over where some actions and projects were best classified, the difference may in reality be slightly different from that indicated.

out 'stress tests' at NPP in two countries (Armenia and Iran) and in responding to their outcomes. The promotion of nuclear safety culture, however, is at the heart of the Instrument and, in practice, nuclear safety is achieved by those responsible for the design, construction and operation of nuclear installations[31]. It is a moot point, therefore, whether the objectives of the Instrument could have been better and more efficiently achieved (i.e., greater added value for expenditure of a given resource) through giving greater attention to cooperation with operators of NPP, but limited specifically to enhancing nuclear safety culture[32]. This is something that warrants further consideration in future.

The geographic scope of the programme is fully in line with the provisions in the Regulation, i.e., global scope but with priority given to cooperation with EU pre-accession countries[33] and those in the European Neighbourhood, with a regional approach preferred elsewhere (see Figure 5). About 50% of the resources used to fund projects (i.e., the total budget less that used for support activities) were allocated to cooperation with pre-accession countries and those in the European Neighbourhood, with by far the majority of this to the latter; about 20% were allocated to countries elsewhere in the world, with the majority of this for cooperation with Iran. The remaining 30% or so were allocated to cooperation at a regional level (e.g., the Western Balkans, Central Asia, ASEAN, the Gulf Cooperation Council, southern Africa, non-EU countries bordering the Mediterranean Sea, etc) or with wider, often global, reach (e.g., the Training and Tutoring programme, cooperation in some activities implemented by IAEA on behalf of the Instrument, etc). Cooperation at a country level has been established with 15 countries and, at a regional level, with 6 regions[34].

4.2.2 Duration of an Action and the Project Life Cycle

Requests for cooperation under the Instrument will often, understandably, tend to focus on more immediate, rather than longer-term, needs and priorities. The time that elapses between the initiation of a request and the implementation of cooperation is therefore an important factor affecting the relevance, effectiveness and efficiency of the Instrument. If the timescale to address the needs and priorities underlying a request for cooperation is not in line with the timescale over which cooperation will take place, there is a risk that the cooperation will no longer be optimal or even relevant. While it is possible for cooperation under the Instrument to be implemented rapidly in response to a request, it can also take several years.

The main steps in implementing one annual cycle of the Instrument (i.e., receipt of requests for cooperation, development and approval of an AAP, contracting and follow-up of implemented projects) are described in Annex 6, together with factors determining their respective timescales.

The time between a request for cooperation and the start of its implementation (i.e., contracting a project) is generally quite long, occasionally extending up to as much as six years. Contracts then typically have a duration of three or four years. The total time between a request for cooperation and the completion of cooperation can then be up to ten years. This has implications for the nature and timing of requests for cooperation, the formulation of Action Documents in response to requests, and the effectiveness of the cooperation. For cooperation under the Instrument to be relevant to their needs and priorities, potential partners need to be made aware of the likely timescales over which the cooperation will be delivered, particularly where a Financing Agreement (FA) may need to be negotiated, and to formulate their requests accordingly. In addition, Action Documents prepared in response to a request need to clearly set out the main objectives to be achieved, but provide sufficient flexibility to accommodate small changes in circumstances and avoid the risk that an overly prescriptive formulation can no longer be implemented as described and the action and the funding committed are

[31] The two large accidents at Chernobyl and at Fukushima-Daiichi both had their origins, at least in part, in design weaknesses, and that at Chernobyl was further exacerbated by poor safety culture.
[32] With the aim, therefore, clearly being to improve nuclear safety culture and not to provide (or being seen as providing) support to nuclear energy or distorting competition.
[33] Prior to INSC II nuclear safety cooperation with pre-accession countries took place under the Instrument for Pre-accession Assistance (IPA).
[34] In addition, cooperation at a regional level has been a feature of some projects implemented by IAEA (see Section A2.2.4)

lost. Achieving an appropriate balance is challenging, particularly for those inexperienced in such matters.

The long time between a request for cooperation and the start of a project can be a serious impediment to the effective implementation of the Instrument and how it is perceived by partner countries. Efforts that were made in INSC-II to reduce the 'time to contract' compared with that in INSC-I have, however, met with limited success. For INSC-II projects contracted up to June 2021 (see Annex 1), the average time between the approval of the action (i.e., the EC Decision) and contracting was about 23 months; the average time for projects contracted with a FA was about 35 months[35] and for projects without such an agreement about 15 months. A modest reduction, of about 7%, in the average 'time to contract' for all projects in INSC-II was achieved by limiting the use of FA to where they were essential and by contracting through a negotiated agreement when duly justified. About one third of projects in INSC-II were contracted with a FA compared with two thirds in INSC-I. This modest improvement, however, disguises significant increases (compared with INSC-I) of about 14% in the average 'time to contract' for projects implemented with a FA and of about 26% for projects implemented without a FA (i.e., the improvement in the overall average 'time to contract' is purely due to the much smaller proportion of projects implemented with a FA). In practice, the increase in the average 'time to contract' for projects implemented without a FA will be even greater, as no account has been taken of the additional time needed for projects implemented by ISCT and STCU to be contracted. Making a plausible allowance for the latter (i.e., 6 months), the average 'time to contract' for projects implemented without a FA in INSC-II will have increased by about 40% compared with INSC-I. The lack of resources in Units F1 and R6 are the most likely causes of these increases.

Further efforts are needed to reduce the 'time to contract'. An increase in resources, both within INTPA and in the support it receives from JRC, would obviously improve the situation, but other steps could be taken meanwhile to shorten the project life cycle, specifically preparing ToR for projects in parallel with the approval process for AAP (typically 6 months)[36]. This would come with the risk that the effort so deployed may be wasted if one or other action within an AAP failed to receive approval or if radical changes were made to its scope or content in the approval process, but experience indicates that this risk is low. Additional resources would be needed temporarily to deal with the preparation of ToR for actions within approved AAPs as well as those within AAPs still within the approval process, but an increase in resources by a few tens of percent over two or three years should be sufficient to significantly shorten the average 'time to contract'.

4.2.3 Contracting Mechanisms

Following approval of an Action Document, either Terms of Reference (or Technical Specifications for the provision of supplies) are prepared as the basis for open or restricted tendering, or a Description of the Action is prepared for contracting via a negotiated agreement where duly justified. Contracting via negotiated agreement takes less time than open or restricted tendering and offers some advantages in appropriate circumstances. In the TACIS programme most cooperation with regulatory authorities was implemented through negotiated agreements because of the benefits it gave in enabling the establishment of trust and effective working arrangements and providing continuity of support. Under INSC this approach has been used with decreasing frequency, because, in the light of enlargement (resulting in a significant increase in the number of Member States with nuclear expertise) and the opening of markets, the benefits of open or restricted tendering in terms of savings and efficiency were judged to outweigh those of continuity of support. Nevertheless, across the whole of the programme,

[35] The main factors contributing to the longer 'time to contract' for projects implemented with a FA are, firstly, the two-step process of negotiating an FA followed by contracting and, secondly, the much longer timescale available (typically 3 to 4 years) for contracting such projects. In addition, the start of some 'follow on' projects in a country has been deliberately delayed to avoid or minimise overlap with an ongoing project that might otherwise have led to the capacity of the partner to absorb the cooperation being exceeded.

[36] Or in the case of projects implemented with a FA, in parallel with the negotiation of the FA; this would potentially result in even greater reductions in the 'time to contract'

more than half of the projects (56%) continue to have been implemented via a negotiated agreement in INSC-II; albeit with some reduction compared with INSC-I (64%).

The reasons used to justify contracting by negotiated agreement generally fall into one of the following categories: implementation by an international organisation (e.g., IAEA, UNDP, ISTC, STCU) thereby offering benefits such as added value, complementarity and synergy with other programmes; the required expertise being largely confined to a single organisation (e.g., IAEA or JRC for cooperation on safeguards); contributions to EBRD funds, again offering added value, complementarity and synergy benefits from pooling the resources of many donors; failure to solicit credible bids in an open or restricted tender; and extending the scope of ongoing cooperation that had been established previously through open or restricted tendering. It is important to recognise, however, that implementation via an international organisation or through contributions to EBRD funds, while less resource intensive for INTPA Units F1 and R6, involves a loss of direct control, flexibility and visibility for the Instrument, with projects being perceived to be IAEA or EBRD projects and not INSC projects, even if they comply with the EU visibility requirements.

For certain types of project, cooperating with the IAEA offers several benefits. The IAEA has an extensive network of cooperation worldwide and well-established channels, in particular under their Technical Cooperation and Nuclear Safety programmes, and there are advantages in utilising rather than duplicating these. The IAEA also has a structure which allows it to provide small-scale support to a large number of countries, which would not be possible for projects implemented directly under the rules governing the INSC with its comparatively heavy administrative burden. On the other hand, under the INSC, the EC is better prepared to implement large projects, particularly in the EU neighbourhood, and reach a larger number of countries with standardised programmes, such as the Training and Tutoring for capacity building for Nuclear Safety Regulators. Cooperation with the IAEA has proved to be very useful in identifying needs for assistance and priorities, and contributing to the definition and implementation of some projects. It also helped to avoid duplication of effort and optimise the use of limited financial resources by identifying and making use of possible synergies. The structure created by the MoU and the formal and informal channels of communication that were developed proved to be effective for the interaction between the EC and the IAEA and continued to contribute to the successful implementation of INSC-II. Nevertheless, cooperation with IAEA has also been associated with some difficulties. For some projects, especially those providing on-site assistance, implementation through open and competitive tendering may have delivered better outcomes and been more cost-effective. Greater clarity and transparency on the criteria or process used in deciding which INSC projects are judged likely to be more effectively implemented by IAEA, rather than through open tendering, would be warranted. Delays in implementing and/or amending projects have also been encountered because IAEA was unable to accept some of the restrictive provisions governing the financing of INSC projects; these problems have, however, been recently resolved.

A significant change in INSC-II in comparison to INSC-I is the greater use made of ISTC and STCU for contracting some projects. The advantages of doing so are: firstly, it reduces the burden of contracting on those responsible for implementing INSC within INTPA (i.e., Units F1 and R6) and those providing technical support at a time when both are under-resourced; and, secondly, it facilitates the implementation of projects for which support was being provided by more than one source, thereby avoiding duplication and exploiting synergies. However, the benefits in terms of a reduction in the 'time to contract' may be less clear-cut, as the ISTC and the STCU (and other international organisations where initial contracting has been by negotiated agreement) will often need further time to contract in turn, and this will add to the time before implementation can begin.

4.2.4 Resources for Programme Implementation

The mid-term review drew attention to human resource limitations within INTPA and their effect on the Instrument's efficiency. Human resources within INTPA have, if anything, decreased further since the review. This evaluation has noted considerable variability in the quality of action documents and project reports. The consistent view of interviewees is that the resources available in INTPA and in JRC for programme development and project implementation have been barely sufficient to carry out the essential administrative tasks of programming, contracting and following up of projects, with nothing

available for desirable activities, such as reflection on outcomes, successes or problems and lessons to be learnt, and development of improved processes, procedures, etc. There are several underlying causes.

Reduction in allocated human resources

The budget for cooperation in INSC-II, excluding contributions to EBRD funds, was about one-half of that for INSC-I[37], and the number of projects contracted (or to be contracted) in INSC-II has been about 60% of that in INSC-I. The human resources allocated for managing the Instrument declined by about one third during the period of its implementation. This reduction in human resources, while possibly logical and justified, appears to have failed to recognise that the administrative burden was not directly proportional to the budget. In view of the project implementation cycle set out in Annex 6, a large number of INSC-I projects were being implemented during the period 2014-2020; in fact, some actions approved in the last year of INSC-I may still be being implemented at the start of INSC-III. Furthermore, some administrative tasks need to be carried out irrespective of the number of projects and INTPA had to allocate significant efforts to policy matters in the absence of sufficient resources in EEAS (see below). The effectiveness with which INSC-II has been implemented has, as a result, been reduced. While budgets have been committed and projects contracted in accordance with the AAP, this has only been achieved through the continuing commitment and dedication of those involved. Inevitably, in these demanding circumstances, there has been some loss of quality as was recognised in the mid-term review and this evaluation.

At the same time, there has been and continues to be a substantial loss of experienced and knowledgeable staff from INTPA F1, through retirements of several officials or their transfer elsewhere. While some vacant posts have been filled, it takes time for staff unfamiliar with nuclear safety to develop sufficient understanding of what is a highly technical subject, even when supported by technical expertise from the JRC and elsewhere. The resulting loss of such expertise and institutional memory has had a detrimental effect on programme effectiveness.

Lack of policy resources

In the light of experience with the TACIS programme, when INSC was developed, there was a clear distinction established between programme policy and programme implementation: RELEX was responsible for the policy (in particular, the drafting of the Instrument, and the development of the Strategy and MIPs, etc.) and INTPA (formerly AIDCO then DEVCO) for its implementation (i.e., the development of AAP and AD, contracting, project follow up, etc). At the time, RELEX and AIDCO cooperated closely and both had sufficient resources and in-house expertise to fulfil their respective roles. However, with the creation of the European External Action Service (EEAS)[38], which largely absorbed the former functions and responsibilities of RELEX, responsibility for INSC policy remained with the EEAS, but without sufficient in-house resources for developing informed policy on nuclear safety. In its absence, DEVCO/INTPA took the leading role in developing policy with the cooperation and approval of the EEAS. Although these arrangements may have been working adequately, they have: placed additional demands on DEVCO/INTPA; allowed knowledgeable resources within EEAS to have reached a 'cliff-edge' situation of relying on one individual with institutional memory; and resulted in loss of political support and visibility. In addition, the clear separation between policy and its implementation has been lost.

JRC

The JRC provides essential technical support to INTPA in implementing the Instrument, *inter alia*, preparing terms of reference and technical specifications for projects, evaluating tenders, and in the resolution of technical problems arising during project implementation, some of which are required to be carried out by EC staff. The support INTPA has requested from JRC has decreased gradually over

[37] The financial reference amounts in the Regulations for INSC-I and INSC-II were 524 and 225 MEuro, respectively. After making allowances for contributions to EBRD Funds, the reduction in the budget that could be allocated for cooperation with partner countries or regions was about a factor of two.

[38] The EEAS was formally launched on 1 January 2011, having been created by the Treaty of Lisbon which was signed in 2007 and entered into force in late 2009

the duration of the Instrument for two reasons: firstly, the reduced budget of INSC-II compared with INSC-I; and, secondly, restrictions on the human resources within JRC which have prevented the recruitment of staff with the requisite knowledge and experience to replace those who have retired or transferred elsewhere. A further reduction was evident during the Covid pandemic resulting from delays to projects and restrictions on travel. The need for technical support from JRC is likely to increase gradually with the transition from INSC-II to INSC-III owing to the larger budget of the latter.

As well as this support, JRC has carried out a number of cooperation projects in areas where it has particular expertise (e.g., safeguards, early warning radiation data exchange platforms). Experience with such projects, in particular, has raised a number of concerns over the continuing commitment and sustainability of support from JRC. The scope of a project on safeguards had to be severely curtailed, and another on establishing an early warning radiation data exchange platform in the Gulf region suffered long delays, because the necessary resources could not be provided by JRC; this experience has undermined confidence in using JRC to implement future projects.

Assurances have been given by JRC that they will have the capacity and capabilities to service INTPA's requirements in INSC-III. However, the failure to replace experienced staff, who have provided technical support to INTPA over an extended period, has led to doubts whether JRC can provide the requisite expertise in the regulation of radiation and nuclear safety. At the same time, JRC is subject to continuing pressures to reduce head count[39], and nuclear activities need to compete for priority with other RTD activities.

It may therefore be advisable for INTPA to build greater resilience into how it accesses technical expertise in future, in particular to complement the support provided by JRC and provide an alternative source of support to mitigate any shortfall that may arise within JRC. Extensive expertise on such matters is widely available in several European countries, and mechanisms (i.e., support measures and other support activities) are available within the Instrument to access it. Where the roles currently performed by JRC (e.g., evaluation of tenders) cannot be filled by external experts, other means would need to be explored. Possibilities include the use of experts from ENER in evaluations, or the recruitment of more technical experts directly into INTPA. This may, in any case, be necessary if INTPA is to continue playing a major role in INSC policy matters (see above).

4.2.5 Organisational and Procedural Arrangements

The focus of the Instrument is the provision of technical assistance, and, as a result, it does not fit easily within the broader goals, culture and structure of INTPA; its different legal basis, the Euratom Treaty, is an added complication. The Instrument also has a relatively small budget and few synergies with the other Instruments implemented by INTPA[40]. These differences, and the need to follow procedures and arrangements not necessarily optimised for providing technical assistance, add to the administrative burdens of implementation and place additional pressures on limited resources. Superficially attractive solutions, such as implementation by the IAEA or through EBRD funds, risk a loss of control over how EU funds are spent, and the loss of visibility for the Instrument and the added value and leveraging of financial resources and political engagement that it currently offers.

Improving, and being seen to improve, nuclear safety in countries around the world, and particularly in countries on Europe's doorstep, is in Europe's best interests. Doing so efficiently and effectively through the INSC requires sufficient resources. Either these resources need to be provided within INTPA (and/or EEAS for policy matters) or consideration should be given to whether the Instrument could be located elsewhere within the European Commission where the resources needed can be provided, where it may benefit from synergies, and where its profile may be further enhanced, not least

[39] EURATOM budget was cut by 21% leading to the reduction of some 120 staff

[40] Within INSC-II (i.e., while implemented within DEVCO), there were limited synergies with the nuclear security activities financed by the Instrument contributing to Stability and Peace (IcSP); in the future within INSC-III (i.e., implemented within INTPA), there may be opportunities for synergies with non-power applications foreseen in the Neighbourhood Development, International Cooperation Instrument – Global Europe (NDICI-GE).

at a political level (e.g., within the Service for Foreign Policy Instruments (DG FPI), DG ENER, etc). A careful analysis should be carried out of the pros and cons of the potential options.

Within DEVCO, the Instrument dealing with cooperation on Nuclear Safety (INSC) and that dealing with Stability and Peace (IcSP) were located within the same Unit. In the transition from DEVCO to INTPA in early 2021, the part of the Unit dealing with IcSP moved to the FPI. This has left INSC more isolated, with less opportunity to exploit synergies or cross-fertilisation of ideas and approaches in addressing radiological and nuclear issues that fall within their respective remits.

4.2.6 Achieving Self-reliance in Partner Countries

Under INSC and previous programmes, support has been provided to enhance the capabilities of the regulatory authority in Ukraine and its TSO for nearly 30 years. The competence of SNRIU has been enhanced considerably over this period and good regulatory practice is now embedded in much of its *modus operandi*. Likewise, the competence of its TSO has been greatly enhanced and is best exemplified by it being contracted, on a commercial basis, to provide technical support on radiation and nuclear safety to organisations within and outside Ukraine (in some cases, as part of a consortium carrying out INSC projects). Yet the current programme includes a project which aims to develop a ten-year strategy for further support to enhance the capabilities of the regulatory authority. This apparent continuing need for support raises questions about the effectiveness of the support already provided over the past three decades, and suggests that it may have engendered dependency rather than self-reliance.

An external evaluation of support to the nuclear regulatory authority in Ukraine (18) (see summary in Annex 5) identified as strengths of the INSC programme that there had been the transfer of high expertise from regulators and TSOs in EU Member States to the Ukrainian regulatory authority and its TSO, and that INSC support was well aligned with the EU framework and directives on nuclear safety. However, it identified as weaknesses that EU procedures require 2-3 years from concept to contract, that governance of the regulator was weak and its independence had been undermined by legislation changes[41], and that the high staff turnover within the regulatory authority was detrimental to capacity building. This large turnover of staff in SNRIU is largely a consequence of low salaries relative to those in its TSO and the wider nuclear industry, both in Ukraine and beyond. Opportunities for greater remuneration and improved career prospects elsewhere are difficult to resist for SNRIU staff once they are trained.

Solutions are beyond the remit of INSC support, but may be amenable to solution by the Ukrainian government in much the same way as it has been achieved in other European countries, i.e., formally linking the salaries of regulatory staff to those performing comparable roles in the nuclear industry, with the industry, via taxes or levies or the payment of fees, being charged the costs of its regulation. Concerted action at a political level within the EC or in wider international groupings (e.g., the nuclear safety and security group in G7) may achieve the leverage needed with the Ukrainian government to remedy this problem.

Similar issues apply to support to the Armenian regulatory authority and its TSO, with both also suffering high turnover of staff owing to low salaries.

Cooperation on waste management under INSC also showed limited evidence that Ukraine is becoming self-sufficient as a result. Despite the good governance structure, and the existence of a national strategy for radioactive waste to 2035 and a strategic road map (acknowledged in a case study in the mid-term review (14)), many waste management projects appear to represent an ad-hoc response to a problem, with little reference to either the national strategy or the strategic road map. In addition, the next ten-

[41] The independence of the regulator was re-established, at least legally, further to pressure from the G7 and the EC. However *de facto* independence is not possible without adequate financing. In one of the findings of the Court of Auditors special report of 32016 on the EU assistance to Ukraine it was noted also that 'the rotation of mid and senior management jeopardised the reforms supported by EU assistance and the sustainability of results, while low salaries created a potential incentive to corruption'.

year State programme for radioactive waste management (to replace the programme which ended in 2017) has still not been approved. While the external evaluation of nuclear waste projects in Ukraine (21) (see summary in Annex 5) concluded that the achievements of the INSC projects were of high quality, with substantial progress towards the provision of essential facilities, equipment, and procedures, the external evaluation of EU support to the nuclear regulatory authority (18) (also summarised in Annex 5) found no visible leadership and coordination in the industrial radioactive waste management sector, with no clearly communicated masterplan showing how the actions jointly support radioactive waste management in Ukraine, and with the road map described as little more than a 'shopping list'. The JSO is developing the road map to be more strategic and based on programmes rather than projects to address these issues.

The JSO supports INTPA in the implementation of the Instrument by assisting Ukrainian partners/ End Users in the identification, preparation and implementation of cooperation projects. Given the size, diversity and complexity of support provided by INSC to Ukraine, the presence of JSO has proved invaluable. Appropriate links have been established with most relevant Ministries and institutional arrangements are in place to provide oversight of cooperation and a framework for identifying priorities. Much effort has also been channelled by JSO into encouraging the partners/End Users to adopt a more strategic approach to addressing nuclear safety and waste management issues faced by the country and using this as a framework for seeking more targeted and meaningful cooperation from INSC and other donors. However, these efforts have met with only partial success and have not been helped by relatively frequent changes in government and turnover of senior management in key Ministries and/or other relevant organisations. Also, as an INSC contractor, JSO can exercise little leverage to achieve such change.

In the absence of a strategy and road map for Ukraine to become largely self-sufficient in nuclear safety and waste management, including ensuring the sustainability of the infrastructure (i.e., CSF and ISF-2) established at Chernobyl, in the next five to ten years, requests for support may become never ending and a dependency culture entrenched which may prove difficult to break.

4.2.7 Measurability of Outcomes

The mid-term review drew attention to the need for greater focus on the measurability of outcomes of the Instrument in order to improve its effectiveness. Much attention has been given by the Instrument (and its predecessor, TACIS) and those overseeing its implementation (i.e., the INSC Committee) to the development of meaningful indicators of performance or outcome but with limited success. The latter is a consequence of the nature of many INSC activities, with their outcomes for, or the impact on, the partner country only being realised long after project completion and often in a form not readily amenable to measurement. Meaningful and reliable measurement of outcomes would require the establishment of a basis for comparison, exclusion of the effects of other forms of support, and monitoring long after project (and possible programme) completion, something that is not easily realised.

A recurring theme in many ROM reports was that insufficient attention had been given in the logical framework (logframes) of projects to outcomes and impacts of cooperation as opposed to their outputs. This weakness was also highlighted in the MTR. Much effort has been allocated by ROM Global over a number of years to remedy this situation, not only within INSC but also in the other INTPA Instruments. Progress is being made, albeit slowly. ROM Global are currently supporting INSC in enhancing the logframes for the ToR of a sample of projects about to be tendered. Based on experience gained, this process will be 'rolled out' for all new projects. However, the lack of resources in F1, referred to above, may limit the success of this effort. Initiatives will also need to be followed up or repeated with contractors and partner countries who are collectively responsible for updating/finalising the logframe at the start of a project. Support from ROM Global in the inception meetings of a sample of projects has the potential to achieve tangible progress and set a precedent in what is an important area for efficacy of project implementation. But, based on experience to date, resistance to these changes may be encountered by some contractors and partner countries.

4.2.8 Covid-19

The Covid-19 pandemic has inevitably had an impact on the implementation of INSC-II and particularly on its effectiveness and efficiency. The duration of many projects has been extended by about one year. These issues are understandable and have been outside the control of INTPA and JRC staff and contractors. Nevertheless, alternative arrangements have been put in place within most projects to achieve project objectives, to the extent practicable, while travel has continued to be restricted, and albeit within an extended timescale. As a result, the overall impact of the pandemic and associated restrictions on programme implementation, while not to be underestimated, has been less than initially feared.

4.3 Evaluation Findings

The biggest factor hampering the efficiency and effectiveness of the Instrument, as well as its relevance, its added value, its coherence, consistency, complementarities and synergies, and its leverage, is the continuing lack of sufficient human resources for its implementation. Lack of sufficient resources underlie the difficulties encountered in reducing the average 'time to contract' and thereby improving the responsiveness of the Instrument to partner countries' needs, and improving the effectiveness of implementation in meeting these needs. Sufficient resources would enable greater attention to be given to the measurability of outcomes, to the improvement of processes, to increasing the visibility and communication of the Instrument, and to addressing policy matters. It would also enable INTPA to improve its interactions with Delegations and other EU players, strengthen the Instrument's policy and political dialogue and allow the EU to take better advantage of its world leading role in nuclear safety. All of the recommendations in the mid-term review and in this evaluation are contingent on sufficient human resources being made available.

4.3.1 Relevance

The mid-term review found that the specific objectives of the Instrument were well aligned with EU policies and priorities and were relevant to partners' needs and priorities. The promotion of the highest standards of radiation and nuclear safety (i.e., compliance with the EU's Directives on radiation protection, nuclear safety and management of radioactive waste and spent fuel), supporting the establishment of strong, independent and sustainable regulatory authorities, environmental remediation (e.g., restoration of radioactive waste legacy sites), and seeking continuing improvement were at the core of the 2030 Agenda for Sustainable Development. A recommendation was made that cooperation under the Instrument should be continued and possibly reinforced to meet priority needs.

The findings of the mid-term review are broadly shared by this evaluation. The programme is demand led and is responsive to the needs of partner countries. This was evident at the time of the mid-term review and continues to be so. Requests for cooperation, from either a new or existing partner, are carefully scrutinised and the nature and form of cooperation tailored to best achieve their objectives. Examples of the responsive nature of the programme to emerging needs is best illustrated by: the significant increase in support given to EP&R reflecting the major improvements made both nationally and globally following the accident at Fukushima Daiichi NPP; the support provided for conducting, and responding to the outcomes of, the 'stress tests'; and the significant cooperation with Iran following the agreement of the JCPoA. Further consideration could, perhaps, be given to whether there should be a role for cooperation with those responsible for design, construction and operation of nuclear installations in achieving the Instrument's objective of promoting an effective nuclear safety culture. In addition, the relevance of implemented cooperation projects could be further improved either through greater alignment of the timescales of the needs and priorities of partner countries with the timescales over which the implementation is likely to take place, given the typical 'time to contract', or through significant reductions in the 'time to contract'.

4.3.2 Effectiveness

The mid-term review found that the Instrument, since its inception in 2007, had consistently delivered outputs contributing to its main goal of enhancing radiation and nuclear safety (including environmental

remediation) and bringing these in accord with best European/international standards and practice. It had also contributed to EU cross-cutting issues, particularly to the goals of a better environment and sector governance, and to a minor extent, ownership and gender equality. The Instrument's processes and documents were found to be well focused on activities and outputs of projects but less so on outcomes (i.e., the use made by partners of the projects' outputs).

Some reservations were made on the effectiveness with which the Instrument was being implemented, in particular: insufficient attention being given to the measurability of outcomes (i.e., baselines had not been developed systematically at national and regional levels, programming documents did not define measurable targets); the lack of a comprehensive monitoring system for following its achievements at an outcome and impact level; more attention needed on management processes to ensure the achievement of expected measurable changes; strategy and programming documents were in need of increased detail; and very limited use had been made of external evaluations which constrained lessons learned and accountability. A number of recommendations were made to improve the situation, in particular:

- the development of an approach in which the selection process as well as results appraisal needed to be better documented, shifting away from the current focus on activities and outputs towards more results-focused and measurable processes
- capacities in management-by-results should be strengthened at all levels
- strategy and programming documents should be more specific
- a comprehensive monitoring system should be developed
- ROM review missions should be regularly applied to representative project samples to strengthen accountability and results-orientation
- evaluations should be used as a standard lesson-learning and accountability tool
- an impact evaluation should be carried out
- visibility and communication of the Instrument should be increased.

The findings of the mid-term review, at the time it was undertaken, are broadly shared by this evaluation, albeit subject to some qualifications as elaborated upon below.

Many of the issues raised in the mid-term review have long been recognised by those implementing the Instrument, those monitoring its performance and those providing oversight (i.e., the INSC Committee). Two factors have contributed to the limited progress made so far in effectively addressing them: firstly, the very limited resources available within the units responsible for implementing the programme in INTPA (units F1 and R6); and, second, the particularities of the INSC programme in relation to the wider 'INTPA family'. Nonetheless, the programme is taking, or has taken, a number of steps to address many of the recommendations made in the mid-term review, in particular the following:

Measurability of outcomes

Support is being given by the ROM Global team in improving the content of the logframe matrix in the ToR for a sample of projects, in particular establishing measurable outcomes in a consistent and transparent manner. If successful, this support will be 'rolled out' across all new projects and will go some way towards responding to the recommendations in the mid-term review concerned with the need for measurable outcomes (as opposed to outputs) and will also facilitate external project monitoring.

External evaluations

External evaluations have been made of several of the more substantive elements of the programme, namely: the training and tutoring (T&T) programme (20); cooperation with Armenia (19); cooperation with Ukraine in the area of waste management (21); and support to the regulatory authority of Ukraine (18). A summary of the main findings of these external evaluations can be found in Annex 5, but, in general, they were found by those responsible for implementing the Instrument to have been of limited added value.

Impact evaluation

This report has attempted to provide an evaluation of the impact of the Instrument, albeit at an intermediate stage in its implementation. The evaluation is based on responses from partner countries to a questionnaire that, *inter alia*, enquired as to the use they had made, or the impact, of project outputs in enhancing radiation and/or nuclear safety. The responses of each partner country to the questionnaire are summarised in Annex 4 and key impacts have been presented in Section 3.

More detailed and specific programming documentation

While well intentioned, the recommendation in the mid-term review for programming documentation to be more specific and detailed is not fully shared by this evaluation. A careful balance needs to be achieved/maintained between prescription and flexibility in the main programming documents, i.e., the Action Documents (AD) forming the basis of the Annual Action Programmes (AAP) which are subject to formal approval in EC Decisions (see Section 4.2.3). While not fully sharing the findings of the mid-term review regarding the need for greater specificity or detail in the programming documents (for the reasons set out in Section 4.2.2), this evaluation has identified other issues that warrant attention. These concern the great variation in the quality, form of presentation and level of detail between Action Documents. While the ADs are largely fit for purpose, achieving greater uniformity in their quality and content would be beneficial in the subsequent development of ToR and project implementation. This need has long been recognised by those implementing the programme but resource limitations and other more competing priorities have resulted in this issue being given less attention that it would otherwise deserve.

Visibility and communication of the Instrument

In principle, this evaluation supports the finding of the mid-term review that the visibility and communication of the Instrument should be increased. In practice, the situation is more nuanced. Most potential partners are already well informed through various mechanisms or channels of the existence of the Instrument and the support it could provide for enhancing radiation and nuclear safety, etc. These include the Regulatory Cooperation Forum (RCF) which is co-sponsored by the Instrument and IAEA, presentations at, and in the margins of, the IAEA General Conference and other direct contacts with the partner countries (e.g., through the Ukraine Supervisory Board). Further visibility of the EU/EC's actions was provided in the context of the G7 NSSG and the Chernobyl donors' assemblies and pledges. However, the wider visibility of the EC's actions remained limited, partly due to limitations on the human and budgetary resources available, which prevented wider participation of staff in relevant meetings and interaction with the Delegations.

Raising the profile of the Instrument in other fora offers greater opportunities, for example among decision makers (e.g., the EC, European and national Parliaments, the Council, EEAS, etc), opinion formers and interest groups. Achieving a broader and shared understanding of the objectives of the programme and its actual achievements would contribute to a more informed debate on its role and importance within INTPA's wider portfolio, or even whether it may be better located elsewhere. However, such activities, if they are to be effective, require the commitment of significant resources which are currently not available within the programme; indeed, diversion of resources to such activities could negatively impact the core activities of programming, contracting and project follow up and is not advised in the current circumstances. The development and dissemination of the TIPINS data base of cooperation projects implemented under TACIS and INSC, by JRC, was intended to greatly improve the visibility and communication of the programme but has not been realised; this failing should be rectified at the earliest opportunity subject to adequate resources being available[42].

This evaluation has additionally found that the effectiveness of cooperation and the sustainability of outcomes, specifically in Ukraine (but also potentially in Armenia) are being adversely affected by a large turnover of staff in the regulatory authority, largely as a consequence of low salaries relative to

[42] It is expected that in future the projects funded by the Programme will be listed in a database accessible to the public including project descriptions, project objectives, the implementation status, costs, outcomes from the projects and, finally, details of any evaluations of the projects.

those in its TSO and the wider nuclear industry. Ways in which these problems could be overcome are addressed in Section 4.2.6.

4.3.3 Efficiency

The mid-term review found that the Instrument was performing well with mechanisms and resources appropriate to support the project pipe-line and delivery of outputs. However, human resource limitations were affecting the time dedicated to supporting quality processes. Adequate capacities for support were being provided at an expert/technical level by JRC and in overseeing and facilitating the cooperation with Ukraine via the Joint Support Office (JSO) in Kiev. The limited absorption capacity of some partners was a constraint on project performance in some cases. Centralised management of INSC was a justified arrangement to ensure that qualified assistance was provided on the basis of high-level nuclear expertise. The Instrument was found to be well aligned for flexibility and speed of delivery but policy markers in Action Documents could be improved.

The findings of the mid-term review are largely shared by this evaluation, albeit with some important caveats. There is broad agreement that the Instrument is performing well in terms of programming, contracting and project follow up within the requisite timescales and given the resources available. These tasks are essential but demanding, both intellectually and administratively, and consume most of the available resources. Other matters, key to ensuring and maintaining the efficacy and efficiency of programme implementation, are not, however, receiving sufficient attention (e.g., quality assurance, continual improvement from lessons learned, dialogue with policy DGs and EEAS, development of new approaches/procedures, database of projects, etc). Unless these resource issues are addressed, the efficacy and efficiency of programme implementation will continue to decline over time and this may be difficult to reverse.

There are also concerns over the adequacy and sustainability of the technical support being provided to the programme by JRC, in particular, but not only, from JRC Petten. Should these concerns persist, it would be advisable to explore other options for acquiring the technical support required to complement any shortfall in JRC's future provision; possible means for doing so are set out in Section 4.2.4.

4.3.4 Added Value

The mid-term review found that the Instrument fosters unique added value to engagement in nuclear safety cooperation with third countries, well beyond the capacities of Member States and other donors. The institutional framework allows the EC to act at a global level on nuclear safety cooperation with consultations with the G7/8, and features: specialised know-how and expertise, high nuclear safety standards and exclusive EU powers to address nuclear safeguards; and a relatively substantial financial provision and continuity for nuclear safety cooperation with a track record of over a quarter of a century. It was identified as demonstrating good practice during the 2017 review meeting of the Convention on Nuclear Safety. The Instrument allows the EU to assume a world leading role in nuclear safety and permits engagement in policy-level dialogue with partner countries and, in specific cases, the triggering of political dialogue in the wake of nuclear safety negotiations. Member States would not be able to address the nuclear safety and safeguards priorities with comparable standards as achieved by INSC.

The findings of the mid-term review are shared by this evaluation. More attention could be given to promoting the considerable achievements, both political and technical, of INSC. Historically, this role was filled by those responsible for INSC policy but resources for this declined following the establishment of EEAS. This gap needs to be filled and can only be done by increasing the resources in INTPA and/or EEAS, otherwise core functions related to implementation of the Instrument will be compromised.

4.3.5 Coherence, Consistency, Complementarities and Synergies

The mid-term review found that internal coherence and complementarity of actions is ensured through the adopted mechanisms and management processes, including the committee reviews such as those by the Quality Support Group, Inter-Services Consultation, the INSC Committee, and consultations with the European Nuclear Safety Regulator Group (ENSREG). A number of recommendations were made

for improvement, including: reinforcement of the political and policy dialogue; that support services should assist in the process of result orientation, improving the Instrument measurability and strengthening strategies and quality of programming and action documents; that complementarities with other instruments should be reinforced while recognising that there was limited scope for this given the specificity of INSC; and that INSC should work less in isolation and increase relevant interactions with Delegations and other EU players. An important proviso was added, that human resources should be adjusted to meet the challenges of all these and other recommendations made in the mid-term evaluation.

The findings of the mid-term review are broadly shared by this evaluation and are supported by the evidence, both that available at the time of the mid-term review and that accumulated since. Resource limitations have, however, greatly constrained the degree to which the recommendations have been addressed.

There is a need for increased interaction and engagement with other DGs and the EEAS on matters of mutual interest. Some progress has been made in three areas. Firstly, following the reorganisation of DEVCO and its transition to INTPA in early 2021, greater emphasis has been placed on enhancing the policy dialogue and engaging with relevant actors (e.g., EEAS, ENER, NEAR, JRC, RTD) at significant stages in the development and implementation of the programme. This has proved very beneficial in developing further cooperation with Belarus and China in INSC-III, and that experience should act as a stimulus for future engagement on issues of future political or technical import. But, resources need to be provided for this essential activity, otherwise momentum for such improvements will lapse. Secondly, support is being provided by the ROM Global group in developing approaches to enhance the measurability of the programme and its component projects (see Section 4.3.8 above). Thirdly, cooperation with other instruments has been enhanced with projects implemented through the International Scientific and Technical Centre (ISTC) and the Scientific and Technical Centre for Nuclear and Radiation Safety in Ukraine (STCU) via negotiated agreements. While all of this progress is to be welcomed, it needs to be recognised that wider engagement and consultation require resources which, currently, would need to be diverted from project contracting and follow up.

4.3.6 Leverage

The mid-term review found that the INSC supports leveraging of both political engagement and financial resources for the nuclear safety sector. The EU was found to play a leading role in following up challenges and initiatives identified in the G7/8 Nuclear Safety and Security Group. The Instrument was found able to provide swift reactions through the promotion of a concerted political and policy effort, giving the EC the opportunity to lead civil cooperation on nuclear safety, as demonstrated by INSC-I and INSC-II interventions. In specific cases the Instrument has proved that it works as a door-opener to the EU for political engagement. The policy dialogue is supported by sound coordination between DEVCO (now INTPA) and EEAS. The Instrument also contributes to the leveraging of significant financial resources for nuclear safety cooperation from donors as well as from partner countries. The EU has a leading role in the policy and political dialogue aimed at supporting the independence of the Ukrainian regulatory authority. However, these actions to achieve policy results were found not to be supported by documented evidence of quantifiable achievements (particularly in relation to the measurability of outcomes), and the mid-term review concluded that there was scope for strengthening the Instrument's policy and political dialogue; in particular, the Delegations could play a more significant role in supporting the dialogue with government and institutions to promote the nuclear safety agenda, and there was also scope for increasing both internal and external visibility for INSC and EU work through the Instrument.

The findings of the mid-term review are largely shared by this evaluation. However, for the areas where the review found that there is room for improvement, in particular, on documented evidence of quantifiable achievements, strengthening the Instrument's policy and political dialogue and increasing both internal and external visibility for INSC, a proviso should also be added that human resources need to be adjusted, as appropriate, to meet the challenges, as for other recommendations made in the mid-term review. The actions undertaken by the EU, in cooperation with the G7, aimed at supporting the independence of the Ukrainian regulatory authority have helped to achieve the goal of establishing the

legal framework to ensure the independence of the regulator; however, work remains to be done to ensure that the government provides adequate funds for its functioning and capacity-building. In addition, continued engagement at a political level will be essential to ensure that the considerable investments made through the Chernobyl projects are sustainably utilised.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Successful Cooperation

The specific objectives of the Instrument are well aligned with EU policies and priorities and are relevant to partners' needs and priorities. It is effective in enhancing radiation and nuclear safety and safeguards and bringing operations in partner countries worldwide into line with best European/international standards and practice. It operates efficiently using mechanisms and resources generally appropriate to support the delivery of outputs. It fosters unique added value to engagement in nuclear safety cooperation with third countries, well beyond the capacities of Member States and other donors. Internal coherence and complementarity of actions are ensured through the adopted mechanisms and management processes. It also supports leveraging of both political engagement and financial resources for the nuclear safety sector. Cooperation has been successfully established with a large number of countries and several regions, the budget has been committed, and significant improvements have been made in enhancing nuclear safety, waste management and safeguards. The impact of the Covid pandemic and associated travel restrictions, while not to be underestimated, has been less than initially feared; the duration of many projects has been extended by about a year.

Perhaps the greatest achievement that occurred during the period of INSC-II, but which was the culmination of support under previous programmes as well as under INSC-II and which involved many other donors within the international community, was the completion of the construction of the Chernobyl New Safe Confinement in 2019. This has contributed significantly to making the site of the world's worst nuclear disaster environmentally safe. Other major achievements include: the considerable cooperation with Iran in the context of the JCPoA, which has strengthened the regulatory authority in Iran in discharging its regulatory responsibilities and enhanced the capabilities of safeguards inspection; the development of a strategic master plan for remediation of uranium legacy sites in Central Asia and the establishment of an EBRD account to support its implementation, which is well underway; support for carrying out 'stress tests' and responding to their outcomes; and the Training and Tutoring programme that has met with widespread support and trained thousands of individuals from regulatory organisations and their TSOs in best practice in nuclear safety, radioactive waste management and safeguards.

Other significant impacts of cooperation include: improved EP&R arrangements supported by early warning monitoring and decision support systems in several countries and regions; and improved management of radioactive wastes in several countries, particularly EU pre-accession and neighbourhood countries.

5.2 Recommendations to Improve Cooperation

The Instrument and its implementation have fulfilled, or are in the process of fulfilling, its objectives. Its continued successes and the considerable added value and leveraging of financial resources and political engagement that it provides, are, however, being put at risk because sufficient human resources are not being provided to support it, both in INTPA and EEAS. This was a conclusion of the mid-term review and the situation has not improved since, rather the contrary.

The resources within Unit F1 of INTPA are barely sufficient to fulfil the core functions of project contracting and follow-up. Other important, but less essential, activities for the effective implementation of the Instrument (e.g., quality, visibility, engagement with other actors in the EC and beyond, continuing improvement, etc.) have, as a consequence, been neglected or given less attention than they merit. This is not sustainable and must be remedied in the transition to INSC-III.

The times between requests for cooperation and project implementation are long (sometimes as long as 10 years) and are a serious impediment to the effectiveness of cooperation and how it is perceived by partner countries (see Section 4.2.2 and Annex 6). Such long timescales are not compatible with criteria in the Regulation such as "intervention at the appropriate moment" when considering cooperation with countries wishing to develop nuclear generating capacity.

The increase in the average 'time to contract' in INSC-II, despite efforts to reduce it, provides compelling evidence in support of the judgement that the resources for implementing the Instrument within INTPA are insufficient. Further efforts need to be made to reduce the 'time to contract' significantly. Means to achieve this have been suggested (i.e., developing ToR in parallel to the approval process of an AAP, or in parallel to negotiation of a FA – see Section 4.2.3) but would require a substantial, though temporary, increase in resources to deal both with ToR for approved actions as well as ToR for actions still in the approval process. In any event, partner countries need to be aware of the timescales involved so that they are better able align their needs and priorities with realistic time periods for implementation.

INTPA Unit F1 has also had to assume responsibility for policy matters, adding to the pressures on resources. Either INTPA should be given the resources necessary to carry out both policy and operational functions effectively, or, preferably, a clear separation should be restored between the development of policy for, and implementation of, the Instrument. In the latter case, EEAS would need increased and knowledgeable resources to fulfil its designated role and responsibilities.

If the resources needed cannot be provided by INTPA, consideration should be given to whether the Instrument could be located elsewhere in the European Commission where the necessary resources, of sufficient quality and quantity, can be provided, greater synergies can be exploited, and where the profile of the Instrument may be further enhanced, not least at a political or policy level (e.g., within DG FPI, DG ENER, etc). A careful analysis should be carried out of the pros and cons of the potential options.

The JRC provides essential technical support to INTPA in the implementation of the Instrument, the need for which is expected to increase in the future with the larger budget of INSC-III. It has also carried out a number of INSC projects in areas where it has particular expertise (e.g., safeguards, early warning radiation data exchange platforms). Despite assurances by JRC that it will have the capacity and capabilities to service INTPA's future requirements, doubts remain over whether it will be able to provide the requisite expertise in the regulation of nuclear safety and/or carry out projects where it has unique competence. INTPA should, therefore, consider: firstly, building greater resilience into how it accesses technical support in future (e.g., complementing the support provided by JRC by making greater use of external expertise and that available elsewhere within the European Commission); and, secondly, using JRC to carry out projects only where JRC has demonstrable capacity to do so and where it has given firm assurances that its resources will be deployed for such purposes.

Cooperation with Ukraine, by far the largest recipient of support from the INSC, has been ongoing for almost three decades and has made a major contribution to addressing the challenges faced in the aftermath of the Chernobyl accident and as a result of the break-up of the former Soviet Union. Questions arise, however, over the sustainability of the outcomes of the cooperation and how effectively they are being exploited more widely, in particular:

- SNRIU suffers from a large turnover of staff (and associated loss of expertise) as a result of low salaries compared to elsewhere in the nuclear sector; this undermines the efficacy and sustainability of the cooperation
- continuing support over decades from INSC and other donors may have hindered progress towards 'self-sufficiency', indeed possibly creating a dependency culture
- support to waste management organisations has been somewhat piecemeal.

Some possible remedies have been suggested to address the low salary issue (see Section 4.2.6). Future cooperation is likely to be more effective if it is strategically focused with the aim of achieving 'self-sufficiency' in the next five to ten years, in terms of both achieving high standards of nuclear safety and addressing legacy waste management issues, including ensuring the sustainability of the major

Chernobyl projects. Otherwise, requests for cooperation are likely to continue *ad infinitum*. Greater engagement by the EC at a political level with relevant Ministers in Ukraine will be instrumental in this respect.

Institutional arrangements for achieving effective cooperation with IAEA are in place and should be maintained. However, implementation, by IAEA, of INSC projects should be limited to activities where IAEA has unique expertise or capabilities (e.g., in safeguards), or where they are able, by virtue of their *modus operandi*, to demonstrably bring added value to the process and/or achieve outcomes in a more cost-effective manner. Greater use of IAEA (and other international organisations, e.g., ISTC, STCU, EBRD) reduces resource needs in INTPA but not overall; more importantly it decreases control, visibility and flexibility.

Increasing use over time has been made of ISTC and STCU to implement projects on behalf of, and under contract to, INSC. While these arrangements appear to be working well, it would be prudent to carry out an evaluation of projects implemented by ISTC and STCU at an appropriate time, in particular to establish strengths and weaknesses, opportunities for improvement, and where the organisations can be best used in future.

Consideration should be given to increasing cooperation on enhancing nuclear safety culture with those organisations who design, construct and operate nuclear installations, given their responsibility for nuclear safety and its achievement. Such cooperation, if properly targeted and delivered (e.g., without distorting competition), would make more effective and efficient use of resources available for enhancing nuclear safety.

6 REFERENCES

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Annex 1: Projects Included in the Annual Action Programmes (AAP) – 2014 to 2020

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
AAP 2014						
IQ3.01/14	Support of Iraq RA on RWM, decommissioning and remediation	1.5	Feb-16	Y	Y	T
MC3.01/14	Training and tutoring for experts of RA and their TSO	3.0	Dec-15			T
TZ3.01/14A	Support of Tanzania RA on uranium mining and milling	2.1	Sep-16	Y	Y	NA
TZ3.01/14B	Upgrading radio-analytic laboratories in TAEC	1.9	Nov-16	Y	Y	NA
UA3.01/14[47]	Strengthening SNRIU capabilities in licensing and severe accident management	2.0	Oct-17	Y	Y	T
KG4.01/14A	EIA and feasibility study for Mailuu-Suu	2.45	Oct-17	Y	Y	T
KG4.01/14B	Supply and installation of equipment for risk assessment	0.48	Nov-18	Y	Y	NA
UA4.01/14A	Specification of waste forms held at Ukrainian nuclear energy facilities	6.2	Nov-18		Y	T
UA4.01/14B	Development of national plan for geologic disposal of radioactive waste		Aug-18		Y	T
UA4.01/14B1	Development of national plan for geologic disposal of intermediate level radioactive waste		Sep-19		Y	T
UA4.01/14C	Safety assessment of waste management sites and design of remedial measures		Jul-18		Y	T
UA4.01/14D	Detailed design of technological building at Vektor complex and associated infrastructure		Cancelled[48]			
EBRD-ERA	Contribution to the Environmental Remediation Account for Central Asia	8.45	Dec-15			NA
Support	Support measures for management of INSC (various)	1.05				
Total 2014	**11 contracts in 4 countries, 1 multi-country/regional contract and 1 fund contribution**	**29.13**				

[43] Project/contract identifiers or codes - XXn.mm/yy: XX is the two-digit ISO country code other than multi-country or regional projects referred to as MC; n refers to different priority areas where 1 and 3 refer to nuclear safety culture with support to the operator and regulatory authority respectively, 4 to radioactive waste management and 5 to nuclear safeguards; mm refers to the number of a project in one or other priority area; and yy are the last two digits of the AAP year

[44] Indicative budget as set out in the annual action programme; actual amounts may differ depending on the outcome of tendering or negotiation process

[45] FA – Financing Agreement – entries marked Y indicate that the project was implemented with a Financing Agreement

[46] NA – Negotiated Agreement – entries marked NA were contracted using a negotiated agreement; those marked T were contracted via open or restricted tendering

[47] Combined with UA3.01/15 and implemented through a single contract

[48] Cancelled due to critical delays in previous project UA4.01/11A

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
AAP 2015						
AM3.01/15A	EP&R - Early warning radiation monitoring network in Armenia	1.0	Dec-18		Y	T
AM3.01/15B	EP&R - Installation of JRODOS decision support system in ANRA's Emergency Centre		Mar-19		Y	NA[49]
BY3.01/15	Strengthen the capabilities of Belarus RA on EP&R	1.0	Dec-17	Y	Y	T
CN3.01/15	Enhancing the capabilities of NNSA and its TSO in the various areas	3.0	Jan-17	Y	Y	T
MC3.01/15	Cooperation with the IAEA's Departments of TC, NSS and NE on various nuclear safety issues[50]	3.5[51]	Dec-16	Y		NA[52]
MO3.01/15	Capacity building and enhancing the regulatory framework for Moroccan RA	2.0	Dec-17		Y	T
UA3.01/15[53]	Strengthening capabilities of SNRIU for the regulation of nuclear activities	4.5	Oct-17		Y	T
TJ4.01/15[54]	Supply and installation of water treatment facility at Taboshar	3.1	Dec-18			NA[55]
MC5.01/15A	Enhancing capabilities in China on safeguarding nuclear materials	5.0[56]	Aug-16	Y		NA[57]
MC5.01/15B	Enhancing capabilities in Southern African countries on safeguarding nuclear materials		Nov-16			NA[58]
EBRD-CSF[59]	EC Contribution to the Chernobyl Shelter Fund on behalf of the EU	30	Nov-15		Y	NA
EBRD-ERA	Contribution to the Environmental Remediation Account for Central Asia	8.0	Dec-15			NA
Support	Support measures for management of INSC (various)	1.74				
Total 2015	**7 contracts in 6 countries, 3 multi-country/regional contracts and 2 fund contributions**	**59.74**				
AAP 2016						
AM1.01/16	Provision of on-site assistance to the operator of the Armenian NPP	1.2	Mar-17			T

[49] Implemented by KIT
[50] Cooperation largely on radioactive waste management issues
[51] Plus 4.5 M€ co-financing from IAEA
[52] Implemented by IAEA
[53] Combined with UA3.01/14 and implemented through a single contract
[54] Not initially identified in AAP2015 but included later through a non-substantial change
[55] Implementation coordinated and led by ISTC
[56] Budget and duration subsequently increased to 8.1 M€ and 84 months, respectively, to include TJ4.01/15
[57] Implemented by JRC through an AA
[58] Implementation coordinated and led by ISTC and included funding from both INSC and IcSP, with the former supporting cooperation on safety and safeguards and the latter on security
[59] Funded from a different EU budget line (see Section A2.2.2.2)

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
IR1.01/16	Support for conducting 'stress tests'	5	Dec-17			NA[60]
IR3.01/16	Enhancing the capabilities of the Iranian Regulatory Authority		Apr-17			T
AM3.01/16	Enhancing the capabilities of ANRA for reviewing the long-term safety of ANPP Unit 2	2.5	Dec-16			T
BY3.01/16	Strengthen the capabilities of the Belarusian RA	3.5	Oct-17			NA[61]
MC3.01/16A[62]	Multinational and regional T&T for RA and their TSO	2	Sep-17			NA[63]
MC3.01/16B[64]	Multinational and regional T&T for RA and their TSO	1	Sep-17	Y		NA[65]
REG3.01/16	Enhancing EP&R in ASEAN: technical support for decision making	1	Nov-17			T
TR3.01/16	Support of Turkish RA	3	Nov-17			T
UA4.02/16	Emergency Measures for the Prydniprovskiy Chemical Plant	3.5	Nov-16			NA
EBRD-CSF[66]	EC Contribution to the Chernobyl Shelter Fund on behalf of the EU	40	Jul-16		Y	NA
JSO	Management of INSC in Ukraine	3				NA[67]
Support	Support measures for the management of INSC (various)	1.67				
Total 2016	**8 contracts in 5 countries, 3 multi-country/regional contracts and 1 fund contribution**	**67.37**				
AAP 2017						
AM1.01/17	Support to operator: improvement of the tightness of the confinement and spent fuel pool	4.0	Apr-20		Y	NA[68]
AM3.01/17A	Support to RA - improvement of EP&R – provision of alternative water supply	2.5			Y	T
AM3.01/17B	Support to RA – improvement of EP&R – provision of alternative power supply				Y	NA[69]
IR3.01/17	Promotion of nuclear safety culture - Iranian RA	4.0	Oct-18			T
RS3.01/17	Support to Serbian Regulatory Authority and the Vinča Site	2.0	Mar-21		Y	T

[60] Was initially tendered
[61] Implemented by RISKAUDIT
[62] Implemented through an addendum to an ongoing contract (MC3.01/14)
[63] Implemented by ENSTTI
[64] Implemented through an addendum to an ongoing contract (MC3.01/13 funded by INSC-I)
[65] Implemented by ITER-Consult
[66] Funded from a different EU budget line (see Section A2.2.2.2)
[67] Implemented through an addendum to an ongoing contract tendered in 2013
[68] Was initially tendered
[69] Was initially tendered

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
GE3.01/17[70]	Support on radioactive waste management in Georgia	1.0[71]	Nov-17			NA[72]
UA4.01/17	Remediation of the Prydniprovskiy Chemical Plant in Ukraine	5	Cancelled[73]			
MC5.01/17A	Strengthening nuclear materials safeguards capabilities in Serbia	1.5	Aug-18			NA[74]
MC5.01/17B	Supporting the establishment of effective nuclear materials safeguards in Serbia	1	Jul-18			NA[75]
MC5.01/17C	Enhancing safeguards capabilities in Iran related to verification and monitoring activities	2.5	Sep-18			NA[76]
EBRD-ERA	Contribution to the Environmental Remediation Account for Central Asia	5.5	Dec-18			NA
EBRD-NSA[77]	Contribution to EBRD NSA for management of radioactive waste at Chernobyl	19.1[78]	Jul-17			NA
Support	Support measures for the management of INSC (various)	1.88				
Total 2017	**7 contracts in 5 countries, 3 multi-country/regional contracts and 2 fund contributions**	**49.98**				
AAP2018						
GH3.01/18	Support of the Regulatory Authority of Ghana	1.2	Sep-19			T
IR3.01/18A	Support RA in Iran (verifying safety of nuclear reactors, management system for NSC, enhancing waste management, installing DSS)	2.0	Apr-20		Y	T
IR3.01/18B	Establish and equip ERC and analyse needs for NSC laboratories	4.0			Y	T
MC3.01/18	EP&R in the Gulf Cooperation Council	1.7[79]	Sep-19			T
MC3.02/18	EP&R in the Western Balkans		Dec-19			T
MC3.03/18	Supporting IAEA in implementation of its Action Plan on nuclear safety	2.0[80]	Dec-19			NA[81]

[70] Included in the AD for support to the RA, but largely a waste management project
[71] Plus 0.2 M€ from Swedish International Development Cooperation Agency (Sida)
[72] Implementation coordinated and led by Sida
[73] Cancelled due to delay in obtaining license to carry out the remediation; support is now to be provided under AAP 2020
[74] Implementation coordinated and led by STCU
[75] Implementation coordinated and led by STCU
[76] Implementation coordinated and led by IAEA
[77] Funded from a different EU budget line (see Section A2.2.2.2)
[78] Plus 85.9 M€ from EBRD, G7 and other donors
[79] Including an Administrative Agreement with JRC to support regional exchange of monitoring information
[80] Plus 0.31 M€ co-financing from IAEA
[81] Implementation coordinated and led by IAEA

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
MC3.04/18	Education for leadership in nuclear safety	0.8	Jun-19			NA[82]
UA3.01/18[83]	Support of the Ukrainian Regulatory Authority	1.8	Oct-19			NA[84]
BA4.01/18	Support of RA in Bosnia and Herzegovina on waste management, etc	1.0	Dec-19			T
RS4.01/18	Safe management of spent fuel and radioactive wastes at Vinča site in Serbia	0.8	Dec-19			NA[85]
MC4.01/18	Water monitoring system related to uranium legacy sites in Central Asia	3.0	Dec-19			NA[86]
MC4.02/18	Local engagement of stakeholders on uranium legacy sites in Central Asia	1.0	Jul-19			NA[87]
UA4.01/18A	Improve the technical and human capabilities of SAUMEZ	1.5[88]	May-21		Y	
UA4.01/18B	Improved dosimetric control system in ChEZ and around Buriakiva Vektor Complex	0.8	Dec-20		Y	T
UA4.01/18C	Supply of improved dosimetric control system and environmental monitoring	3.4			Y	T
MC5.01/18	Strengthening States' Systems of Accounting for and Control of Nuclear Materials	1.6[89]	Dec-19			NA[90]
MC5.02/18	Safeguards Education and Training	2.7	Jun-19			NA[91]
MC5.03/18	Safeguards Training	0.7	Mar-19			NA[92]
Support	Support measures for management of INSC (various)	1.51				
Total 2018	**9 contracts in 5 countries and 9 multi-country/regional contracts**	**31.51**				
AAP 2019						
AM3.01/19	Support to the Armenian Nuclear Regulatory Authority	1.2			Y	
IR3.01/19	Support to the Iranian Nuclear Regulatory Authority	5.0			Y	
MC3.01/19	EWRMN and RDEP in ASEAN	2.2	Dec-20			T
GE4.01/19A	Support safety assessment of RWM facilities in Georgia	3.2[93]	Jul-20			NA[94]

[82] Implementation by a direct grant
[83] Implemented through an addendum to contract for UA3.01/14 and UA3.01/15
[84] Implemented by RISKAUDIT
[85] Implementation coordinated and led by IAEA
[86] Implementation coordinated and led by ISTC
[87] Implementation coordinated and led by UNDP
[88] Plus co-financing of 1.129 M€
[89] Plus 0.68 M€ co-financing from IAEA
[90] Implementation coordinated and led by IAEA
[91] Implemented by JRC through an AA
[92] Implemented by ENSTTI
[93] Plus 1 M€ co-financing by third parties (Sida)
[94] Implementation coordinated and led by Sida and STCU

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
GE4.01/19B	Specification and supply of mobile monitoring laboratory		Aug-19			NA[95]
UA4.01/19A	Safety culture in RWM in Ukraine	1.8[96]			Y	NA[97]
UA4.01/19B	Design and specification of national radiation monitoring network	0.7				
UA4.01/19C	Supply of national radiation monitoring network	3.4				
EBRD-ERA	Environmental Remediation Account for uranium legacy sites in Central Asia	10[98]	Dec-19			NA
JSO	Management of INSC in Ukraine	3				NA[99]
Support	Support measures for management of INSC (various)	1.65				
Total 2019	**8 contracts in 4 countries, 1 multi-country/regional project and 1 fund contribution**	**32.15**				
AAP 2020						
AM3.01/20	Promoting safety culture in ANRA and achievement of highest safety standards	1.5			Y	
BY3.01/20	Enhancing the capabilities of the RA in Belarus and its TSO	3.0				
MC3.01/20	Enhancing capabilities and capacity in RA in Western Balkans in EP&R	1.0				
MC3.02/20	Training and tutoring for experts of RA and their TSO	3.5				
MD4.01/20	Enhance regulatory capabilities and capacity for RWM in Moldova	2.8[100]				NA[101]
UA4.01/20	Remediation of the Prydniprovskiy Chemical Plant in Ukraine	5.7[102]				NA[103]
UA4.02/20	Management of HLW at the Pidlisnyi facility	3.1[104]			Y	NA[105]
UA4.03/20	Comprehensive water monitoring system for ChEZ	1.9[106]			Y	
IR5.01/20	Establishment of an effective and efficient nuclear safeguards system in Iran	5.0				
JRC	Project Cycle Management of nuclear safety projects	2.3				NA[107]

[95] Implementation coordinated and led by STCU
[96] Plus 0.65 M€ co-financing by third parties
[97] Implementation coordinated and led by STCU
[98] Plus 7.2 M€ co-financing by third parties
[99] Implemented through an addendum to an ongoing contract tendered in 2013
[100] Plus 0.68 M€ co-financing by third parties
[101] Implementation coordinated and led by Sida or STCU
[102] Plus 9.4 M€ co-financing by third parties
[103] Implementation may be coordinated and led by Sida and/or STCU
[104] Plus 1.2 M€ in kind contribution from Ukraine
[105] Implementation may be coordinated and led by Sida and/or STCU
[106] Plus 0.3 M€ co-financing by third parties
[107] Implementation through an Administrative Arrangement with the JRC

Project/Contract[43]	Description	Budget[44] M€	Contract signed	Complete	FA[45]	NA/T[46]
Support	Support measures for management of INSC (various)	1.59				
Total 2020	**8 contracts in 5 countries and 2 multi-country/regional contracts**	**31.39**				

Annex 2. Summaries of Projects Implemented under INSC-II

A2.1 Promoting Nuclear Safety Culture and Implementation of the Highest Safety Standards

A2.1.1 Pre-Accession Countries

A2.1.1.1 Serbia

Two research reactors were constructed on the Vinča site in the 1950s and operated until the early 1980s when they were shut down and decommissioning began. Large amounts of waste, in various forms, had been generated as a result and were being stored in poor conditions with potential to pollute the ground and the water table. Extensive support has been provided to the Serbian Regulatory Authority (SRBATOM) through the Instrument for Pre-accession Assistance (IPA). The support was implemented through contractual agreements with the IAEA and covered a wide range of issues including characterisation and conditioning of wastes, decommissioning waste stores, surveys of the Vinča site, and strengthening radiation safety capabilities and infrastructure. These activities were not very successful and contracting with IAEA ceased; a new project under the direct management of the EC began in 2021 (see Section A2.2.1.2 below).

Support of SRBATOM has continued under INSC-II with the objective of strengthening its capabilities in the fields of radiation and nuclear safety and radioactive waste management. Cooperation within project RS3.01/17[108] focused on the following issues: reviewing of and proposing amendments to draft legislation on radiation and nuclear safety to bring them in accord with EU Directives; and establishing a registry of radiation exposures for radiation workers, including the design of the database, specification and procurement of the hardware and software and training in its use. The contract for this work was only signed in March 2021 and completion is scheduled for May 2024.

A2.1.1.2 Turkey

Four VVER-1200 type reactors, with a total installed capacity of 4,800 MWe, are currently under construction at the Akkuyu site on the southern coast of Turkey. Operation of the first unit at Akkuyu is foreseen by 2023. Two further sites on the northern coast of Turkey, Sinop and Igneada, have been identified for the construction of further NPP.

Cooperation with the Regulatory Authority of Turkey, the Turkish Atomic Energy Authority (TAEK) began in November 2017 under the auspices of project TR3.01/16. Its aim is to strengthen the managerial and technical capabilities of TAEK in specific areas, namely: reviewing and undertaking deterministic and probabilistic safety analyses; performing manufacturing and construction inspections; and the further development and improvement of its management system. The cooperation builds on a twinning project implemented under the Instrument for Pre-accession Assistance (IPA) that focused on transposition of the EU nuclear safety *acquis*, human resource management and enhancing licensing and inspection capabilities. The expected outcomes are: enhanced capacity and capabilities for reviewing and assessing safety analyses; an approach to manufacturing and construction inspections that is broadly in accord with best international/European practice; capacity and capabilities for carrying out such inspections enhanced with reduced need in future for third party support; and development and use of an integrated management system capable of being certified by an accredited certification body.

Much progress has been made but significant delays have been encountered owing to changes in the Turkish nuclear law and the Covid pandemic. A new regulatory authority, Nükleer Düzenleme Kurumu (NDK) and a TSO, Nükleer Teknik Destek Anonim Şirketi (NÜTED) were established in July 2018 and progress was essentially put on hold for about 7 months during the reorganisation of regulatory responsibilities (i.e., transfer from TAEK to NDK). The Covid pandemic has also hindered progress significantly owing to restrictions on travel but measures are being taken to minimise its impact through alternative means of implementing the various project activities. Nonetheless, the duration of the

[108] Cooperation on a range of issues concerned with waste management and decommissioning was also included in this project and these are addressed in Section A2.2.1.2.

contract has been extended by 15 months to compensate for these delays that were beyond the control of the Contractor.

A2.1.1.3 Western Balkans

The countries in the Western Balkans all received considerable support from the IPA, in particular to assist them in adopting and complying with the *acquis Communautaire*. Cooperation has continued under INSC-II, both on a country and a regional basis; that on a country basis is described elsewhere in this annex. Cooperation at a regional level is being implemented through two regional projects concerned with improving EP&R in the region. While none of the countries in the Western Balkans operate NPP or research reactors, NPP are in operation in several neighbouring countries (i.e., Slovenia, Bulgaria, Hungary and Romania) and arrangements are needed to ensure timely and effective response should an incident or emergency occur at these facilities.

The objective of the first project (MC3.02/18) is to improve the capabilities of the regulatory authority in each country for assessing and managing the consequences of accidental releases of radioactive material in threat, release and recovery phases. This is being achieved by: firstly, establishing or improving links between the countries and with the ECURIE and EURDEP systems used by the EU for early notification and the exchange of radiation monitoring data; and, secondly, the installation and customisation of the Real-time On-line DecisiOn Support system (RODOS) in each country, providing training in its use, and the conduct of a large number of diverse desk-top exercises. The objective of the second project (MC3.01/20) is to improve capabilities for radiation monitoring in the event of an accident, in particular but not exclusively, in providing early warning of enhanced levels of radiation or radioactive material over the territory of countries in the Western Balkans. Early warning radiation monitoring networks (EWRMN) will be established or improved in each country and other monitoring equipment (e.g., aerosol and iodine monitors, etc) provided to enable timely information on elevated levels of radiation or radioactive material over the territory of the Western Balkans. When installed and operational, these EWRMN will bring the Western Balkan countries in line with good European practice.

The first project is at an early stage of implementation and the second has yet to be contracted. Progress with the installation and customisation of RODOS has been hindered by the Covid pandemic with all activities so far having been conducted remotely. Despite these difficulties, solid progress has been made although concerns remain over the sufficiency of human resources within some regulatory authorities to ensure the sustainable operation of RODOS in national emergency centres.

A2.1.2 European Neighbourhood Policy - East

A2.1.2.1 Armenia

Armenia has two nuclear power reactors, of first generation VVER design, sited at the Armenian Nuclear Power Plant (ANPP) (also known as the Metsamor Nuclear Power Plant). Operation began in 1976: one reactor was shut down and is awaiting decommissioning; the other remains in operation[109], has a capacity of about 400 MWe, and generates a large proportion of Armenia's electricity. Cooperation with Armenia has continued over a long period, firstly under the auspices of the TACIS programme and subsequently under INSC. Cooperation has focused on two main areas: firstly, enhancing the capacity and capabilities of the Armenian Nuclear Regulatory Authority (ANRA) and its Technical Support Organisation, the Nuclear and Radiation Safety Centre (NRSC); and, secondly, providing on-site assistance to the operator of the ANPP to improve its safety. Support was initially targeted at addressing those safety deficiencies at ANPP that had been identified as of high or highest concern, both through the provision of on-site assistance and equipment and enhancing the regulatory capabilities of ANRA. Attention then turned to addressing other deficiencies of lower (albeit important)

[109] The EU and the US tried to persuade Armenia to shut down this second reactor also, as first generation VVER reactors were deemed to be not upgradeable to internationally acceptable safety standards at reasonable cost, and studies were made for alternative sources of electricity generation. However, in view of the significant proportion of Armenia's electricity being generated by this reactor and the replacement cost, Armenia kept it in operation and the European Commission decided to continue supporting safety upgrades.

concern and, in the latter stages of INSC-I, supporting both the operator and ANRA in the conduct of the 'stress tests'.

Further cooperation with Armenia under the auspices of INSC-II was approved in AAP 2015, 2016, 2017, 2019 and 2020 (projects AM3.01/15, AM3.01/16, AM3.01/17, AM3.01/19 and AM3.01/20 supporting ANRA, and projects AM1.01/16 and AM1.01/17 the operator of ANPP). The objectives and status of each are summarised below.

Support to ANRA and NRSC

The objective of project AM3.01/15 is to enhance the capabilities of ANRA in preparedness for and response to a nuclear or radiological emergency. It is being achieved by: firstly, the installation of an automatic on-line early warning radiation monitoring network (EWRMN) in Armenia, in particular located around ANPP; and, secondly, the installation of JRODOS in ANRA's emergency centre to support decision making in an emergency, and its customisation to Armenian conditions. The project is well advanced but has suffered delays consequent upon the war with Azerbaijan and the Covid pandemic resulting in the duration of the project being extended by 12 months.

The objective of project AM3.01/16 is to enhance the capabilities of, and assist ANRA and NRSC in, the review, assessment, licensing and supervision of measures to improve the safety of ANPP in response to the 'stress tests', and of licensing applications related to its planned Lifetime Extension (LTE). *In situ* support is being given to ANRA and numerous reviews (more than 50) have been made of documentation providing safety justification for measures being taken to improve the safety of ANPP and/or justifying the lifetime of its key systems and components. The project is well advanced, appears to be largely achieving its objectives, and is well adapted to the needs of the End Users[110]. Its efficacy, however, has and continues to be hindered by difficulties in gaining timely access to essential documentation from ANPP and the Russian designer with implications for the project duration.

The objective of project AM3.01/17 is to support ANRA in improving EP&R in the event of station black out (SBO) or loss of ultimate heat sink (LUHS) resulting from external hazards. This is to be achieved through the procurement, testing, delivery, training and support during testing and commissioning, etc, of alternative power and water supplies that are seismically and environmentally qualified. The provision of such equipment will enable national emergency response teams to provide alternative supplies of power and water in the event of SBO or LUHS. The provision of alternative power supplies is at an advanced stage of tendering; that for alternative water supplies will be contracted by a negotiated agreement owing to the absence of bids.

The objective of project AM3.01/19 is to improve the capabilities of ANRA and NRSC in environmental radiation monitoring and bring them in accord with state-of-the-art European practice. It will be achieved by supporting the establishment of a national laboratory for environmental radiation monitoring. The support will comprise two components: firstly, a review of the proposed design of the laboratory and its equipment to ensure they are compatible with the functional requirements; and, secondly, to procure equipment to be installed in the laboratory. Training will be provided on approaches to and methods for environmental radiation monitoring and in the use of the installed equipment, including quality assurance. Support will also be provided for the secondment of ANRA/NRSC personnel to an accredited laboratory/ies in Europe for more advanced training. This project has yet to be contracted.

The objective of project AM3.01/20 is to further improve the regulation of nuclear safety in Armenia, in particular fully aligning it to relevant EU Directives and WENRA safety reference levels. It will be achieved through the following activities: informing ANRA/NRSC of experience in implementing the EU Directives and WENRA safety reference levels in countries operating VVER; assessing compliance

[110] About 1 year after the project began it was subjected to a ROM review which confirmed its satisfactory implementation up to that time (ROM report, Enhancing the capabilities of the Armenian Nuclear Regulatory Authority and its Technical Support Organisation in reviewing documents demonstrating the long-term safety of Unit 2 of Metsamor NPP (A3.01/16) C374196. February 2018.

of Armenian regulatory infrastructure, practice, regulations, rules, etc, with requirements in the EU and developing an Action Plan to achieve necessary changes; and the development of new regulations compliant with the EU Directives and WENRA reference levels. This project has yet to be contracted.

Support to the operator of ANPP

The objective of project AM1.01/16 is to provide on-site assistance to ANPP, in particular to assist its operator in the implementation of measures to improve safety in response to the 'stress tests'. Support in various forms is being provided, *inter alia*, transferring knowledge and experience from elsewhere in Europe in responding to the 'stress tests', review and analysis of foreseen safety improvements, development of technical specifications for plant safety upgrades or modernisations, support during the licensing process, training in enhancing safety culture and operational safety, and assistance in the follow up of on-site assistance provided under INSC-I. The project is well advanced, appears to be achieving its objectives and is scheduled for completion in early 2022.

The objective of project AM1.01/17 is to support the operator in making improvements to the safety of ANPP in response to the 'stress tests'. Support will be given to improve the leak-tightness of the ANPP confinement and that of the spent fuel pool (SFP) with the aim of bringing them in accord with best practice for VVER-440/230 designs. The work began in 2020 and is at an early stage of implementation. Restoration of the leak-tightness of the SFP will be achieved during one plant outage while improving the leak-tightness of the confinement will be achieved during five outages.

An external evaluation (19) of cooperation with Armenia under the auspices INSC-I and II was carried out in 2018. It comprises: a review of past, ongoing and planned INSC actions; an assessment of their impact on the End Users; and a gap or needs analysis that could inform the nature and scope of possible future cooperation. The main findings of this evaluation, which relate to cooperation under INSC-II, are summarised in Annex 5.

A2.1.2.2 Belarus

Cooperation with Belarus has continued over a long period, firstly under the auspices of the TACIS programme and subsequently under INSC. It initially focused on supporting the authorities with managing the health and environmental impacts of the accident at the Chernobyl NPP in 1986. The focus shifted over time towards enhancing the capacity and capabilities of the regulatory authority for radiation and nuclear safety, particularly over the past decade, following a decision by Belarus to use nuclear power as a source of energy. Under INSC-I, three projects (BY3.01/08, BY3.01/09 and BY3.01/13) were undertaken to enhance the capacity and capabilities of the regulatory authority in Belarus (Ministry of Emergency Situations (MES)), and its Department on Nuclear and Radiation Safety (Gosatomnadzor (GAN)), for regulating the design, siting, construction, and operation of the two NPP on the Astravets site.

Cooperation continued under INSC-II and support was provided through three projects (BY3.01/15, BY3.01/16 and BY3.01/20) all concerned with further enhancing the capacity and capabilities of MES/GAN in various areas.

A mobile radiation laboratory was supplied under the auspices of project BY3.01/15. It will be used in support of licensing activities and for EP&R; it is equipped, *inter alia*, with fixed and mobile air samplers, gamma dose rate monitors, a gamma spectrometer, a portable neutron detector, and personal electronic dosemeters.

Cooperation with MES/GAN under BY3.01/16 focused on four topics: a) the development of an integrated management system and updating of key regulatory documents; b) enhancing the technical capabilities of MES/GAN and its TSO; c) enhancing EP&R capabilities; and d) the regulation of waste management activities. Support under topic a) included: update of strategic documents; *in situ* assistance for the management of MES/GAN on a wide range of issues (including licensing, review of safety documentation, support in following up the 'stress tests', implementing recommendations of the 2016 IRRS mission); strengthening safety culture; further developing the regulatory framework; oversight and inspection of radiation protection and nuclear safety; communication and public information. Support under topic b) included: the development of an effective and independent system

of technical support; review and assessment of safety documentation including FSAR; and improving technical capabilities for deterministic and probabilistic safety analyses and the development of a risk informed regulatory approach. Support under topic c) included: upgrading of GAN's emergency centre including tools for accident diagnosis and prognosis, source term estimation and modelling of the dispersion and impact of radioactive material released accidently to the environment; further developing the capabilities of regional sub-divisions of MES in EP&R; and improving arrangements for coordination of response to accidents with trans-boundary impacts. Support under topic d) focused on improving the capabilities of MES/GAN on the management of radioactive waste and spent fuel.

The project began in October 2018 and encountered some difficulties during its implementation, possibly owing to its high level of ambition and the large number of diverse topics for which support was being provided. Issues beyond the control of the contractor were further sources of difficulty, in particular travel restrictions consequent upon the Covid pandemic, the need to replace a Key Expert, and the lead contractor, RISKAUDIT, ceasing to trade. The duration of the project has been extended to mid-2022 and, where practicable, activities are being implemented remotely; others, however, require the in-situ presence of the Contractor's or MES/GAN's experts in Belarus or elsewhere in Europe which may not be possible.

Cooperation with MES/GAN under project BY3.01/20 has the same overall aim as previous projects, i.e., further enhancing the capacity and capabilities of MES/GAN in regulating radiation and nuclear safety. But, following the commissioning of the new NPP (BelNPP) and it entering into commercial operation in 2021, the focus of the cooperation will shift towards supporting MES/GAN in its oversight and regulatory control during the early stages of its operation. The project is in the process of contracting and cooperation will focus on the following: exchange of experience in the conduct of the 'stress tests' and, if requested, supporting MES/GAN in its review and assessment of provisions made to further enhance the safety of BelNPP in response to the 'stress tests'; supporting MES/GAN in its oversight of implementation of the BelNPP Action Plan for establishing and maintaining safety culture; enhancing MES/GAN's oversight and regulatory control of radiation and nuclear safety, fire protection, and EP&R during the early stages of operation of BelNPP; improving legislative provisions; training in the use of a mobile laboratory for inspections and responding to incidents or emergencies at public events; establishing a system for operating experience feedback; and providing training in the use of computer codes for the purposes of reviewing or making independent assessment of deterministic and probabilistic safety analyses.

A2.1.2.3 Ukraine

Cooperation with Ukraine has continued over a long period (almost three decades), firstly under the auspices of the TACIS programme and subsequently under INSC. The main objective of the cooperation under INSC-II is to enhance the capacity and capabilities of the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) and its TSO (SSTC). The focus of the cooperation gradually shifted over time from support for licensing modernisation measures at NPP towards support for regulation to ensure the safe management of radioactive waste and spent fuel, remediation activities, as well as for other areas such as emergency preparedness, research facilities, etc. Seven projects were implemented under INSC-I and focused, *inter alia*, on further enhancing the capacity and capabilities of SNRIU in the regulation and licensing of nuclear safety and waste management, in particular in relation to safety improvements being made to VVER in response to the 'stress tests' and the development of new and improved infrastructure for waste management.

Cooperation with SNRIU under the auspices of INSC-II was approved in AAP 2014, 2015 and 2018 (projects UA3.01/14, UA3.01/15 and UA3.01/18). All three projects have been implemented in an integrated manner by RISKAUDIT[111], initially under a contract (awarded via restricted tendering) that covered the first two projects, and subsequently through an addendum to the contract to include the third. Support has been, or is being, provided in the following areas:

[111] Now implemented by IRSN following the cessation of trading by RISKAUDIT in 2021.

- Component A: strengthening SNRIU's capabilities in the licensing of nuclear installations other than NPP, i.e., fuel fabrication facilities, accelerator driven systems (neutron source), research reactors, critical and sub-critical assemblies, and the interim storage of spent fuel. European knowledge and experience on the licensing of such facilities have been transferred, capabilities within SNRIU for reviewing and undertaking safety assessments enhanced, and draft regulations and guidelines prepared. This component of the cooperation has been completed successfully.
- Component B: enhancing the capabilities of SNRIU for assessing and reviewing provisions for severe accident management, with a focus on spent fuel pools. European knowledge and experience have been transferred, *inter alia*, in the following areas: providing an in-depth understanding of severe accident phenomena; further development, verification and validation of models for analysis of severe accidents in spent fuel pools; and SNRIU's capabilities have been enhanced. This component of the cooperation has been completed successfully.
- Component C: strengthening and alignment of Ukrainian nuclear safety regulations with the EU *acquis* and WENRA reference levels. European knowledge and experience have been exchanged and support given to SNRIU in how to implement the EU Directives on the Basic Safety Standards (24), nuclear safety (25), responsible and safe management of spent fuel and radioactive waste (26) and achieving harmonisation with WENRA's updated reference levels (27). Recommendations have been made on where and how Ukrainian regulations need to be changed. Support has been given in drafting revised regulations and guidance in a limited number of cases while recognising that a much larger number of regulations and guidelines would be impacted, and therefore need revision, in achieving full alignment with the EU *acquis*.
- Component D: enhancing the capabilities of SNRIU in the assessment and regulation of external hazards. European knowledge and experience have been transferred, gaps in Ukrainian legislation and assessment methodologies identified with recommendations made on how they should be filled, and guidelines developed for assessing and regulating external hazards, both natural and man-made. This component of the cooperation has been completed successfully.
- Component E: enhancing the regulatory framework and capabilities in SNRIU in the area of operating experience feedback. European knowledge and experience have been transferred and the following guides, procedures, requirements or approaches developed: a regulatory guide for monitoring the effectiveness of the operating experience feedback system used in Ukraine for NPP; a procedure for the quantitative assessment of operational events; regulatory requirements for analysis of low level operating events and near misses; regulatory requirements for reporting, investigating and accounting for operational events at NPP. This component of the cooperation has been completed successfully.
- Component F: supporting SNRIU in regulating radioactive waste management. European knowledge and experience have been transferred and support is being given to SNRIU in: assessing the safety of a wide range of waste management activities, including classification, treatment, storage, disposal, clearance, remediation, etc; its interaction with waste management organisations on safety issues; and the development of regulatory guidelines for assessments. This component of the cooperation is well advanced apart from the development of the guidelines which are delayed by more than a year owing to limited capacity in SSTC.
- Component G: supporting and enhancing the capabilities of SNRIU in its review and assessment of measures taken by operators of NPP to further enhance the safety of Ukrainian NPP in response to the 'stress tests'. European knowledge and experience have been transferred, criteria established to select those measures (from the thousand or more to be implemented) that would be subject to in depth review, and independent assessment and inspection made for 36 selected measures (distributed between the four NPP sites in Ukraine). This component of the cooperation is largely complete apart from the in-depth review of

measures at Rivne NPP where visits/inspections have been delayed because of restrictions on travel as a consequence of Covid.

- Component H1: developing a strategy for completing the regulatory framework, capacity building and resource planning in SNRIU. Cooperation is ongoing but delayed due to Covid and the need to conduct meetings remotely. Completion is currently scheduled for February 2022 with the development (based on a fact-finding mission and review of SNRIU's strategy for the period 2019-24) of: a multi-annual strategy; an approach to ensuring continuous regulatory improvement; a comprehensive concept and multi-annual strategy for the continuation of INSC support to Ukraine over the next decade.
- Component H2: implementing the HERCA-WENRA approach to improve coordination of protective actions for emergencies with trans-boundary impacts. Cooperation is in progress but delayed due to Covid and the need to conduct meetings remotely. Completion is currently scheduled for February 2022 and is focusing on requirements and methodology for implementing the approach, the role of and training in the use of RODOS for these purposes, and integration of the approach into the regulatory framework for EP&R.
- Component H3: supporting SNRIU in the regulation of waste management, decommissioning and remediation. European knowledge and experience are being transferred and support given to SNRIU in: assessing the safety of waste management activities; preparing a regulatory guideline on the structure and content of a safety analysis report for a long-term storage facility; preparing a document on the application of terminology in waste management; and preparing and conducting an inspection of a licensee's clearance process. This component is well advanced but has encountered delays due to Covid and is scheduled for completion in March 2022.
- Component H4: supporting SNRIU in the licensing of diversified fuel supplies for Ukrainian NPP. European knowledge and experience are being transferred and support given to SNRIU in the development of a regulatory document comprising the procedure and requirements for reviewing and assessing the safety of facilities for fuel fabrication. This component is ongoing and scheduled for completion in March 2022.

An external assessment (18) of cooperation with SNRIU under the auspices INSC-I and II was carried out in 2017. It comprises: a review of past, ongoing and planned INSC actions; an evaluation of potential redundancies between the actions; an assessment of impact and sustainability; and a gap analysis that could inform the nature and scope of possible future cooperation. The main findings of this assessment related to the evaluation of INSC-II are summarised in Annex 5.

A2.1.3 European Neighbourhood Policy – South

A2.1.3.1 Morocco

Morocco has operated a 2 MW research reactor since 2007 and has expressed an interest in the use of nuclear energy for desalination and other purposes. In anticipation of the possible use of nuclear energy, it has taken steps to develop the requisite legislative and regulatory framework and infrastructure for such purposes. INSC has contributed to these developments, initially through project MO3.01/09 which focused on the establishment of a regulatory body, the Moroccan Agency for Nuclear and Radiological Safety and Security (AMSSNuR). Cooperation continued in INSC-II through project MO3.01/15, the objectives of which were: to support the development of a regulatory framework, arrangements for EP&R, a policy and strategy for radioactive waste management and a communications strategy; capacity building within the regulatory body; establishment of a management system; optimisation of medical exposures; and Morocco's accession to the Convention on Nuclear Safety.

The project is well advanced and is expected to achieve its objectives with its outputs being used by AMSSNuR to further improve and develop various aspects of its regulatory framework. Some

reservations were identified in a ROM report[112] on the project management and leadership by the contractor but this does not appear to have unduly detracted from delivery of expected project outputs. An IRRS mission and an EPREV mission to Morocco are foreseen in 2022 and this will, *inter alia*, provide an additional source for validating the value and use made by AMSSNuR of project outputs.

A2.1.4 Africa

A2.1.4.1 Ghana

The Ghana Atomic Energy Commission (GAEC) operates a small research reactor (34 kW) and is investigating the use of nuclear energy. The National Regulatory Authority (NRA) of Ghana was established in 2016. An Integrated Nuclear Infrastructure Review (INIR) was conducted by IAEA in 2017 and identified the development of a national plan for human resources development (including that in NRA) as an important action required in the development of a nuclear power programme in Ghana.

Ghana requested cooperation with INSC aimed at strengthening the NRA and assuring its independence. Support is being provided through project GH3.01/18, the objectives of which are to support NRA in: refining its strategy and plans for enhancing its capacity and effectiveness; establishing an integrated management system; establishing plans for human resource development and training; establishing safety principles, requirements and criteria for use in the installation of NPP in Ghana; enhancing capabilities and expertise on licensing activities; and establishing a strategy for public communications and stakeholder involvement.

The project began only a few months before the onset of the Covid pandemic and its implementation has been constrained by restrictions on international travel. Many activities have had to be postponed as they could not be implemented remotely and implementation of others has been less efficient. Contingency plans are being developed for the further implementation of the project in a manner or manners different from those initially proposed, should restrictions on travel persist.

A2.1.4.2 Tanzania

Large deposits of uranium have been found in Tanzania with exploration work beginning in earnest in 2007. About 100 locations have received an exploration licence and a licence to mine and process uranium at the Mkuju river site has been issued subject to further authorisations. The IAEA carried out a Uranium Production Site Appraisal Team (UPSAT) mission in 2013 and, *inter alia*, recommended the establishment of a regulatory infrastructure and legislation to ensure that uranium was extracted safely with due protection of people and the environment. An Integrated Regulatory Review Service (IRRS) mission took place in 2015 and reinforced the findings of the UPSAT mission, in particular the need to: update the legislative and regulatory framework including developing new regulations and guides; develop and implement an integrated management system; and implement a graded approach in all regulatory activities.

Tanzania requested support from INSC-II to help it respond to the recommendations of the UPSAT mission and this has been provided through project TZ3.01/14. The project had four main objectives: enhancing the legal and regulatory framework for uranium mining and milling and associated transport; supporting evaluations of the feasibility of transporting the extracted and processed uranium to the Dar Es Salaam seaport from where it would be exported; implementing a regional outreach programme on the regulatory framework and training and education on radiation and nuclear safety, including promoting the development of a sustainable capacity within Tanzanian universities; and strengthening the capabilities of the Regulatory Authority, the Tanzanian Atomic Energy Commission (TAEC), including the upgrading of its radioanalytical laboratories which provide services in dosimetry, radiation protection, environmental sampling and nuclear safeguards.

[112] ROM Report, MO3.01/15 – Support to the Regulatory Body of Morocco for capacity building and for enhancing the regulatory framework for nuclear and radiation safety. C-383918. May 2020.

A ROM review carried out about two years after the project began confirmed its satisfactory implementation up to that time[113]. The project was completed in April 2021 and achieved its objectives. The legal and regulatory framework has been improved by revision of existing, and development of new, regulations in accordance with international standards. Cooperation among the various Tanzanian authorities, with a role or responsibility for mining and processing of uranium, has been greatly improved during project implementation, in particular through developing a shared understanding of the issues and eliminating overlaps. The preparedness of Tanzanian ports to handle Class VII dangerous goods, which include uranium ore concentrate, has been assessed and recommendations for improvement of specific areas such as emergency preparedness have been provided. The knowledge, skills and competencies of the regulatory body in developing and delivering training for radiation workers, as well as in public communication, have been enhanced. The radioanalytical laboratories were upgraded and TAEC personnel trained in the use of new equipment.

Commercial mining and processing of uranium has yet to begin. The planned open pit mining of uranium at the Mkuju river site was suspended in 2017 owing to the low uranium prices; extraction by *in situ* leaching is currently being investigated.

A2.1.5 Asia

A2.1.5.1 Association of South East Asian Nations (ASEAN)

Bi-lateral cooperation with several countries in ASEAN took place under the auspices of INSC-I, in particular, Indonesia, Malaysia, the Philippines, Thailand and Vietnam. The cooperation, on a country basis, focused on further enhancing the capacity and capabilities of the respective Regulatory Authorities at a time when their governments were considering or planning to embark on the use of nuclear energy. The accident at Fukushima Daiichi NPP resulted in policy changes (i.e., plans to use nuclear energy were put on hold or cancelled) and this largely removed any pressing need to further enhance regulatory capacity and capabilities. The accident also led to a wider recognition, at both technical and political levels, that EP&R capabilities at national and regional levels in ASEAN needed to be enhanced and cooperation was requested with INSC.

INSC-II is supporting and has supported ASEAN in improving EP&R in the region through three main activities. Firstly, in cooperation with IAEA, it supported the development of a strategy and action plan for improving regional cooperation on EP&R in ASEAN[114] (28). Secondly, in response to the action plan, it is providing (through project REG3.01/16) tools to enable each country to assess and manage the radiological consequences of any future incident or emergency that may affect ASEAN; this is being achieved by the installation and customisation of the ARGOS and RODOS decision support systems[115] in national emergency centres and providing training on their use. Thirdly, through project MC3.01/19, a regional early warning radiation monitoring network is being established by improving national networks in some countries and establishing them for the first time in others. In addition, an ASEAN Radiation Data Exchange Platform (ASEAN-RDEP) is being developed with the same functionality and purpose as the EURDEP platform that has had long usage in Europe.

The first project (MC3.01/16) is very well advanced but is suffering from Covid related delays; some extension will be needed to conduct further desk top exercises aimed at enhancing the sustainably of the cooperation. The second project (MC3.01/19) is progressing satisfactorily with site selection for the radiation monitors well advanced and factory acceptance tests for the monitors scheduled to be carried out in early 2022.

A2.1.5.2 China

Cooperation with the Chinese nuclear regulatory authority, the National Nuclear Safety Administration (NNSA) and its Technical Support Organisation (TSO), the National Safety and Radiation Centre

[113] ROM report, TZ3.01/14 – Support to the Regulatory Authority of Tanzania. C372861. April 2018
[114] This activity was implemented through an Administrative Agreement with the JRC at Ispra
[115] Both these decision support systems have found wide usage for these purposes in Emergency Centres in Europe and elsewhere.

(NSC), began in late 2013 under the auspices of INSC-I (project CN3.01/11); this project focused on enhancing the capacity and capabilities of NNSA/NSC in a number of areas of strategic importance for the regulation of nuclear safety. The cooperation continued under INSC-II (project CN3.01/15) and focused on the exchange of knowledge and experience and further enhancing and strengthening the regulation of nuclear safety in the following areas: radioactive waste management and decommissioning; EP&R; transport of radioactive materials; safety principles for the reprocessing of nuclear fuel; seismic analyses and safety; and R&D facilities and infrastructure supporting the regulation of radiation and nuclear safety.

In the waste management and decommissioning area, support was provided to NNSA/NSC in further developing their requirements and approaches for regulating the following activities: the release of gaseous and liquid effluents to the environment; the disposal of solid radioactive wastes in near surface and intermediate depth facilities and in deep geological formations; high integrity containers used for waste disposal; decommissioning of nuclear facilities; and how trust and confidence in the regulatory process could be enhanced. In the EP&R area, NNSA/NSC's approach to evaluating the adequacy of operators' arrangements was reviewed and advice given on how it could be further enhanced; in addition, the technical tools and methods used by NNSA for aiding judgments on the adequacy of measures being taken, or planned, by the operator in response to a nuclear or radiological accident/emergency were reviewed and enhanced through the provision of tools developed and widely used in Europe for similar purposes (i.e., RODOS). In the transport area, support was given in further developing NNSA/NNC's approach and requirements for the safe transport of spent fuel and UF_6 and bringing them in accord with best international practice. Experience in Europe with the establishment and use of facilities and infrastructure for R&D in support of the regulation of radiation and nuclear safety was exchanged and was used by NNSA/NSC in establishing their own R&D base. In addition, European knowledge and experience with seismic safety analyses and safety assessment principles for nuclear fuel reprocessing plants was shared with NNSA/NSC and support given to further develop their regulatory approaches and requirements in these areas.

About 2 years after the project began it was subjected to a ROM review which confirmed its satisfactory implementation up to that time[116]. The project has proved to be very successful with a high level of commitment and ownership by NNSA/NSC, who have fully exploited the project outputs in further enhancing their regulatory capacity and capabilities (see Annex 4).

A2.1.6 Middle East/Gulf

A2.1.6.1 Gulf Cooperation Council (GCC)

The Gulf Cooperation Council (GCC - Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) is in the process of further developing and enhancing its EP&R for radiological and nuclear incidents or emergencies within the Gulf region. It requested support from INSC in two contexts: firstly, to support it in the development of a radiation data exchange platform (GCC-RDEP) for the GCC with the same purpose and functionality as EURDEP that has had long usage in Europe; and, secondly, to support it by installing the RODOS decision support system in the GCC emergency centre, customising it for use in the GCC region and providing training in its use. Support in developing the GCC-RDEP is being provided by the JRC at Ispra through an Administrative Agreement; that for the installation and customisation of RODOS is being provided through project MC3.01/18.

Progress with the development of the GCC-RDEP (i.e., a customised version of EURDEP) has been significantly delayed owing to: insufficient resources/expertise in JRC following the retirement of, and failure to replace, key personnel; IT security requirements in JRC preventing access by GCC to the platform on which GCC-RDEP is being developed; and the impact of Covid. Work continues but appears to be encountering a number of difficulties for which solutions have yet to be established.

[116] ROM report, CN3.01/15 – Enhancing the capacity and regulatory capabilities of the Chinese NNSA in the areas of waste management and decommissioning, emergency preparedness and response, transport, reprocessing plant safety. C376058. October 2018

JRODOS has been installed on dedicated hardware provided by GCC within its centre; it has yet to be installed in individual Member States pending agreement of a concept of operations within the region. GCC staff have visited Emergency Response Centres (ERC) in Germany and Austria to become familiar with how JRODOS is used as part of national emergency arrangements in Europe. Customisation of JRODOS to the Gulf region is ongoing; the standard hydrological models in JRODOS are being customised for the Gulf and a proposal for categorising radioecological regions in the Gulf area has been developed and awaiting GCC approval. Covid has affected the efficacy of implementing the project but progress has been largely maintained through remote interaction.

A2.1.6.2 Iraq

Iraq has received much support from the EU, US, IAEA and others over the past two decades to deal with legacy wastes and nuclear facilities damaged during the Iraq war. Support was provided by both the Instrument for Stability and INSC-I. The former focused on capacity building through training scientists, formerly involved in weapons' programmes, in decommissioning and radioactive waste management. INSC support was focused on the Ministry of Science and Technology (MoST), the body responsible for waste management and decommissioning. Support was provided in the design and safety assessment of a near surface disposal facility for low and intermediate level waste and supplying a mobile analytical laboratory.

In INSC-II, the focus shifted to strengthening the capabilities of the regulatory authority (Radiation Protection Centre (RPC)) in the areas of radioactive waste management, decommissioning and remediation of contaminated sites. Support was provided (via project IQ3.01/14) in four main areas: capacity building in the context of authorisations, inspection and enforcement and periodic safety reviews; reviewing and updating existing regulations on decommissioning, waste management and waste disposal and developing draft safety guides on a wide range of related issues; supporting RPC in its review of the safety assessment for a waste disposal facility; and exchanging European knowledge and experience on inspection of waste disposal facilities.

The objectives of the project were largely met although the project had to be extended by a year owing to the late submission by the Ministry of Science and Technology (MoST) of the pre-construction safety assessment report in support of a licence application for the Al-Tuwaitha radioactive waste disposal facility. Three regulations were reviewed and twelve safety guides developed and advice was given on the development of a regulatory framework. A few tens of RPC staff were trained in a wide range of relevant topics.

A2.1.6.3 Iran

Iran has, *inter alia*, one operating nuclear power reactor at the Bushehr Nuclear Power Plant (BNPP), enrichment facilities and research reactors. For many years Iran was in a situation of non-compliance, or not fully complying, with IAEA safeguards agreements and, as a result, incurred severe sanctions, mainly by the US and the EU. After extensive negotiations, with the aim of reaching a mutually-agreed long-term solution that would ensure that Iran's nuclear programme would be exclusively peaceful, on 14 July 2015, the P5+1[117] and Iran concluded the Joint Comprehensive Plan of Action (JCPoA), which was subsequently endorsed by a UN Security Council Resolution. This opened the way for the lifting of some of the sanctions and cooperation between the EC and Iran on nuclear safety. Under Annex III of the JCPoA, concerning Civil Nuclear Cooperation, it provides specifically for cooperation on nuclear safety and safeguards.

Since 2016 the EC has provided extensive support to the Iranian Nuclear Regulatory Authority (INRA), directly or through the IAEA. The first cooperation action with Iran took place under the 2016 Annual Action Programme. It is being implemented through two projects. The first (IR3.01/16) aims to enhance the capabilities of, and provide support to, INRA in: designing the future Nuclear Safety Centre (NSC); reviewing the regulatory framework; cooperating on safety analysis; reviewing the 'stress tests' carried out at the Bushehr NPP; providing training; and planning and organising regional conferences on

[117] The five permanent members of the United Nations Security Council (China, France, Russia, United Kingdom, United States—plus Germany) together with the European Union

nuclear safety. In parallel, a second project (IR1.01/16) is providing support to the nuclear power production company of Iran (a subsidiary of which is the operator of the Bushehr NPP) in carrying out the 'stress tests'. Projects IR3.01/16 and IR1.01/16 commenced in April 2017 and December 2017, respectively. Both projects are ongoing, having suffered delays and their durations extended owing to the political situation and the Covid pandemic.

A second action under AAP 2017 concerns the promotion of nuclear safety culture through support to INRA in developing a nuclear regulatory framework as well as internal procedures, guidelines and training according to the highest EU and international nuclear safety standards. The project (IR3.01/17) is intended to build explicitly on the results of project IR3.01/16 and includes: the further development of the legal and regulatory framework for nuclear safety and the INRA management system; support in assessing and reviewing the safety of nuclear installations; and support on emergency preparedness and response. The project began in October 2018 and is still underway, having been delayed because of travel restrictions due to the pandemic.

A third action under AAP 2018 concerns: further enhancing the capabilities of INRA in assessing and verifying the safety of nuclear reactors; establishing a management system; enhancing regulatory oversight of radioactive waste management; the installation of a decision support system for nuclear and radiological emergencies; and analysis of equipment needed for typical laboratory functions of the NSC. This action is being implemented through one project (IR3.01/18A) addressing most activities in the action up to specification of the equipment needed for the NSC, with the supply of equipment provided for in a second project (IR3.01/18B). The first project began in April 2020 but only work that could be carried out on-line has been possible so far because of travel restrictions due to the pandemic. It has also been delayed by delays in previous projects. The second project has not yet started, although a call for tender is in preparation.

A further action, included in AAP 2019, concerns the supply of the equipment needed for typical laboratory functions of the NSC, and supporting the provision of equipment for expert activities in the Emergency Response, Radiation Protection or Radiation Monitoring Centres of Iran. Implementation of this project is foreseen to be by the IAEA through a delegation agreement.

Cooperation with Iran under the INSC continues to be implemented effectively despite the difficult political environment in recent years. Overall, some 25 M€[118], amounting to about 11% of the INSC-II budget, has been committed for this purpose. It reflects the will for a rapid improvement of the situation and the importance of delivering on the commitments under the JCPoA.

A close working relationship is being maintained between the EC and the EEAS, in order to help ensure a coherent approach vis–à-vis Iran. The EC continued to coordinate its activities with other international donors through the Joint Commission established under the JCPoA and the IAEA Technical Cooperation Department.

A2.1.7 Multi-country

A2.1.7.1 Training and Tutoring

Training, in one form or another, is an integral part of most cooperation projects implemented under the INSC programmes, with its scope, content and delivery optimised to achieve the particular objectives of a given project. While training delivered within projects remains a key component, the need for a more integrated and holistic approach to the training of nuclear regulators and their TSO was recognised, in particular to meet an increasing demand and make best use of limited European resources. In response to these needs, a training and tutoring (T&T) initiative was launched in 2012 and supported by INSC. Its objective is to strengthen, through T&T, the capabilities of regulatory authorities and their TSO for regulating nuclear safety.

Some 9 M€ was contributed by INSC-I for T&T, which was provided by two consortia. Given the success of the support and continuing demand from regulatory authorities and their TSO, it has

[118] Also including cooperation on safeguards (see Section A2.3.3.2)

continued under INSC-II in projects MC3.01/14, MC3.01/16 and MC3.01/20, with a broadly comparable level of funding to that in INSC-I.

Training is being provided in four distinct but linked areas: the legal basis and regulatory processes; basic, applied and advanced technologies; regulatory practices (e.g., assessment, inspection, investigation, audit); and human and organisational factors. The training is complementary to and does not duplicate that provided by other entities (e.g., IAEA, universities, etc). New courses are developed as need dictates (e.g., for senior management in regulatory authorities) and are delivered in different settings reflecting the needs of the trainees and enhancing their efficacy. Most courses are held in Europe and delivered in English (with interpretation in some cases); courses are also held at a regional level and delivered in other languages where this is more effective. A few tens of training courses have been developed since the programme began and have been delivered with a frequency reflecting demand. Training courses typically comprise between 1 to 3 modules, with each module lasting a week. Tutoring is also being provided and is tailored to the needs of the individual. Typically, tutoring comprises 1 to 3 modules, with each module lasting about 4 weeks.

About 300 to 400 trainees per year have attended training courses since the programme began and tutoring has been provided to about 15 to 20 persons per year. Regulatory authorities (and their TSO) from more than 20 countries have benefited from the programme through T&T of their personnel.

Phase IV of the programme was subjected to a ROM review in 2017/8[119] which confirmed the broadly satisfactory implementation of the programme. The excellent quality of the training material was noted, but some concerns were expressed about the efficacy of the training owing to the relatively small number of participants (typically, less than 10) attending courses held in Europe, perhaps reflecting a decreasing demand as a result of participation in earlier courses.

An evaluation of T&T activities implemented under the auspices INSC-I and II was carried out in 2018. It comprises: a review of past, ongoing and planned T&T activities; an assessment of their impact; and a gap analysis that could inform the nature and scope of possible future T&T. The main findings of this evaluation relating to INSC-II are summarised in Annex 5.

A2.1.7.2 IAEA

Support is being given to IAEA in implementing its Action Plan on Nuclear Safety and in providing assistance to INSC partner countries to improve global nuclear and radiation safety (MC3.03/18). Four topics are being addressed: enhancing the use of seismic experience data; improving nuclear safety for countries embarking on the use of nuclear energy; holding a 2-week school for Nuclear and Radiological Leadership for Safety; and strengthening education and training in radiation safety and sustaining human resource development and knowledge management in Africa.

The contract was signed in December 2019 and there has been little, if any, progress with the first three topics by the end of 2020 owing to administrative delays and the impact of Covid. Progress has, however, been made on the fourth topic with Postgraduate Educational Courses in Radiation Protection and the Safety of Radiation Sources having been held (November 2020 till March 2021) for English-speaking countries in Accra, Ghana, and for French-speaking countries in Rabat, Morocco.

A2.1.7.3 Education for leadership in nuclear safety

This project (MC3.04/18) builds on a 'Pilot School for Safety Leadership' held at the Université Côte D'Azur in 2017. Further material is being developed for the education of early and middle career managers in safety leadership. A more academic approach is being followed with a view to accreditation and the issue of a university diploma. The project comprises four main tasks: development of the diploma contents, achieving accreditation for it, and preparing for the implementation of the course; implementation of the first course with about 25 attendees (about 10 from the EU and 15 from INSC partner countries); implementation of a second course a year later; development of e-learning for some

[119] ROM report, MC3.01/14 – Training and Tutoring, 4th Phase. C363046. February 2018.

elements of the course with a view to sustainability; and establishing inter-university agreements to include safety leadership courses in the schedule of MSc students.

The contract was signed in June 2019 and good progress was made in the first year. The course content was developed and accreditation was achieved for the diploma. Restrictions on travel owing to Covid, however, compromised plans for the second year, i.e., holding the first course. Consideration was given to providing training on-line but was deemed impractical as a means for transmitting practical competence and expertise that would be best achieved in small groups of trainees interacting with each other and the trainers. The first course was postponed till September 2022 and the duration of the contract extended by a year. The composition of the consortium also changed following the cessation of activities by ENSTTI in December 2020; their activities within the project have been taken over by the European Education Network (ENEN).

A2.2 Radioactive Waste Management, Decommissioning and Remediation

A2.2.1 Pre-Accession Countries

A2.2.1.1 Bosnia and Herzegovina

Bosnia and Herzegovina has no nuclear industry, but has radioactive waste from the use of radioactive material in hospitals and industry. None of the waste storage sites was appropriately licensed. The cooperation (project BA4.01/18) is aimed at enhancement of the regulatory capabilities and improvement of the national practices for management of radioactive waste in the country. It builds on the results of a regional cooperation project under the Instrument for Pre-accession Assistance (IPA). It is directed towards finding an appropriate solution for the safe and secure storage of the radioactive waste, in line with international standards and good practices and in compliance with the EU *acquis*, building up the capacity of the regulatory authority on licensing waste storage facilities, and providing comprehensive training for its staff, as well as providing support to the regulatory authority in a number of related areas. The project began in February 2020 and is scheduled for completion at the end of January 2023. The Covid pandemic has necessitated some adjustments to the project schedule, but, as yet, not the anticipated completion date.

A2.2.1.2 Serbia

The Vinča site in Serbia served, for many years, as the main radioactive waste management facility in former Yugoslavia, dealing with both nuclear and non-nuclear wastes, as well as a centre for research and waste solidification technology development. The first cooperation project with Serbia (RS3.01/17)[120] involves several activities aimed at improving waste management at the Vinča site, specifically related to: developing a plan for treating liquid radioactive waste from spent nuclear fuel pools and four liquid underground storage tank, and for decommissioning the pools and tanks; removal, conditioning and storage of sealed and unsealed radium sources from a radium bunker; and the removal, classification, conditioning and storage of nuclear materials and radioactive waste from a materials science laboratory. The second cooperation project (RS4.01/18) is aimed at: establishing comprehensive programmes to characterise, treat, condition and safely and securely store radioactive waste and disused sealed sources; and removing all low- and intermediate-level radioactive waste and sealed sources from two old waste storage hangars, safely and securely storing the waste, dismantling the old hangars and associated sheds, and remediating the surrounding area for subsequent industrial use. This cooperation represents a follow-up to activities carried out under previous IPA projects, and there appears to be some overlap with one of these. The first project only began in March 2021 and is scheduled for completion in May 2024. The second project is being implemented through indirect management with the IAEA and began in December 2019. However, the work is not planned to commence until Q3 2021.

[120] Cooperation on topics related to nuclear safety culture are also included in this project and are addressed in Section A2.1.1.1. of this Annex.

A2.2.2 European Neighbourhood Policy – East

A2.2.2.1 Moldova

Moldova is a non-nuclear country, but radioactive waste has been produced from the use of radiation and radioactive material in research, medicine, industry and agriculture. This was stored at a national disposal site in the near-surface facility without conditioning until 1995, when its use ceased on the recommendation of IAEA experts. There is evidence of leakage of radioactive waste from the facility and contamination of the surrounding area. With the support of Sweden, Moldova has adopted a National Strategy for Radioactive Waste Management with an Action Plan for its implementation for the period 2017-2026. The Action Plan includes measures for decommissioning of the old facility, repackaging of the waste, decontamination, remediation, and management of the generated radioactive waste. It is planned to complete these actions by 2026. The cooperation builds on an IAEA pre-feasibility study, and the Swedish International Development Cooperation Agency (Sida) is financing a parallel project on the development and implementation of a radiological monitoring programme at the national waste management site and the construction of storage facility for radioactive waste from decommissioning of the old disposal facility. The specific objectives of the INSC cooperation project (MD4.01/20) are to: update the legal and regulatory framework in line with EU and international standards; carry out a feasibility study on final disposal solutions; provide and install equipment for retrieval, treatment and storage of radioactive waste; and put in place a human resource plan for the operator and regulator. The project has not yet been contracted.

A2.2.2.2 Ukraine

A large proportion of both the number of waste management projects and the funding allocated under INSC-II was to projects in Ukraine. Ukraine has a large volume of radioactive waste resulting from the Chernobyl accident in 1986. Some of this waste has been placed in disposal facilities; other wastes are stored at disposal facilities or temporary locations both within and outside the Chernobyl Exclusion Zone. Additional volumes of radioactive wastes are expected to arise in the future, resulting from remediation activities at the destroyed Chernobyl Nuclear Power Plant (ChNPP) Unit 4 and decommissioning of Units 1-3 of the shutdown plant. Substantial volumes of radioactive waste have been accumulated and will continue being generated at the operating Ukrainian nuclear power plants and subsequently during their decommissioning. Radioactive waste is also generated as a result of operation of research institutes, industrial enterprises and medical institutions using ionising radiation sources. Several operating and idle uranium production enterprises are also sources of radioactive waste.

Contributions under INSC-II have continued to be made to the established EBRD accounts for the Chernobyl Shelter Fund (CSF) and the Nuclear Safety Account (NSA) which supported major radioactive waste management projects at the Chernobyl site.

Chernobyl Shelter Fund

The CSF was created in 1997 to finance the Shelter Implementation Plan (SIP) and assist Ukraine in making the site of the temporary shelter over Chernobyl's destroyed reactor, Unit 4, stable and environmentally safe. The New Safe Confinement (NSC), the largest project under the SIP, also aimed at creating the conditions for the eventual dismantling and decommissioning of the contaminated structures.

In spite of all the controls put in place[121], cost overruns became inevitable due to the technical complexity of the projects, their one-of-a-kind nature, stringent regulatory requirements and the difficult working environment. The total cost of the Chernobyl Shelter Implementation Plan (SIP) projects

[121] The EU made its 2011 pledge conditional upon increased and fully independent monitoring of the projects. This was to be achieved through a Site Monitoring and Reporting Contractor (SMRC), to follow the cost and schedule during the construction phases and to provide independent reports. The SMRC was funded by the EU, US and the UK under an account (fund) managed by the EBRD

increased in 2014 to some 2,150 M€, which created a funding gap of 615 M€[122]. This sum, which was validated after an audit and detailed reviews, was to be covered by donors to the Chernobyl Shelter Fund (CSF) and the EBRD. Timely additional funding became the major risk for the successful completion of the project. In 2015, the EC announced a further contribution to the CSF which was included in the AAP 2015 and 2016 (30 M€ and 40 M€, respectively)[123]. The EC contribution was established in accordance with the burden sharing agreed among the G7 members and the EC (on the basis of previous/historical contributions) and further discussions among the EU members of the G7 and the EC.

The construction of the New Safe Confinement was completed in 2019 at a cost of about €1.5 billion. The total cost of the SIP amounted to some €2.15 billion, of which the EU, through the EC, contributed 432 M€. Following systems installation, testing and commissioning, the New Safe Confinement was handed over to the Ukrainian authorities. After almost 24 years, in October 2020, the Chernobyl Shelter Fund received the Donors' Assembly non-objection for its closure. A relatively small amount of funds left in the account was returned to the donors.

Nuclear Safety Account

The NSA was set up in 1993 to finance nuclear safety projects in Central and Eastern Europe. As the essential work came to an end, the NSA concentrated on two projects related to radioactive waste management in Ukraine and the decommissioning of the Chernobyl Units 1, 2 and 3: the Liquid Radioactive Waste Treatment Plant **(**LRTP**)** and the Interim Spent Fuel Storage Facility (ISF-2).

The LRTP, which was completed in 2014 at a cost of some 40 M€, provides for the retrieval of highly active liquids from their current storage tanks, processes them into a solid state and moves them into containers for long-term storage.

The ISF-2, the last project funded by the NSA, will process, dry and cut more than 21,000 fuel assemblies from the Chernobyl units 1-3, which will then be placed in double walled canisters and stored in concrete modules on site for a minimum period of 100 years. It had an initial estimated cost of about 300 M€, but suffered a significant cost increase mainly due to external factors outside the project management control (in particular, depreciation of the Euro against the US$, cost escalation and contractor claims due to the risk of war at the time). By the end of 2015, the EBRD indicated that the NSA would require an additional 105 M€ to complete the project. A pledging conference was organised in Kiev in April 2016 to raise the required sum. The EC pledged 19.1 M€ and this was included in the AAP 2017.

The ISF-2 received its operational license in April 2021 and work to process and store the fuel commenced in June 2021. The total cost of the project amounted to some 380 M€, however the exact cost of the project was yet to be determined at the time of writing due to ongoing commercial disputes. The donors agreed to extend the term of the NSA until the end of 2022 to allow more time for resolution of the commercial disputes.

[122] One of the main reasons for the price increase was the so called 'provisional sums' which were included in the contract for items with an unfinished design concerning in particular the auxiliary systems, for which the price could not be reliably established at the time. The 'provisional sums' items also caused more than one year's delay to the original October 2015 completion date, driving the price even higher. After the price revision, the contract for the New Safe Confinement (NSC), the main contract under the SIP, was eventually converted to a fixed price contract and the main uncertainties were transferred to the contractor.

[123] The G7 Presidency assisted by the Contact Group took the lead in the fundraising from G7/EU and non-G7 donors. An agreement was reached among the G7 members on their individual contributions, but the EC had to increase its contribution from that based on the historical burden sharing (45.6 M€) to 70 M€, to ensure an agreement among the European Members of the G7. The EC funding was provided under a new separate budget line, in addition to the INSC financial envelope defined in the INSC Regulation. The amount of this additional budget was provided from the Reserve under the Header IV of the EC budget.

National strategy

In addition to these funds, there have been specific cooperation projects in Ukraine that have been focused on building on work included in INSC-I and the earlier TACIS programme, mainly dealing with radioactive waste issues in the exclusion zone and in addressing the legacy of uranium production activities. A comprehensive national strategy for managing Ukraine's legacy waste and future radioactive waste was developed through the TACIS project UA4.03/04[124] which led to the revision of the legislation on radioactive waste management in 2008. Building on this, a "Strategic Road Map" (SRM) for radioactive waste management was developed in 2009 and has since been regularly updated. In principle, the SRM defines a 20-year-programme containing more than 60 individual projects on radioactive waste management and, since 2009, the SRM has supported the selection process for the inclusion of projects in the INSC programmes. However, in practice, project documents make little reference to the SRM. There is also an increasing emphasis on collaborative working between the EU-funded contractors and the Ukrainian partners and end users. This has resulted in a greater focus on training and transfer of knowhow with the overall aim of improving the capability of the Ukrainian entities to perform the work to a high standard of safety. This is evident, at least as an aim, in most of the INSC-II projects in Ukraine.

National action plan for geological disposal

Project UA4.01/14B was concerned with the development, with relevant organisations in Ukraine, of a national action plan for the establishment, operation and closure of a geological disposal facility for high level waste, and possibly also spent fuel, including a site selection process involving public engagement, a detailed implementation schedule with costs, and training in safety assessment and programme management. The project started in September 2018. Subsequently an additional contract (UA4.01/14B1) was added to deal with the fraction of intermediate-level waste that could be co-disposed with the high-level waste. This started in September 2019. Both projects were negatively affected by the pandemic. In particular, the public engagement events planned for the Spring of 2020 were initially postponed and eventually replaced with a webinar event and some of the envisaged public engagement work was cancelled. The project was completed in March 2021.

National radioactive waste management organisation

The State Agency of Ukraine for the Management of the Exclusion Zone (SAUMEZ [125]) has responsibility for the Chernobyl Exclusion Zone (ChEZ) and the ChNPP, including the issues of long-term storage and/or disposal of radioactive waste. It is also responsible for the management nationally, on behalf of the Ukrainian State, of non-nuclear radioactive waste. The Central Radioactive Waste Management Enterprise (CERWM), the Chernobyl NPP, and the State Corporation "Radon" are subsidiaries of SAUMEZ. Two actions in INSC-II contained elements aimed at strengthening the capabilities of SAUMEZ to fulfil its responsibilities, particularly following the entry into force of the Association Agreement between Ukraine and the EU in 2017 and the transfer in 2018 to SAUMEZ of the fund for radioactive waste management in Ukraine. The first of the subsequent projects (UA4.01/18A) is aimed at embedding international best practice within SAUMEZ in programme management. It began in May 2021 and is still underway. The second of the subsequent projects (UA4.01/19A) is aimed at supporting SAUMEZ in transforming Ukraine's radioactive waste management sector organisations into a uniform integrated entity with efficient, productive bodies, utilising up-to-date management techniques, whilst ensuring a strong safety culture aligned with international best practice. This project is yet to commence.

Problematic liquid wastes

Project UA4.01/14A is concerned with the management of problematic liquid radioactive waste, comprising slurries, sludges, resins and salt cake, generated at operating and shutdown nuclear power

[124] Development of a National Strategy and a Concept for State Programme for Radioactive Waste Management in Ukraine, including the Strategy for NNEGC Energoatom Radioactive Waste Management

[125] Also referred to in documentation as SAUEZM (State Agency of Ukraine for Exclusion Zone Management) and SAMEZ (State Agency for Management of the Exclusion Zone).

plants, which were unable to be processed at the LRTP. The work involves the analysis of the waste streams and the development of technical solutions for processing three of the waste streams, alongside a preliminary safety assessment and review by the regulatory authority. The project began in November 2018 and there was initially a delay to the commencement of sampling of the waste streams which was then exacerbated by the Covid pandemic. However, by adjusting the planned schedule and carrying out some tasks in parallel, the project is expected to be completed as originally scheduled in November 2021.

State Corporation "Radon"

Project UA4.01/14C is concerned with the preparation of comprehensive safety assessments of the six radioactive waste management sites of the Ukrainian State Corporation "Radon". These facilities were created in Soviet times and include near surface concrete-lined pits, wells for disused sealed sources and tanks for storage of liquid waste. A project under INSC-I, addressed the design and provision of equipment and procedures for the retrieval, processing and packaging of the solid waste in the concrete-lined pits, and included trial retrieval at a pilot site prior to the retrieval of the waste held in the pits at all the "Radon" sites by the Ukrainian authorities. While this was proceeding, the nuclear regulator called for comprehensive safety assessments to be submitted for all the sites, so that the level and the nature of any hazard could be understood and remedial action could be prioritised and designed. The preparation of the comprehensive safety reports is the first objective of this project. The second part is addressing the waste stored in the wells and tanks and the escape of tritiated water from a small number of pits at one site with the aim of designing suitable techniques and equipment that would allow all these issues to be addressed. Because of the situation in eastern Ukraine, only five of the sites have been included in the project. The project began in November 2018 and is progressing on schedule, despite minor delays due to the pandemic. Safety assessments have been completed for one site and submitted to the regulator and are being completed for the other sites. A web-based training event was held to develop sustainable capability within "Radon" for carrying out safety assessments. The project is expected to be completed in October 2021.

Chernobyl Exclusion Zone

Following the 1986 disaster, much of the most radioactive debris material (including some nuclear fuel) was sent to the Pidlisnyi facility, a specially constructed above-ground structure consisting of eight concrete modules, two of which have been filled. It was commissioned in December 1986 with a design lifetime of 20 years. Project UA4.02/20 aims to: support the establishment of technical proposals, based on supporting safety analysis, for the longer-term management of the Pidlisnyi facility; transfer knowledge and capability on the long-term management of existing radioactive waste storage facilities resulting from the Chernobyl accident; and develop the skills of Ukrainian staff to allow them to perform similar analyses at other storage facilities, independently. This project has yet been contracted.

Monitoring systems

Other elements of the waste management actions in Ukraine in the AAP 2018 and 2019 concern the provision of monitoring systems. UA4.01/18B and UA4.01/18C concern the specification and supply of updated dosimetric monitoring and environmental monitoring systems within the exclusion zone. UA4.01/18B began in December 2020 to develop the specification of the monitoring systems to be supplied under UA4.01/18C and is still underway, and the supply contract has yet to be contracted.

UA4.01/19B and UA4.01/19C [126] concern the establishment of an integrated automatic radiation monitoring system covering the whole territory of Ukraine by integrating the existing on-site monitoring systems at operating nuclear power plants into a unified system, modernising outdated equipment and monitoring stations, and establishing relevant procedures for operation and information exchange. The first project is for the development of an integrated design of the monitoring system and

[126] These projects may have been more appropriately classified under nuclear safety culture, but have been included under radioactive waste management because they were included in the radioactive waste management action document.

the second concerns the partial supply of the required equipment with the remaining equipment to be supplied by Ukraine. Neither project has yet begun.

Project UA4.03/20 concerns the design of an improved radiation monitoring system of water resources in the Chernobyl Exclusion Zone. This project has not yet begun.

Remediation of the uranium legacy site of Prydniprovskiy Chemical Plant (PChP)

The PChP was operational from 1947 to 1992, and was one of the largest enterprises for uranium production in the former Soviet Union processing uranium ores mined in Ukraine, Central Asia and East European countries, including the Czech Republic and Germany. Between 1992 and 2000, no planned or regulatory controlled decommissioning measures or clean-up took place, although a large amount of pipework and some equipment was dismantled and apparently removed from the site. Some buildings and industrial facilities had been re-purposed for other State-owned industrial production, and some facilities had passed to the private sector via long-term leasing or direct purchasing. Whilst some clean-up activities had taken place, this work had been implemented without regulatory control, by non-radiological workers and in a non-systematic way. The site contained a number of significant radiological hazards, which required up-to-date detailed mapping, full characterisation, and the development of sound site safety analysis, before consideration could be given to commencement of clean up, decommissioning, and complete site remediation.

Cooperation with the PChP site began under INSC-I (project UA4.01/10G), which aimed to implement modern, effective methodologies and tools for planning the remediation activities. However, this project identified uncontrolled, and in many cases uncontained, radiological hazards, and short-term measures were needed to urgently contain them and to ensure appropriate control. Support is being provided (UA4.02/16) to implement a number of urgent measures to provide the site owners, operators, and regulators with improved and sustainable means to ensure the long-term safety and security of the site, pending its decommissioning and remediation under the proper control and approval of the regulatory bodies. The project began in November 2016, with a four-year duration initially, but has been extended by a further year because of the pandemic. It is expected to be completed on the revised schedule. According to a ROM report of March 2021[127], the project is highly likely to deliver the major part of the planned outputs, achieve the essence of the expected outcomes and contribute as planned to the implementation of urgently required safety improvement measures at the plant. Delays in the development and adoption of legislation by the Ukrainian ministries during the first years of implementation were exacerbated by the pandemic, but the JSO provided substantial support in the delivery of the outputs and progress improved in 2020. The project is considered to be well embedded in the plans and structures of the target groups and to deliver concrete results that will encourage further actions and enhance awareness of the State and private enterprises and of the local population about the possibility of practical positive changes at PChP.

A second project (UA4.01/17) aimed to complete the urgent measures started in the preceding project, including by establishing detailed design solutions for the highest priority remedial actions, procure any specialist equipment, and support the clean-up of at least one high priority building. This element was cancelled because of a delay in obtaining a licence to carry out the remediation and was reintroduced in the AAP 2020, with the addition of some longer-term measures including developing a radioactive waste management plan and a temporary storage facility for highly contaminated equipment and materials, as well as enhancements to the capacity of key stakeholders. This project (UA4.01/20) has not yet been contracted.

A2.2.2.3 Georgia

Georgia has no nuclear power plants, only a research reactor which ceased operation in 1988 and is being decommissioned, all of the fuel having being sent abroad. The majority of other radioactive waste in the country comprises disused sealed and orphan radioactive sources left after the country became independent from the Soviet Union. There are two radioactive waste management sites in the country:

[127] ROM report, UA4.02/16 – Emergency Implementation Measures for Pridniprovskiy Chemical Plant (PCHP) at Kamyanske (formerly Dneprodzerzhinsk) in Ukraine. C379607. April 2021.

a centralised storage facility and a disposal site at Saakadze. Cooperation was first established in 2004 under the TACIS programme and continued under INSC-I with two projects supporting the operators of the two sites with surveys, strategic assessments and preparation of safety assessment reports. These projects identified a number of issues, including the lack of an effective operator and security systems at the Saakadze site, deterioration of underground tanks at Saakadze and improvements needed at the centralised storage facility. Support has also been provided by the Swedish radiation safety authority with funding from the Swedish International Development cooperation Agency (Sida) and complementary support has also been provided by other countries and the IAEA.

A new law on nuclear and radiation safety was approved in Georgia in 2016 and gave the regulatory body in Georgia the status of an agency with its own budget and greater independence and established the Department for Radioactive Waste Management (DRWM) as the sole operator of the two sites and other storage sites. In addition, a national radioactive waste management strategy was approved. Project GE3.01/17 aimed to provide support with the implementation of this strategy and comprised the following main elements: assessment of the inventory of radioactive wastes (including disused sources) in Georgia and defining appropriate means for their management; compilation of geo-scientific and other relevant information for the Saakadze site and assessment of its suitability for a national radioactive waste management facility; development of a proposal, for approval by government, for the use of Saakadze as a national site for the management of radioactive waste; development of the functional requirements for the design of the waste management facilities at the Saakadze site and the design itself; and regulatory review and approval of the design. The project began on 1 December 2017 and, despite an initial delay to allow for the signature of a cooperation protocol between the Swedish and Georgian regulatory bodies, was completed on schedule in December 2019. The success of the cooperation is exemplified by the approval by the government for the use of the Saakadze site as a national waste management facility and regulatory approval, in principle, of the design of the facilities.

Cooperation continued under two further projects. GE4.01/19A is aimed at carrying out a final operational safety assessment and detailed design of the facilities in order to obtain a construction licence. This project began in July 2020 and is still underway. Project GE4.01/19B concerns the provision of a mobile laboratory and associated training to enhance the capabilities of the regulator. This project began in August 2019 and is also still underway.

A2.2.3 Central Asia

Uranium mining and processing activities have been carried out in Central Asia since the mid-1940s. Many of these activities were centred on the mountainous areas where Kyrgyzstan, Tajikistan and Uzbekistan border each other. Following the fall of the Soviet Union, many of the activities ceased in the 1990s to leave a legacy of abandoned uranium mining and milling sites, together with associated waste rock and low-grade ore dumps and tailings piles. These legacy facilities pose serious risks to the environment and public health, particularly because of the possibility of structural failure, as a result of erosion, or triggered by floods, earthquakes, landslides and mudslides, which could lead to widespread, and trans-boundary, dispersion of the radioactive and toxic material. The Central Asian countries do not have the means to remedy matters.

There has been cooperation with the countries affected since 1995, initially under the TACIS programme and subsequently under INSC-I, and additional support has been provided by the IAEA and other international organisations, including the Commonwealth of Independent States (CIS). With support from the IAEA, the Coordination Group for Uranium Legacy Sites (CGULS), consisting of concerned States in Central Asia and the main national/international organisations, including the EC, was established in June 2013, and it developed[128] a strategic master plan (17) setting out remediation priorities, building on integrated environmental impact assessments (EIA) and feasibility studies that had been carried out under INSC-I to identify remediation solutions at many of the priority legacy sites in Kyrgyzstan, Tajikistan and Uzbekistan.

[128] With support from, and in cooperation with, INSC via an INSC-I project implemented by IAEA.

The first action in Central Asia under INSC-II (MC4.01/14) comprised three elements. The first concerned an initial contribution to a new EBRD account, the Environmental Remediation Account (ERA), to fund coordinated remediation work in the Kyrgyz Republic, Tajikistan and Uzbekistan in accordance with the strategic master plan then being developed. This fund was established by the EC with the support of CGULS to provide a vehicle to secure multi-donor funding possibilities and implement large multi-annual remediation works contracts, including their proper preparation and management. The strategic master plan was developed and published to support the request for donors to this fund. Under the ERA, Kyrgyzstan has been very cooperative and projects are progressing well, in Uzbekistan projects are progressing, albeit at lower pace, while in Tajikistan progress has been slow as the necessary financing agreement has yet to be concluded with the EBRD. Further contributions to the ERA were included in the AAP 2015, 2017 and 2019.

The second element of the action in the AAP 2014 concerned the conduct of an integrated EIA and feasibility study at the priority site of Mailuu-Suu in the Kyrgyz Republic, with the aim of producing costed and integrated conceptual management and remediation plans for the site, including design criteria and standards for the remedial works and a stakeholder engagement process. The project to implement this part of the action (KG4.01/14A) began in October 2017 and was completed successfully in August 2020, although travel restrictions due to the pandemic made it impossible to organise a public hearing in Mailuu Suu to present and discuss the feasibility study and EIA, or to hold the final workshop in Bishkek. The third element of the action concerned related work to design, produce a technical specification for, and supervise the installation of mobile and fixed equipment for early warning monitoring of landslide risks at all the uranium legacy sites in the Kyrgyz Republic. The design and technical specification parts of this work were included in project KG4.01/14A and a separate contract (KG4.01/14B) provided for the supply of the equipment. The technical specification of the equipment was prepared in May 2018 and the supply was contracted in January 2019. Problems with the import permits and customs clearances delayed completion of delivery until the first quarter of 2020 and led to a project extension. Most parts of the system were successfully installed and training on the system was provided, but some parts of the system cannot be installed until the end of travel restrictions.

The AAP 2015 included a safeguards action that was subsequently the subject of a non-substantial modification to make funds available for a project in Tajikistan (TJ4.01/15). The aim of the project is to provide a treatment plant for contaminated mine water from a former uranium mining site at Taboshar (or Istlikol), being used by some residents for drinking water and for livestock and irrigation. The detailed design of the water treatment plant had been developed under a project in INSC-I, which began in 2016. A tender was launched in 2017 to implement the water treatment facility, but was not successful, and it was concluded that the specified water treatment facility was too complex and had running costs too high to be sustainable. It was decided to redesign the water treatment facility to simplify the system and this redesign was also carried out under the INSC-I project. Project TJ4.01/15 under INSC-II was established in parallel for the procurement, supply, construction and installation of the facility. The project was contracted with ISTC in December 2018 and is not yet complete.

Since the agreement of parties to the strategic master plan in 2017, there have been two multi-country/regional projects under INSC-II in addition to those funded under the EBRD-ERA. The first (MC4.01/18) addresses the establishment of a watershed monitoring system and the strengthening of analytical capacities of laboratories in Kyrgyzstan, Tajikistan, Uzbekistan and Mongolia. It represents a follow-up to a then recently completed project under INSC-I which involved the design of a regional watershed monitoring system and the establishment of an essential analytical laboratory. Its aim is to supply elements of the monitoring system, specifically watershed monitoring stations and equipment for analytical laboratories, and related capacity building and training. The supply of monitoring stations is to include site preparation, installation and commissioning of the stations as well as capacity building and training of personnel. The laboratory equipment to be supplied consists of devices for radiological and chemical analysis, and the supply includes the set-up of equipment in the laboratories and the training of personnel. The project began in December 2019, but the inception meeting was postponed because of the pandemic. In the interim, issues have been identified that cast doubt on the viability of the project as currently specified, and significant changes to the project have been suggested by the contractor.

The second multi-country/regional project (MC4.02/18) is also a follow-up to an earlier INSC-I project and concerns improving engagement with the people living in areas with uranium legacy sites, the local authorities and the governments of Kyrgyzstan, Tajikistan and Uzbekistan, to ensure the long-term sustainability of the environmental remediation programme. It aims to build on the solid stakeholder network successfully established under the previous project and strengthen the efforts to support public participation. The project began in July 2019 and is scheduled to be completed in July 2022. Despite the difficulties introduced by the pandemic, it is proceeding on schedule. Severe restrictions on movement and physical distancing have inevitably impacted the way the project has engaged communities, especially planned face-to-face activities in the field. Instead, engagement with local stakeholders and pilot communities in collaborative decision-making continued using online methods, remote engagement tools, and training of trainers in small groups, including active participation by community leaders.

A2.2.4 Multi-country: IAEA

The AAP 2015 included a multi-country action with the IAEA. The action represented the continuation of the cooperation and coordination developed through a previous Contribution Agreement. The project (MC3.01/15) started in December 2016 and was completed in July 2021. It comprised six individual IAEA projects designed to address groups of countries with the same needs and priorities. Specifically, it provided for: support to the secretariat of the Coordination Group for Uranium Legacy Sites (CGULS) to coordinate assessment and technical advice on uranium legacy site proposals and projects; information and training to enhance the capacities of its Member States to establish frameworks for radioactive waste management; the development of capacities to improve radioactive waste and radiation safety in Africa; further development of the CONNECT online platform for enhanced communication and training on radioactive waste management; further funding for an interregional project aimed at establishing and sustaining national frameworks to ensure safe use of radioactive sources through their lifecycles, i.e., from production to final disposal; and enhancement of the capabilities of non-EU Mediterranean Member States (NEMMS) to respond to radiological emergencies occurring in coastal ports and within the Mediterranean basin. It was a rather complex project in terms of its diverse scope, the number of countries involved and the objectives to be achieved.

A Results Oriented Monitoring (ROM) mission carried out in 2018[129] gave a generally positive assessment of the examined criteria: relevance, efficiency, effectiveness and sustainability of the project. However, the ROM report made the observation that "the permanent presence of IAEA in many of its Member States facilitates a lot communication, but the same seems not to be valid in relation to the EU Delegations, which do not seem to have any role in the process". The final report on this project concluded that, overall, the results achieved met the objectives.

A2.3 Nuclear safeguards

A2.3.1 Pre-Accession countries

A2.3.1.1 Serbia

In the process of pre-accession to the European Union, Serbia committed to improve the management of nuclear materials at the Vinča site in line with the Community *acquis* and the best EU practices. To achieve this goal, Serbia requested support from the European Commission to the Regulatory Authority of Serbia in the adoption of the Euratom safeguards regulation. Support to enhance the safeguards capabilities in Serbia was provided under a multi-country action under AP 2017, which also included Armenia and Iran (see below for further details of the cooperation with these countries). The cooperation in Serbia was aimed at improving measurements, control of the inventory and the control of movements of nuclear materials at the Vinča site. It included three components: (i) training in nuclear material accountancy and measurement; (ii) nuclear materials characterisation; and (iii) the delivery of necessary equipment (non - destructive assay for nuclear material identification and containers for the transport and storage of nuclear material that would be provided within the limits of the available

[129] ROM report, Pagoda IAEA. C378378. June 2018.

budget). The project was implemented by the STCU, it started in July 2018 and was successfully completed in February 2021. However, the on-site visibility event which was due to take place with the participation of representatives from the EC, the EU Delegation in Serbia, local Serbian authorities, the Public Company Nuclear Facility of Serbia (PC NFS) and media was cancelled due to the restrictions imposed as a result of the Covid pandemic.

A2.3.2 European Neighbourhood Policy – East

A2.3.2.1 Armenia

Further cooperation to enhance the safeguards capabilities in Armenia was due to be provided under the multi-country action under AAP 2017 mentioned above for Serbia. The relevant component of the action provided for support on accountancy and control at the Armenian nuclear power plant to ensure the control and the monitoring of spent nuclear fuel in accordance with Armenia's safeguards obligations. To achieve this goal, the JRC was to deliver a state-of-the-art spent fuel burnup verification system and train its users. However, this part of the multi-country action was eventually cancelled as the scope the partner wanted to implement was, in practice, outside what could be financed by INSC.

A2.3.3 Asia/Middle East

A2.3.3.1 China

At its request, as a continuation of the cooperation previously initiated with the country, support was provided to China through a multi-country action under AAP 2015 to enhance its safeguards capabilities. The objective was to promote networking with the European Safeguards Research and Development Association (ESARDA), transfer EU safeguards and non-proliferation experience, and promote technical exchange and cooperation on nuclear safeguards issues. European knowledge and experience in each area was due to be transferred to the China Atomic Energy Authority (CAEA) and its Technical Support Organisation (TSO), the safeguards laboratory of the China Institute of Atomic Energy (CIAE), and the State Nuclear Security Technology Centre (NSTC).

The project (MC5.01/15A) was implemented through an administrative arrangement with the JRC under which one part[130] had the specific objective of enhancing the capabilities of China on nuclear safeguards. European knowledge and experience were to be transferred to key Chinese organisations with a view to bringing their capabilities in accordance with best international standards and practice.

The project began in August 2016 but encountered problems because of the lack of agreement between the Chinese partners and the JRC. One partner dropped out of the project and the other, the Chinese National Nuclear Safety Authority (NNSA), then made clear that they could not build their laboratory prior to 2021, putting at risk the completion of a key task concerning the transfer of nuclear safeguards methodologies. The difficulties the Chinese partners encountered in obtaining authorisations to travel to the EU caused delays to the project and then alternative plans for meetings had to be cancelled due to the pandemic. This prevented the JRC from finalising the tasks, despite the strong interest of the Chinese NNSA. A final meeting was due to take place to give visibility to the project and its outcome, however, as the core of the project could not be completed, no dissemination took place.

A2.3.3.2 Iran

In the context of the JPCoA, Iran agreed to a series of restrictions on its nuclear programme, in particular limits on enrichment (reducing the number of centrifuges, cutting back its stockpile of enriched material, eliminating the stockpile of 20% enriched uranium and limiting all enrichment activities for 15 years to one location), repurposing a part of the underground Fordow facility into a nuclear, physics, and technology centre, and another part for stable isotope production, as well as re-designing the Arak reactor's core to make it less suitable for producing plutonium. Particular attention has been paid to

[130] Administrative Arrangement (AA) №2016/373-289 between DEVCO and the JRC. Part A of the AA concerned Safeguards in China and Part B Safeguards and Non-Proliferation Education worldwide (see below).

enhancing the safeguards of nuclear materials in Iran in order to demonstrate that the Iranian nuclear programme is for peaceful uses only, as agreed under the JCPoA.

In order to support the establishment of effective and efficient nuclear materials safeguards in Iran, a first action was included in the AAP 2017 which was implemented through a multi country project (covering Armenia, Iran and Serbia – see above), and the project was carried out by the IAEA under a Delegation Agreement. Its objective was to further enhance the capabilities of the IAEA Department of Safeguards with regard to its verification and monitoring activities in Iran for a period of three years (2018-2020) by: (i) enhancing the long-term sustainability and capabilities of the Safeguards Analytical Laboratories with regard to performance, quality and timeliness of analysis of inspection samples; and (ii) providing essential equipment and specialised training to the staff in the Office for Safeguards Verification in Iran (SGVI) in order to effectively perform inspections and other monitoring and verification activities in Iran. The project started in September 2018 with a duration of 36 months. In its reports (up to the end of September 2020) the IAEA indicated that no particular difficulties were encountered. The activities envisaged in the first and second year of the Action were implemented as planned.

A further action for the establishment of an effective and efficient nuclear safeguards system in Iran was foreseen under the AAP 2020. This was again foreseen to be implemented by the IAEA. The overall objective of the action is to strengthen the role and capabilities of the respective Nuclear Regulatory Authorities. The project foresees the delivery of technical and scientific equipment for the Nuclear Safety Centre for the measurement and categorisation of nuclear materials, to allow their proper accountancy and control and guarantee the radiation protection of the safeguards' inspectors. Training of personnel is also foreseen. A Delegation Agreement was still with the IAEA for conclusion at the time of writing.

A2.3.4 Africa

A2.3.4.1 Educational Courses on Nuclear Safeguards and Non-proliferation

The second part of the multi-country/regional project MC5.01/15A, implemented by an administrative arrangement with JRC (see above), aimed to provide educational courses on nuclear safeguards and non-proliferation world-wide, based on the ESARDA course experience at JRC over 15 years. Course participants were to be selected by the partner countries with a view to them organising safeguards courses subsequently in their respective countries. The project envisaged ten hosting countries, to be agreed upon by DEVCO, with priority given to courses for Africa. In the event, only one course was held in Centurion, South Africa, in February 2018 and another in Algiers, Algeria in October 2018. The course provided in Algeria was not integrated into the university curriculum as initially foreseen, because of the sensitivity of the topic and national security considerations in the country.

The JRC underwent significant restructuring in 2016 that led to shortages of human resources in 2017. The setting-up and organisation of the ESARDA courses in Africa then proved to be more time and resource consuming than initially expected. At the end of 2018, this part of the administrative agreement was terminated. It was later agreed to duplicate the Southern African course, but the plans were abandoned due to the worldwide Covid pandemic.

A2.3.4.2 Uranium Mining Production and its Transport in the Southern African States

A further element of the multi country/regional action in AP 2015 addressed the mining and processing of uranium and its transport in the Southern African States of Tanzania, Malawi, Namibia and Zambia.

When engaging with Central and Eastern African States, it became clear that uranium mining activities and related transport were not subject to a harmonised framework regarding the licensing and inspection process. For example, uranium mined in Tanzania was being transported to the seaport of Walvis Bay in Namibia for export, a trip of more than 5,000 km through four different States (Tanzania, Malawi, Zambia and Namibia) with different regulatory requirements. At a seminar on uranium mining, milling and transport held in Brussels in October 2014, the four countries recognised the need for harmonisation and agreed to participate in a case study to cover the three aspects of nuclear safety, safeguards and security with support under both the INSC and IcSP. The support activities funded by the project were

implemented by the International Science and Technology Center (ISTC) (project MC5.01/15B). The project started in November 2016 with a three-year duration, but has been extended to May 2022.

The objectives of the project are to: support the regional approach by strengthening the Southern African Development Community (SADC); strengthen and harmonise the regulatory frameworks for sustainable uranium mining and milling and associated transport in the concerned countries and within the sub-Saharan African region; improve safety and security of the transport of uranium ore concentrate in and between the concerned countries; develop a harmonised system of accountancy, control and transport of nuclear and radioactive materials in the concerned countries as well as the necessary nuclear material accountancy and control communication between the originating, transit and destination countries. A ROM report in mid-2018[131] was essentially positive but highlighted that "There is reportedly clear commitment to the project by Malawi and Zambia, while Tanzania and, in particular, Namibia seem to demonstrating lower than anticipated interest to participate in the project". The ROM report also noted "the lack of willingness of the Southern African Development Community (SADC) Secretariat to commit to and participate in the project". However, cooperation with SADC and its members has since improved (except for Namibia which continues to show lower interest) and good progress has been made in spite of the difficulties due to the Covid pandemic. Further steps were taken with respect to the project training component. Following the successful installation and testing of the web-based Information Tracking System (ITS) in Tanzania, Malawi, Zambia and the Republic of South Africa, the scope of coverage by the system was further extended to Democratic Republic of the Congo, Zimbabwe, Mozambique and Madagascar (twice the number of countries envisaged in the project's ToR). Thus, the system allows the monitoring of transportation across contiguous territory linking ports on the Atlantic with those on the Indian Ocean. There still remains the possibility for expanding it to more SADC countries. Opportunities have also been explored for greater inter-regional exchange of experience, including between Southern Africa and Central Asia.

A2.3.5 Other Multi-country Activities

The AAP 2018 included an action to develop programmes through the IAEA, the JRC and TSOs to assist countries worldwide to improve their respective safeguards systems. The action includes three components as follows.

A: Strengthening States' Systems of Accounting for and Control of Nuclear Materials (SSACs) through Training and Advisory Services (MC5.01/18)

In order to assist States in meeting their safeguards obligations, the IAEA Long-Term Strategic Plan (2012–2023) commits the IAEA to "ensure that States have competent State safeguards authorities" and "to provide States, particularly those introducing nuclear power, with guidance and training on the implementation of their respective agreements". To fulfil this mandate, the IAEA Department of Safeguards trains annually approximately 200 representatives from States on the requirements of the SSAC through formal training courses, and conducts IAEA SSAC Advisory Service (ISSAS) missions upon request. This programme is mainly funded from extra budgetary funds, to which the EC is a major contributor.

This component of the action includes training courses on:

- State System of Accounting for and Control of Nuclear Materials;
- The implementation of Small Quantities Protocol;
- The implementation of the Additional Protocol.

ISSAS missions in line with IAEA Safeguards Agreements and Protocols are also to be provided.

This project is being implemented through indirect management with the IAEA. It started in December 2019 and is still underway. Because of the pandemic, all courses planned for 2020 were postponed and

[131] ROM report, MC5.01/15B – Support to Southern African countries in nuclear safety and safeguards. C379139. June 2018.

the training was restructured to meet the objectives through remote learning, and no ISSAS missions were conducted.

B: Safeguards Training and Education (MC5.02/18)

This component was planned to be implemented through the European Nuclear Education Network with the support of ESARDA, in the area of education and training, and the JRC.

The project includes a one-week condensed course on the basics of safeguards, currently organised on an annual basis with JRC collaboration, and a two-week course on nuclear safeguards being developed in the frame of ANNETTE (an education and training project funded by the Research and Training Programme of Euratom). These courses could be organised more frequently, and at different geographic locations within or outside of the EU, to facilitate participation. The JRC would provide support to contracted partners in order to ensure full integration and alignment with the EU and international nuclear safeguards system. The project started in June 2019 and is still underway.

C: Safeguards Training (MC5.03/18)

The objective of this project is to ensure the inventory and control of movements of nuclear materials in accordance with the safeguards obligations of the countries concerned. Training is to be provided to the partner countries in nuclear material accountancy and measurement, nuclear materials characterisation and related nuclear safeguards techniques and methodologies. The training programme would include safeguards courses that would be developed in close cooperation with a European Technical Support Organisation (TSO) and the technical expertise and capabilities of the JRC. It would export the *acquis communautaire* worldwide and contribute to the establishment of legal and regulatory frameworks in line with international standards. The project started in March 2019 and is still underway.

Annex 3: INSC-II Highlights

A3.1 Chernobyl Projects

A major achievement that occurred during the period of INSC-II was the completion of the Chernobyl Shelter and the Interim Spent Fuel Storage Facility (ISF2). The construction of the New Safe Confinement, (NSC), the largest project under the Shelter Implementation Plan (SIP), which began in 2011, was concluded on 26 April 2019 with the completion of the final commissioning test. The NSC has enclosed the destroyed reactor and contains the equipment to dismantle it as well as the surrounding structures. The SIP represents an effort of over twenty years beginning with a conceptual design for the NSC in 2001 to the granting of an operational licence on 20 August 2021. At a cost of some €2.1 billion, the SIP has made a major contribution to ensuring the site of the world's worst nuclear disaster is environmentally safe. The construction of the ISF-2 was completed in 2020, with the conclusion of the hot-testing active phase, during which 186 spent fuel assemblies were moved to ISF-2. At a cost of some €400 million, it provides for the drying and cutting of more than 20,000 fuel assemblies from the Chernobyl Units 1, 2 and 3 and their placement in metal casks which will be enclosed in concrete modules on site. The facility received its full operational licence on 24 April 2021 and work to process and store the spent fuel commenced in early June 2021.

The difficult working environment and the one-of-a-kind nature of the projects posed great technical and financial challenges. The EC was the largest donor to the EBRD funds which financed the projects and played an essential role in closely following them to ensure their efficient running in terms of cost and schedule. The actions of the EC helped to create a climate of confidence among the project management, contractors and the donors to ensure that funding was available for the successful completion of the projects.

A3.2 Iran

For many years Iran was in a situation of non-compliance, or not fully complying, with IAEA safeguards agreements and, as a result, incurred severe sanctions, mainly by the US and the EU. After extensive negotiations to find a long-term solution that would ensure that Iran's nuclear programme would be exclusively for peaceful uses, in 2015 a Joint Comprehensive Plan of Action (JCPoA) was signed. This opened the way for lifting of some of the sanctions and cooperation between the EC and Iran on nuclear safety and safeguards.

Since 2016 the EC has provided extensive support to the Iranian Nuclear Regulatory Authority (INRA), directly or through the IAEA, and to the performance of 'stress tests' at the Bushehr Nuclear Power Plant. It supported also the design and supply of equipment to the Nuclear Safety Centre and the provision of equipment for expert activities in the Emergency Response, Radiation Protection and Radiation Monitoring Centres of Iran.

Some 25 M€ were allocated to Iran under the INSC-II budget, which reflects the will for a rapid improvement of the situation in the country and the importance of delivering on the commitments under the JCPoA. The continuation of an efficient cooperation with Iran under the INSC and the climate of confidence it helped to maintain in the area of nuclear safety and safeguards, despite the difficult political environment in recent years, represents a major success

A3.3 Remediation of Uranium Legacy Sites (ULS) in Central Asia

The mining of uranium in several Central Asian Republics of the former Soviet Union left a huge legacy of mining and processing wastes and abandoned uranium mines. Much of the mining was carried out in the period 1944 to 1995 at which time most of the conventional mines (as opposed to extraction by *in situ* leaching) were closed. With support from the TACIS programme and INSC-I, integrated environmental impact assessments (EIA) were carried out for those sites in Kyrgyzstan, Tajikistan and

Uzbekistan that had been identified as priorities requiring urgent remediation; feasibility studies were undertaken of options for their remediation, including stakeholder involvement and estimates of costs.

Based on these EIA and feasibility studies, a Strategic Master Plan (SMP) (17) for the remediation of ULS in the three Republics was developed in 2017 with support from INSC-II. The SMP was endorsed by the EC, IAEA, EBRD, Rosatom (acting on behalf of the Commonwealth of Independent States (CIS)) and the regulatory authorities of Kyrgyzstan, Tajikistan and Uzbekistan. The SMP provides a framework for permanently resolving the uranium legacy in Central Asia and serves as the basis for coordination among multiple parties in order to make optimal use of limited resources.

In response to an initiative by the EC, the EBRD established an Environmental Remediation Account (ERA) for remediation of ULS in Central Asia that came into operation in 2016. The EC, through the INSC, has been, by far, the major contributor to the ERA with a contribution of 31 M€; contributions have also been made by Belgium, Lithuania, Norway, Spain, Switzerland and the US. Remediation, with support from EBRD, is now underway at the Shekaftar site in Kyrgyzstan. Several priority areas have been visibly transformed by removing contaminated waste material and dilapidated structures. Mine shafts have been closed, toxic material has been safely stored and new water systems have been installed. Remediation at other priority sites in Kyrgyzstan is at an advanced stage of planning. Remediation is also underway at other sites in the region with support from Rosatom.

An update of the SMP is scheduled for issue before the end of 2021. Despite good progress with remediation of some ULS in Central Asia, there remains a major shortfall (of about 40 M€) in the funding needed to complete the remediation foreseen in the Plan.

A3.4 'Stress Tests'

Following the Fukushima accident, the European Council requested that reviews be made of the safety of all NPP in the EU, based on comprehensive and transparent risk and safety assessments (the so called 'stress tests'), in particular of how NPP could withstand the consequences of more extreme external events such as earthquakes, floods, etc, that could lead to multiple loss of safety functions and require severe accident management. The successful completion of these 'stress tests' in Europe, and their regulatory follow up, has led to much interest and requests to transfer this knowledge and experience elsewhere.

Knowledge and experience gained in Europe with the conduct of the 'stress tests' was transferred to Mexico, China and Ukraine during the implementation of INSC-I; support was also provided, when requested, in performing the 'stress tests' in accordance with the ENSREG specifications, and in the analysis of their outcomes, in particular where a need for safety improvements was identified. The response of INSC to requests for cooperation in this area has demonstrated the ability of the Instrument to respond effectively, and in a timely manner, to emerging and important safety issues; this augurs well should needs of a similar nature arise in future.

The exchange of knowledge and experience on, and/or support for, performing and responding to the outcomes of, 'stress tests' has continued in INSC-II. Knowledge and experience have been transferred to Armenia and Iran. Support was also provided to Armenia in performing the 'stress tests', in their review by the regulatory body, ANRA, and in making a number of safety improvements, in particular in the leak tightness of the confinement and the spent fuel pool and in the provision of alternative power and water supplies that could be used in an emergency. The support provided by INSC on the 'stress tests' has made an important contribution to enhancing global nuclear safety.

A3.5 Training and Tutoring

Training, in one or other guise, is an integral part of most INSC projects, and its scope, content and implementation are optimised to effectively achieve the particular objectives of a given project. While training within projects continues to be a key element of most INSC projects, the need for a more integrated and holistic approach to the training of nuclear regulators and their TSO, in particular in

countries planning to embark on the use of nuclear energy, was recognised in INSC-I – both in terms of meeting an identified and increasing demand and making best use of limited European resources in providing the requested training. In response to this need, a Training and Tutoring (T&T) programme was developed and implemented in INSC-I to provide focused training and tutoring within a more integrated and broadly-conceived framework; some 9 M€ was committed for this purpose in INSC-I.

The T&T programme has continued to be an important feature of INSC-II and has been supported with further funding of 6.5 M€. The training courses provided were of three types: courses available on the market and provided by others, where INSC support facilitated the participation of interested trainees through registration, visa and logistics; courses in Europe developed with the support of INSC and owned by the EC; and regional courses organised outside the EU with 20-40% of the content provided by local experts. In addition, support was provided to partner countries to set up national training plans. The achievements of the T&T programme have been impressive (see Section A5.4 for further information) with the training and tutoring, each year, of a few hundred employees of nuclear regulators and their technical support organisations world-wide; by 2019, some 2,400 trainees and tutees in total had been trained or tutored by the programme. The training and tutoring programme was identified as one of the four good practices praised by the 2017 meeting of the Convention on Nuclear Safety.

The training and tutoring focuses on four distinct but linked areas: the legal basis and regulatory processes; basic, applied and advanced technologies; regulatory practices (e.g., assessment, inspection, investigation, audit); and human factors. Training is mostly carried out in Europe but also in regional settings and delivered in local/regional languages where appropriate. Longer duration tutoring (i.e., ‘on the job’ training) on specific topics is also available under the mentorship of European nuclear regulators or their TSO. The T&T programme remains responsive to demand and new courses have been developed in response to identified needs, e.g., two courses developed for senior management in regulatory authorities and ministries to whom they report: firstly, leadership, decision making and conflict management; and secondly, financial resource planning and the remuneration of staff.

The T&T programme is expected to continue in INSC-III in much the same vein as in previous INSC programmes. Demand for training and tutoring remains high and a capability exists to develop new courses in response to identified demand.

Annex 4: Impact of INSC Cooperation

In order to gather information about the impact of cooperation under INSC-II, a questionnaire was issued asking partner countries about how they were using or expected to use the outcomes of cooperation. The responses of those countries that had responded by the end of September are summarised in this Annex. Some light editing has been carried out of the responses to make the English clear.

A4.1 Pre-Accession Countries

A4.1.1 Bosnia and Herzegovina

The governmental organisations in Bosnia and Herzegovina expect to use the results of the cooperation to: complete the procedures to be used for licensing the proposed radioactive waste storage facility; upgrade the safety assessment of the radioactive waste storage facility; and implement the option chosen for radioactive waste storage to upgrade the existing temporary waste storage facility to meet international standards and to serve as the country's central waste storage facility.

A4.1.2 Serbia

In 2018, a new Law on Radiation and Nuclear Safety and Security was put into force and the Regulatory Authority became the Directorate for Radiation and Nuclear Safety and Security. The Public Company "Nuclear Facilities of Serbia" (PCNFS) became the only nuclear operator in the Republic of Serbia. PCNFS is responsible for the accountancy and control of nuclear material, management of radioactive and nuclear waste generated in Serbia and stored in the facilities under its jurisdiction, and decommissioning the old heavy water research reactor, legacy waste storage facilities and security of radioactive material. The cooperation under INSC-II, including the supply of equipment and training, is expected to help significantly in strengthening safeguards capabilities in Serbia. Equipment provided under the first, successfully finished, phase of the project and the establishment of the radiochemical laboratory under the second phase will help PCNFS establish a certified laboratory for complete radionuclide material analysis in Serbia, and a reference laboratory within the region, based on domestic, Euratom, and IAEA regulations. Six people (one female, five male) took part in training.

A4.1.3 Turkey

Cooperation has helped the regulatory authority to develop its regulations and a road map for addressing some important safety issues in line with best European practices. It has also contributed to improvements to the institutional capabilities of the regulatory authority and the qualifications of its inspection personnel, and to the establishment and development of its integrated management system. On-the-job training (OJT) has been provided to twenty members of staff of the regulatory authority and further OJT training is planned. In addition, ten individuals participated in a training course and more have taken part in *in-situ* missions.

A4.2 Neighbourhood East

A4.2.1 Armenia

<u>The operator, ANPP</u>

Following the completion of the self-assessment 'stress tests' (undertaken with support from INSC) and the issue by the Armenian regulatory authority, ANRA, of a national report on their outcomes, the nuclear operator, ANPP, is responding to the recommendations made in the report with further support from INSC. Specifically, ANPP has modernised the spray system, is currently improving the leak-tightness of the confinement, and has begun the process for purchasing autonomous alternative power supply equipment.

An intensive training programme, the Armenian On-Site Assistance (AOSA) programme, has delivered more than 20 training courses covering various nuclear safety topics More than 70 sets of training materials have been developed for the Full Scope Simulator (provided under a previous INSC project in 2013) for training operators in the Main Control Room. The numbers trained have typically been in range of 60 – 120 trainees per annum with a ratio of 20/80% between women and men. The cooperation

has resulted, not only in the implementation of specific plant modifications and improvements, but also in improvement of local skills and capabilities required for the development of nuclear safety documentation.

Operational experience exchange between ANPP and EU Nuclear Operators assisted ANPP personnel in the improvement of personal skills, knowledge and in improving the plant's safety culture. The cooperation also provided valuable inputs into the post-Fukushima ''stress test' activities in Armenia, as well as supporting ANPP in: updating the plant Safety Analysis Report; carrying out the 'stress tests' self-assessment in full compliance with the ENSREG Technical Specification; and in implementing improvements identified in the 'stress-tests'. ANPP regularly receives missions from WANO, and actively participated in the peer reviews on implementation of the 'stress tests' measures, firstly in June 2016 and secondly in November 2019. ANPP and ANRA successfully cooperated with peer-review teams during both missions to Armenia. Armenia has entered into mutual assistance agreements with other members of the CIS in 2020 and an agreement on operational awareness and exchange of information with the Russian Federation in 2015.

The regulatory authority, ANRA

ANRA is reviewing the Comprehensive Modernisation Safety Upgrading Programme for the ANPP in the light of the report on the 'stress tests' and ANPP is implementing improvement measures in accordance with a defined schedule. A follow-up peer review of the ANPP 'stress tests' took place in November 2019. ANRA is using the expert reviews of assessments made and documentation developed by ANPP to inform its regulatory decisions on requirements for the ANPP and improvements needed for its planned life time extension (LTE). ANRA and its TSO (NRSC) have improved regulatory documents and requirements in line with EU standards and international best practice and incorporated these into many relevant Government Decrees and ANRA Orders.

Following a review of Emergency Response Centre procedures, participation at emergency exercises in France and Finland and recommendations from observation of a national emergency exercise, ANRA has developed and is implementing an action plan to improve its emergency response system; it has revised its emergency procedures, is conducting emergency exercises once per quarter, and is participating in IAEA Convex exercises. The EWRMN monitoring stations and systems are being installed at the ANPP and in surrounding areas and JRODOS has been installed and is being customised to Armenia. These will significantly improve ANRA's capabilities in EP&R and in environmental radiation monitoring in Armenia.

The T&T programme has contributed significantly to capacity building and the professional development of ANRA and NRSC staff. In total, 15 NRSC and 14 ANRA staff (17 male and 12 female) participated in T&T events. Knowledge acquired is used to train new staff. In addition, 'on-the-job' training has been organised at institutes in Italy and France and is being used in safety reviews and assessments and in the development of PSA related documentation. Armenia has hosted two IAEA IRRS missions, one IPPAS mission and one INSSP mission in the period 2014-2020, as well as two EC peer reviews of the ANPP 'stress tests'. Cooperation has contributed to preparation for these missions and implementation of their recommendations. Armenia is party to the Convention on Nuclear Safety and the Joint Convention.

A4.2.2 Belarus

MES/GAN has used the results of the cooperation to develop its organisational strategy and policy and implement an integrated management system, including procedures for internal audit and improvement and self-assessment of its safety culture. A new edition of the Law on Radiation Safety (No. 198-3) was issued on June 18, 2019. A professional training plan has been developed for specialists based on an assessment of the competences of the GAN and training, including T&T, has been carried out in various areas of regulatory activity. The knowledge acquired has been used to develop regulatory requirements and in safety assessments of, and supervisory activities, at the Belarusian NPP. Familiarisation with best European approaches and practices gained through cooperation projects has been used to improve the regulatory and legal framework, including legislation on licensing of nuclear activities and other activities involving the use of radioactive material.

The mobile radiation monitoring laboratory is being used to enhance the control/supervisory functions of GAN; it was used in particular in monitoring of areas adjacent to sports facilities in preparation for the European football championship games held in Belarus in 2019. It was also used to detect an orphan source in 2019, to establish the background radiation levels around the Belarusian NPP prior to commissioning, and to monitor the zone of influence of the Ignalina NPP, and around waste storage and other supervised facilities.

Cooperation has also been used to support implementation of the recommendations of INIR, IRRS and EPREV missions. Belarus has been given observer status in WENRA and in the VVER Forum. It is a party to the Convention on Nuclear Safety and the Joint Convention.

A4.2.3 Georgia

A new regulatory authority (Agency of Nuclear and Radiation Safety (ANRS)) was established in 2016 within the Ministry of Environment Protection, and the Department for Radioactive Waste Management was established as the State operator for State owned radioactive waste management facilities. ANRS became the competent authority in regulating nuclear and radiation activities, with a newly established management system allowing increased effectiveness and efficiency for the regulatory control and implementation of international standards in a Georgian context. As a result, 15 new regulatory documents (laws and by-laws) have been issued during the last 5 years, including an updated regulation of inspection activities which was adopted in 2019. Other regulations are also being prepared for update in line with the international standards, including a new version of the comprehensive Law on Radiation Protection, Nuclear Safety and Security that is being drafted, and the Georgian version of the BSS. These actions implement recommendations made by an IAEA IRRS mission held at the beginning of 2018. A new nuclear or radiological emergency preparedness and response plan has been developed and an Emergency Response Centre established within ANRS.

Cooperation on radioactive waste management is aimed at supporting Georgia to achieve the six main goals in its national strategy for radioactive waste management for the period of 2017-2031, developed with the support of the Swedish radiation safety authority (SSM). Georgia has an ambitious plan to construct new radioactive waste pre-disposal facilities and develop disposal options. According to the strategy, construction and commissioning of new pre-disposal facilities is to be completed by 2031. The first phase of INSC support was implemented during 2018-2019, in the framework of which the site selection of new facilities was conducted and a general design developed. The implementation of the second phase is envisaged to commence in 2021. The mobile laboratory equipped with advanced radiological measurement equipment supplied with support from INSC will be used for multiple purposes: radiological emergency response; conducting on-site investigations (e.g., during the site evaluation or characterisation of radioactive waste at the site of the waste producer), etc. A programme for developing capacity in ANRS has been prepared covering, *inter alia*, training for regulators to improve their knowledge and skills in regulating existing facilities and those to be constructed. The training is planned for the next two years and special scientific visits and fellowships in different EU countries will be organised. A complementary project with SSM and Sida has addressed the training of different specialists, including on regulatory issues, and led to the establishment of dedicated educational programmes at Tbilisi State University and Georgian Technical University to ensure a basis for the sustainable development of the necessary human resources in Georgia. Georgia is not party to the Convention on Nuclear Safety, but plans to accede to it in the near future; it is a party to the Joint Convention and has submitted reports to review meetings.

A4.2.4 Ukraine

<u>Waste Management Organisations</u>

The Ukrainian State Association “Radon” intends to apply the process identified under the cooperation for removing radioactive waste from storage facilities to storage facilities at its central production site and at other near-surface storage facilities at the central production sites of its affiliates. The standard technical solution identified for the retrieval of solid radioactive waste from storage facilities and the rehabilitation of the storage facilities is being used as a template for the development of a standard technical solution for all cases of radioactive waste removal at the five “Radon” sites. 18 specialists of

the enterprise were trained on the safety assessment of facilities intended for radioactive waste management, the application of modern safety assessment methodologies and the presentation of its results.

The modernisation of the dosimetric control system in the Chernobyl exclusion zone is expected to affect the behaviour of SSE "Ecocentre" personnel, in particular enhancing their protection and improving nuclear safety culture. The development of an integrated automatic radiation monitoring system and the extension of the RODOS decision support system to the exclusion zone will trigger a revision of existing national safety standards and contribute to improving nuclear safety culture. Staff from SSE "Ecocentre" attended training seminars on projects as well as in preparation for work on equipment provided under the cooperation.

ChNPP, which is responsible for the decommissioning of the shutdown plant, is making use of the outcomes of support under previous INSC cooperation and expects to apply techniques, developed under INSC-II to deal with some problematic waste, to the processing of all problematic wastes. It will use the upgraded dosimetric control system to better quantify and reduce the risks to staff, visitors and the environment around the power plant.

CERWM has used and will use the outcomes of cooperation under INSC-I and INSC-II to carry out safety assessments of radioactive waste disposal and storage facilities around the Chernobyl NPP in order to identify and evaluate options for managing the facilities and the wastes they contain and reducing the associated risks. Recommendations have been put forward regarding institutional control measures, inspection and monitoring, preventative maintenance activities, remediation activities and emergency preparedness and response.

Regulatory Authority

Ukrainian experts in the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) have benefitted from quality interaction and cooperation with European experts, in particular improving their own skills through learning best European experience and applying it to regulatory practice in Ukraine. In addition, regulatory documents on nuclear power plant safety have been developed to improve the Ukrainian legislation and align it with the EU *acquis* and with the WENRA reference levels: nine regulatory radiation safety Acts have been approved and a further two are being finalised.

Cooperation on radioactive waste management is similarly being used to improve the regulatory framework for radioactive waste treatment and disposal facilities, and to develop or improve relevant legislation, regulatory standards or guidelines to align them with international best practice. Sixty-four reports have been prepared reviewing submissions from radioactive waste facility operators.

With support from the T&T programme, SNRIU experts attended training courses on safety culture, emergency preparedness and response, NPP periodic safety reviews, radioactive waste management, decommissioning, nuclear security, safeguards against proliferation of weapons of mass destruction, radiation protection, quality management system, etc. Over 100 SNRIU experts have attended the T&T training courses since 2012. The knowledge obtained has been continuously updated in the course of SNRIU's operational activities. SNRIU has also introduced internal workshops during which those who have benefitted from T&T training can share their knowledge and skills more widely with other SNRIU experts.

The cooperation helped SNRIU revise and develop regulatory documents in response to an IRRS mission in 2008, but further IRRS missions have taken place between 2014 and 2020. SNRIU has established partnerships with regulatory authorities in many countries around the world.

A4.3 Neighbourhood South

A4.3.1 Morocco

INSC cooperation with the Kingdom of Morocco has enabled the regulatory authority, 'AMSSNuR', to achieve all of the objectives in its strategic plan for 2017/21, namely to:

- upgrade the nuclear safety and security regulatory framework;
- enhance the level of nuclear and radiological safety and security at the national level;

- develop and implement the national nuclear security system and the emergency response plan;
- develop and maintain human and organisational capacities;
- establish and implement a transparent and reliable communication and public information policy and strategy;
- strengthen regional and international cooperation; and
- monitor nuclear and radiological safety and security experiences and lessons learned.

All regulations required for the application of Morocco's Law 142-12, covering nuclear safety, radiation protection, emergency preparedness and response, safety of radioactive waste management, safeguards, orphan sources, etc., have been developed. A total of 56 regulations, comprising 15 decrees, 19 ordinances and 22 technical prescriptions have been drafted and submitted to the Head of Government for approval.

AMSSNuR has adopted specific plans to develop and maintain the necessary human resources, education and training programmes in safety and security, knowledge management and national and international partnerships. The workforce of AMSSNuR has grown from a single person in 2016 to 84 employees in 2021 while giving primary importance to gender equality (48% of employees are women and 43% of positions of responsibility are occupied by women). Around 2,300 days of training have been delivered, about an average of seven weeks per person, of which training and OJT efforts under the INSC cooperation contributed more than 10% during the last four years. At the national level, AMSSNuR has established a strategy to develop education and training programmes in nuclear and radiation safety and security which has enabled the identification of more than 13,000 people to be trained or qualified at the national level and more than 300 people to be trained per year or to qualify at the African level.

Following reviews of its draft nuclear safety policy, and policy and strategy for the safety of radioactive management under the INSC cooperation, AMSSNuR has established, in collaboration with all concerned parties, the national tri-ennial reports required by the Conventions dealing with nuclear safety and the safety of the management of radioactive waste and spent fuel, and which were submitted to the meetings of the contracting parties. AMSSNuR has also established plans to control the safety of radioactive waste generated at the national level as well as disused radioactive sources and orphan sources.

As a result of the cooperation, AMSSNuR has been better able to address recommendations of an INIR mission dealing with nuclear safety policy, the strategy for the safety of radioactive waste management, the development of an integrated management system, and the regulatory framework, and to prepare for the IAEA external missions (IRRS and EPREV) planned for 2022. AMSSNuR has also signed 14 bi-lateral Memoranda of Understanding with other countries, including six with neighbouring countries, and a further seven are planned.

A4.4 Other countries

A4.4.1 ASEAN

Cooperation on the development of an Early Warning Radiation Monitoring Network (EWRMN) and Regional Data Exchange Platform (RDEP) has provided a platform to enable ASEAN Member States to work towards greater inter-comparability of monitoring data, e.g., through coordination in specifications of sensor probes, siting characteristics and monitoring station topologies. Technical Working Groups (TWGs) have been established across ASEAN in three areas (radiation monitoring, hazard assessment and radiological dispersion modelling, and EP&R) to coordinate, oversee and sustain long-term capability development in the region. The intention is to establish two further TWGs in nuclear and radiological security and public emergency communications.

Cooperation to provide technical support for decision making on EP&R has provided ASEAN Member States with an enhanced understanding of the expectations of cross-border EP&R, despite the training and table top exercises having to be carried out virtually during the pandemic.

An ASEAN Protocol on Preparedness and Response to a Nuclear/Radiological Emergency, developed with support from IAEA's Technical Cooperation programme, is expected to be formally approved at

the next ASEAN senior officials meeting. It will provide a framework for sustainable future cooperation within ASEAN on EP&R and enable the better integration of support provided by INSC and others.

Training has been provided on EWRMN and RDEP, and on the ARGOS and RODOS decision support systems.

A4.4.2 China

The outputs of a completed project under INSC-I (CN3.01/11) have been used in: compiling a draft *Cyber Security Regulatory Technology Policy of Nuclear Power Plant* to include references to the requirements in IEC 62645 for the cyber security; defining the *Nuclear Safety Culture Traits* (NNSA-HAJ-1001-2017) and drafting the *Nuclear Safety Culture Supervision Procedure*; updating the *NNSA Integrated Management System Manual* (2015); in revisions to HAF001/02/01 *Nuclear Power Plant Operational Phase Incident Report* and *Guidelines for the Review of Nuclear and Radiation Safety Experiences* of NNSA; in revisions to HAD101/08 *Design Basis Flood for the Riverside Nuclear Power Plants* and HAD101/09 *Design Basis Flood for the Coastal Nuclear Power Plants*; in reviews of Fangchenggang, Yangjiang, Zhangzhou, Taipingling, and Changjiang NPPs; and in independent confirmation of calculations of CAP1400 LBLOCA BEPU analysis and of Fuqing unit 5,6.

The outputs of the completed project under (CN3.01/15) INSC-II have been used in: the drafting and revision of HJ/T 61/2001 - *Technical Criteria for Radiation Environment Monitoring*, *Nuclear Safety Guideline for Radioactive Effluents into Environmental Control*, *Public Communication Program for Nuclear and Radiation Safety*, *Emergency Preparedness and Response of Operators of Nuclear Power Plants* (HAD002/01-2010), *Standard for Maintenance and Appraisal of Reliability of Civil Structures in Nuclear Power Plants*, and *Technical Specifications for Effluent Monitoring in Nuclear Power Plants*; in the FSAR review of Unit 5 and 6 of Fuqing Nuclear Power Plant, and the PSAR review of Unit 1 and 2 of Taipingling NPP and Unit 1 and 2 of Zhangzhou NPP; and in nuclear and radiological emergency preparedness and response: in particular, NSC is now capable in using JRODOS to provide technical support for nuclear and radiological emergency decision-making.

The outputs of the cooperation have also been used to complete the development of regulations and standards on radioactive waste management, such as waste classification and the safety of near surface disposal, and improve the waste management regulatory system. The cooperation assisted China in responding to recommendations and suggestions made in an IRRS peer review in 2010. A follow-up IRRS mission in 2016 closed most of the recommendations and suggestions and determined the regulatory body to be effective and credible. Staff from the regulatory authority and its TSO have received ‘on the job’ training abroad and hundreds of people from the regulatory authority and its TSO, institutes, colleges, and licensees have participated in training courses carried out in China. Approximately 60-65% of those trained were male and 35-40% female. China has established bi-lateral or multi-lateral arrangements on radiation and nuclear safety with neighbouring countries, including Japan, Korea, the Russian Federation, Pakistan and Vietnam.

A4.4.3 Ghana

As a result of the INSC cooperation, the Nuclear Regulatory Authority of Ghana expects to: have developed a strategy and action plan for enhancing its capacity and effectiveness; implemented an integrated management system ready for internal and external audit; have a human resources development plan and training programme in place; prepared regulations on design, construction and commissioning of nuclear installations, on site evaluation and on radioactive waste management in line with the international nuclear safety framework, IAEA safety fundamentals, EU and WENRA safety requirements and the relation to IAEA safety standards; and prepared a stakeholder involvement strategy, a communication strategy and operational guidelines. The cooperation is assisting Ghana to address several recommendations from an INIR Mission, challenges and recommendations from review meetings under the Convention on Nuclear Safety (CNS) and the Joint Convention (JC), and challenges identified via the Regulatory Cooperation Forum (RCF). A total of 174 individuals have received training (50 female and 124 male). Ghana is in discussion with the neighbouring countries of Togo, Ivory Coast and Burkina Faso on the development of nuclear power in Ghana.

A4.4.4 Gulf Cooperation Council

As a result of cooperation, the Gulf Cooperation Council will have enhanced EP&R in the region through the installation of a decision support tool, JRODOS, and a radiation data exchange platform, GCC-RDEP, in its Emergency Management Centre. These will have been integrated into arrangements for EP&R in the region, with JRDOS providing decision support and GCC-RDEP functioning as an early warning radiation monitoring network. JRDOS will also have been installed in each of the GCC Member States and customised for use at national and regional levels.

A4.4.5 Kyrgyzstan

The Kyrgyz Republic has used the results of INSC cooperation in the development of a strategy and action plan for regulating radiation safety and in preparing a human resources development plan, including a professional career structure with progression to improve staff retention. It now has up-to-date equipment enabling more efficient and effective regulation. Eleven people (all male) have been trained in the use of mobile equipment for monitoring landslides and twelve people (eight male and four female) in the use of equipment for measuring radon.

It has a strategy for remediation of its legacy sites which has enabled: better characterisation of the types and quantities of radioactive wastes requiring treatment, storage and disposal; better quantification of the risks posed; identification and assessment of alternative options and improved practices, including new facilities, for radioactive waste management; and stakeholder involvement.

A4.4.6 Iran

The on-going INSC cooperation has been highly effective in strengthening INRA in discharging its regulatory responsibilities. The technical support provided has enabled INRA to draft and finalise several important regulations in accordance with the highest safety standards (IAEA and EU). These include General Safety Principles for nuclear facilities and radiological activities and the following regulations: General Safety Regulation for nuclear facilities and activities; Regulation on safety design of research reactors; and Regulation on pre-disposal management of radioactive wastes.

The training provided and the support on the development of guidelines for deterministic and probabilistic safety assessment reviews have greatly improved the existing expertise in INRA for reviewing the SAR and PSA reports for nuclear reactors in Iran. The collaborative review of the PSAR for the Bushehr NPP-Unit 2 was a valuable opportunity for INRA experts to enhance their regulatory review practice through detailed technical discussions with the European experts provided under the cooperation. The cooperation has led to a considerable reduction in INRA's reliance on its foreign consultant (VO "Safety"), clearly indicating the enhanced regulatory technical expertise of INRA as a result of INSC cooperation. INRA's enhanced technical self-confidence is now being applied to more challenging regulatory activities, such as licensing of Bushehr NPPs Unit 1 and Unit 2. Cooperation is continuing on the establishment and operation of a Nuclear Safety Centre and a Nuclear Emergency Centre. INRA is planning to request a further IRRS mission in near future, following a mission carried out in 2010.

By inviting licensees and operators of nuclear facilities to participate in the technical support activities implemented as part of the INSC cooperation, there is now an improved understanding of safety regulations and concepts and practices by licensees (nuclear operators and their TSO). Furthermore, holding nuclear safety schools has introduced wider society, especially academics, to nuclear safety issues and the relevant regulatory activities (including, nuclear safety principles and concepts, review techniques, inspection methods, European safety practice, nuclear safety codes and software, and nuclear Conventions). This has led to the enhancement of safety culture in other sectors of the society. It has led, *inter alia*, to defining several applied research projects in the field of nuclear safety in the national universities and research institutes.

The national waste management organisation, the Iran Radioactive Waste Management Company (IRWA), has participated in the cooperation, with the aim of reviewing and revising the existing National Radioactive Waste Management Policy and Strategy (NRWMPS). This cooperation is still at an early stage and is continuing.

A4.4.7 Iraq

As a result of the cooperation, Iraq has established capabilities to monitor different regions for radioactive contamination and take appropriate action. In addition, radioactive waste from demolition of nuclear facilities is being dealt with in accordance with IAEA standards. Iraq currently lacks a strong scientific base, and is training new staff in relevant fields with the aim of having sufficient human resources in the next ten to fifteen years.

A4.4.8 Tajikistan

Tajikistan has used the outcomes of INSC cooperation to develop important regulatory documents and laws. More than 12 TSO and regulatory staff participated in the T&T programme, four of whom were female. The knowledge obtained has been used in the department responsible for licensing, inspection and response to CRBN accidents. The Government of Tajikistan is supporting the establishment of a new TSO to cover topics including the development of legislation and regulatory requirements, and it will also benefit from knowledge obtained in the training.

Tajikistan plans to use the water treatment plant to be implemented at Taboshar to clean-up water contaminated from uranium legacy sites in the area. Eight people (all male) from the TSO have been trained in relation to planned remediation activities, and they are then training staff of the organisations dealing with radioactive waste management at a regional training centre on nuclear and radiation safety operated by the TSO.

Tajikistan has agreements on radiation and nuclear safety with all countries in the Commonwealth of Independent States in the framework of ATOM SNG.

A4.4.9 Tanzania

Tanzania is using the INSC cooperation to strengthen its regulatory framework to be in line with IAEA recommendations and EU best practices, including reviewing its regulations and developing licensing procedures and inspection guidelines. Aspects of the regulatory framework being addressed are: the radiation safety of uranium mining activities; the security of radioactive sources, nuclear materials and associated facilities; and the safety of radiation practices in the country. The Atomic Energy Act of 2003 and six regulations have been reviewed and revised and are awaiting approval by the responsible Minister. In addition, four guidelines and two procedures have been developed in draft form and are awaiting approval or endorsement from the national authority. The cooperation assisted Tanzania in implementing a recommendation from an IAEA Uranium Production Site Assessment Team (UPSAT) mission. Training has been provided on the use of different types of laboratory equipment and 21 staff (16 male and 5 female) received ‘train the trainers’ training on radiation safety.

Annex 5. Findings of External Evaluations of INSC-II

Four external evaluations of the INSC-II programme have been carried out since, or in parallel with, the mid-term review: two focused on cooperation with Ukraine, one on cooperation with Armenia, and one on the training and tutoring programme. Their findings are summarised in this annex.

A5.1 Assessment of EU Support to the Nuclear Regulatory Authority of Ukraine (18)

This study was published in December 2017 and comprised two parts. The first part was a detailed review of the support provided to the regulatory authority in Ukraine and its technical support organisation under INSC-I and INSC-II to evaluate potential redundancies with past programmes and assess the impact, and the sustainability of the achievements, of the cooperation. The second part built on the results of the first part to develop a gap analysis of the capacity of the regulatory authority and a plan of action for future cooperation to complete the capacity building of the regulatory authority taking account of its absorption capacity. The study was therefore as much concerned with the capabilities of the regulator in Ukraine and its TSO as it was about the effectiveness and efficiency of the INCS programme.

The first part of the study found that, as INSC support to the regulator was redirected from operating nuclear power plants to radioactive waste management facilities, there was: (i) no visible leadership and coordination in the industrial radioactive waste management sector; and (ii) no clearly communicated masterplan showing how the actions jointly support radioactive waste management in Ukraine, nor a comprehensive legislative and regulatory framework for radioactive waste management. It found no evidence of duplication of INSC actions, but that providing repeated, detailed support on specific regulatory guidelines for each radioactive waste storage and disposal facility was not effective and provided limited opportunities for learning, recommending instead the development of generic guidelines that could be applied to specific facilities. Although there was a lack of sufficient transparency regarding the support provided by other donors, their actions were considered generally complementary to those of the INSC, but greater coordination was needed. It also concluded that the impact of the INSC cooperation was evident in the progress being made on the transposition of EU Directives into national legislation, by the regulatory authority becoming a full member of WENRA and taking part in the ENSREG 'stress tests', and by the TSO becoming an associate member of ETSON and active in commercial consultancy. The TSO was considered to have reached a good level of sustainability, but the high staff turnover in the regulatory authority posed a risk to sustainability.

The second part of the study included an extensive analysis of issues facing the regulatory authority in Ukraine, specifically, its independence, and the convergence of Ukrainian legislation and the regulatory framework with the EU *acquis*. The analysis identified as strengths of the INSC programme that there had been the transfer of high expertise from regulators and TSOs in EU Member States to the Ukrainian regulatory authority and its TSO, and that INSC support was well aligned with the EU framework and Directives on nuclear safety. It identified as weaknesses that EU procedures require 2-3 years from concept to contract, that governance of the regulator was weak and its independence had been undermined by legislation changes, that submissions from industry for approval were often not synchronised with regulatory reviews, with the result that actions were diverted to projects with little added value, and that there was no empowered national radioactive waste organisation in place with access to the radioactive waste funds. The ending of support to the nuclear power plant operators demonstrated that it was possible within the programme to achieve sustainability, but the regulatory authority in Ukraine needed to take more responsibility and rely less on its TSO, and the regulatory framework for waste management and the radioactive waste management road map needed to be developed to provide more structure for the INSC actions. The road map was described as little more than a 'shopping list' and there was no national radioactive waste management strategy. INSC projects often lacked a spirit of progress as continuous improvement was considered synonymous with continuous EU support.

The study confirmed that the high staff turnover within the regulatory authority was detrimental to capacity building. More attractive salaries (and an increased budget) were recommended as well as empowering regulatory staff to become more actively involved in INSC projects. The salaries within

the TSO, on the other hand, were found to be in line with the nuclear industry. The regulation, licensing and inspection capacities of the regulator and its TSO were found to be comparable with those of most EU Member States, and there was no need for INSC support for harmonisation with evolving standards. INSC interventions on the regulation of radioactive waste management were found to be entrenched in technical reviews, some with limited added value, lacking a generic approach and oversight, while transposition of essential legislation was blocked in the legislative procedures. The study recommended suspension of INSC interventions pending restoration of the independence of the regulator and improvements in the rate of staff turnover.

The study made reference to a Court of Auditors report in 2016 on EU assistance (as a whole) to Ukraine which identified no specific concerns related to INSC, but which raised some generic issues that could be of relevance, including that: the rotation of mid and senior management jeopardised the reforms supported by EU assistance and the sustainability of results, while low salaries created a potential incentive to corruption; donor coordination by the Ukrainian government was relatively weak and increasing donor involvement was placing strains on an already weak absorption capacity; and the challenges faced by Ukraine were still heavily affecting the reform process and the risks posed by the oligarchs remained high. The study authors considered that the State-owned nuclear power plants were less vulnerable to corruption, and that the highly technical nature of the nuclear industry and the close international attention paid to the nuclear sector in Ukraine mitigated the risks posed by oligarchs.

A5.2 Assessment of Nuclear Waste Projects in Ukraine under INSC (21)

This study, published in September 2019, reviewed support under INSC-I and INSC-II to the safe management of radioactive waste in Ukraine. It aimed to provide an overview of INSC actions, a review of the support provided, an impact assessment of the cooperation and an action plan for the future based on a gap and needs analysis. It assessed the relevance of INSC projects to the needs of Ukraine, the achievements of the projects, and the impact of the support on Ukraine. The study report provided a summary of the responsibilities for radioactive waste management in Ukraine, with the Ministry of Energy and the Coal Industry (MECI) responsible for nuclear energy and the Ministry of Environment and Natural Resources (MENR) responsible for State control over radioactive waste disposal and long-term storage. It identified that there was a strategy for radioactive waste management up to 2035, a national target environmental programme for radioactive waste management up to 2017, and a national programme to 2035 for decommissioning the Chernobyl nuclear power plants and ensuring the safety of the Chernobyl shelter. It set out the management structure for INSC projects in Ukraine, with a Joint Support Office (JSO), to coordinate INSC actions within Ukraine, a Ukraine Supervisory Board, co-chaired by the EC and MECI, with the secretariat provided by the JSO, and a Task Force, involving the EC, the State Agency of Ukraine for Management of the Exclusion Zone (SAUMEZ), MECI and the regulatory authority, to define projects on radioactive waste management, decommissioning and remediation, using a strategic road map as a planning tool.

The study considered the relevance of the INSC projects in terms of the interests of international stakeholder groupings, such as the G7 Nuclear Safety and Security Group, and the international framework of relevant standards and guidelines, and concluded that there was convincing evidence of the relevance of the INSC support to managing nuclear waste in Ukraine. It assessed the INSC projects, most of which related to INSC-I, according to clusters defined by the main end-user. The study report provided a summary of completed projects and their achievements within each of the clusters and concluded that the achievements of the INSC projects were of high quality, with substantial progress towards the provision of essential facilities, equipment, and procedures. It further concluded that, with the completion of the large-scale projects managed by EBRD and the envisaged start of the actual remediation and decommissioning work, further coordination with other donors was likely to be required, to ensure that duplication was avoided, and synergy pursued. A more prominent role for the EU in supporting the coordination was considered to be appropriate.

The study assessed the impact of the INSC programmes in terms of the actions taken by the Ukrainian stakeholders in response to the cooperation within INSC and the outcome of the EU projects. It again addressed the question of impact in terms of the main end-user clusters. INSC support was found to have influenced recent changes in Ukrainian legislation which restored the financing of radioactive

waste management from the radioactive waste management fund and in the structure of the waste management organisation, SAUMEZ. INSC support for radioactive waste management at two nuclear power plants has resulted in the treatment systems being rolled out to the other NPPs. The study found, *inter alia*, that the role of the JSO has been critical to the achievements and impact of the INSC and that continued support was essential in further realising the decommissioning and remediation actions and in empowering Ukrainian staff to gain expertise and confidence to take over such role at the end of the next period. It recommended that SAUMEZ staff should take the lead in drafting the updates of the Strategic Road Map by 2022 while consulting the JSO. It also recommended improvements to project reporting including an improved system of archiving project documents: many documents had to be obtained from the archives of contractors or retrieved from personal computers, with a complete lack of a naming conventions and lack of labelling of documents. The study concluded that INSC has provided key assistance in five major areas: contributions to the large multi-lateral EBRD managed funds; governance of nuclear waste management; provision of key solutions as a catalyst to encourage Ukrainian partners to follow-up; transfer of best-practices as applied in EU Member States and experience in decommissioning; and continued support to capacity building.

A5.3 Assessment of the Nuclear Safety Cooperation with Armenia under the Dedicated EU Instrument (19)

This study, also published in September 2019, similarly aimed to provide an overview of actions in Armenia under INSC-I and INSC-II, a review of the support provided, an impact assessment of the cooperation and an action plan for the future based on a gap and needs analysis. The study report provided a background to nuclear safety in Armenia with a review of the status of the two Units of the nuclear power plant at Metsamor. Two safety assessments have provided the road map for nuclear safety cooperation with Armenia: the first was coordinated by IAEA in 1992, prior to the restarting of Unit 2 in 1995 and was followed up with IAEA expert missions in 2003 and 2009 and subsequent OSART, IRRS and SALTO missions; the second comprised the 'stress tests' carried out in 2015-16. Responsibilities within Armenia for the operation of the nuclear power plant and of the radioactive waste facility lie within the Ministry for Territorial Administration and Infrastructure (MTI), and responsibilities for the regulation of nuclear safety lie with the Armenian Nuclear Regulatory Authority (ANRA). In January 2019, the Armenian government approved a strategy and action plan on the safe management of radioactive waste and spent nuclear fuel for 2019 to 2026. The 2018 partnership agreement with Armenia envisages the implementation within 4 - 5 years of the five Council Directives on nuclear safety and radioactive waste management and both the safe operation of the nuclear power plant and the early adoption of a road map or action plan for its closure and safe decommissioning.

The study found convincing evidence of the relevance of the present and future EU support to the nuclear safety cooperation with Armenia. The IAEA coordinated international donor support to Armenia between 2005 and 2015. This coordination was considered highly effective in avoiding duplication and creating synergy in the set-up of a plan to resolve outstanding safety issues, but there became less need for coordination as the plan was implemented. Similar coordination could be considered for setting up an integrated plan for the safe management of radioactive waste and spent fuel and decommissioning.

INSC actions have focused on: support to the regulator and its technical support organisation; support to other Armenian authorities; and on-site assistance, both 'soft' and 'hard', to the nuclear power plant. The objectives of actions supporting the regulator and its TSO typically concerned strengthening the national nuclear safety regulatory system, promoting an effective nuclear safety culture in line with the Convention on Nuclear Safety, and improving the understanding, and further incorporation in Armenia, of the regulatory methodology and practices as applied in EU Member States. Support to other Armenian authorities has concerned enhancing the national and regional preparedness for responding to radiation incidents and emergencies and the development of a national strategy for radioactive waste management. Support to the nuclear power plant comprised actions aimed at improving operational safety and supporting the implementation of safety related projects, including equipment supply.

The INSC projects were considered to be of high quality, and, together with the work of other donors, enabled substantial progress to be made towards resolving outstanding safety issues at the nuclear power

plant and in following up 'stress tests' issues. On-site assistance to the nuclear power plant operator proved to be a highly effective mechanism in fostering a mutual understanding on introducing and consolidating a real safety culture and, most profoundly, in preparing and supporting a large number of service and equipment supply projects. Support to the regulator and its TSO facilitated high-level license reviews and capacity building on various relevant topics. Assistance to the Ministry was essential in establishing a strategy on the safe management of radioactive waste, spent nuclear fuel, and decommissioning. The impacts of these achievements have been substantiated in the 2017 Armenian National Reports to the Convention on Nuclear Safety and the Joint Convention.

Future needs for cooperation included support with actions identified in the June 2019 follow-up to the 2015 IRRS mission, which found that only 50% of earlier findings were resolved, partially due to a shortage of regulatory staff in both ANRA and its technical support organisation, NRSC. Remuneration of staff was found to fall short compared to the nuclear industry, and there was a major challenge in recruiting and retaining suitably qualified and experienced staff, with some 25% of positions not filled. There was also a need for government actions including on setting tariffs for radioactive waste acceptance and a fund for decommissioning as well as on the system of regulations for storage and disposal facilities for radioactive waste and spent nuclear fuel. The radioactive waste management organisation foreseen in the Armenian national strategy also needed to be established. The study made similar recommendations to that carried out in Ukraine about the need for improvements to project reporting including an improved system of archiving project documents.

A5.4 Assessment of the "Training and Tutoring" Projects under the INSC Cooperation with Third Countries (20)

A third study, published in September 2019, reviewed support on training and tutoring (T&T) under INSC-I and INSC-II, with the aim of providing an overview of T&T actions, a review of the support provided, an impact assessment of the cooperation and an action plan for the future based on a gap and needs analysis. The study assessed the relevance of the INSC T&T projects, their achievements, and the impact of the support, and developed a future plan of action based on a gap and needs assessment. The study report includes a review of training and education provided under the auspices of other international organisations, including the Nuclear Energy Agency of the OECD, the IAEA and the European Nuclear Education Network (ENEN), established in 2003 to maintain and further develop expertise in the nuclear field through higher education and training. In 2016, ENEN was restructured as an international non-profit organisation and moved its activities to Brussels. The study also noted the implementation in the nuclear sector of the European Credit System for Vocational Education and Training (ECVET). A roadmap for implementation of the ECVET system has been prepared by JRC with the aim of addressing a foreseen major shortage of nuclear experts in the future. The study found consensus on the importance of training in maintaining or establishing a competent regulator able to meet the challenges on nuclear safety, with staff shortages a challenge. Issues raised in summary reports on the Convention of Nuclear Safety and the Joint Convention included the safety culture at the regulator, the funding and resourcing of the regulator, recruiting experts, and regulatory knowledge management, and provided further evidence of the relevance of Training and Tutoring of staff of nuclear regulatory authorities and their technical support organisations in third countries.

The study report sets out detailed reviews of the T&T actions established under the INSC programme and how they took account of experience from previous actions. Terms of reference were developed following consultation with potential partner countries using a questionnaire. Training courses supported under the programme were of three types: course available on the market and provided by others, where the assistance facilitated the participation of interested trainees through registration, visa and logistics; courses in Europe developed under T&T projects and owned by the EC; and regional courses organised outside the EU with 20-40% of the content provided by local experts. In addition, support was provided to partner countries to set up a national training plan. The study found the achievements of the INSC T&T projects to be impressive, with training and tutoring provided to between 300 and 400 employees of nuclear regulators and their technical support organisations world-wide. By mid-2019 some 2,400 trainees and tutees in total benefitted from INSC supported courses with some people attending more than one course. There was a favourable gender balance and age

distribution among participants. Positive experience with an initial regional course, has led to further regional courses and high interest among partner countries.

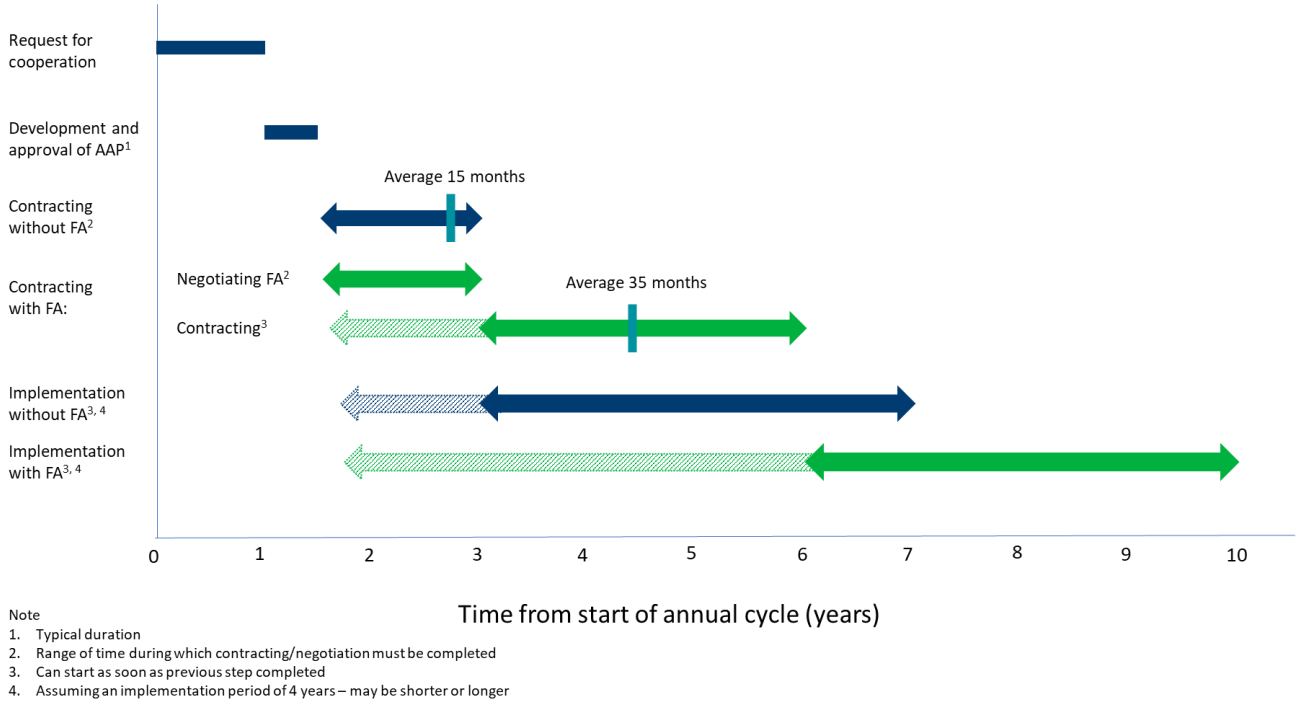
Measuring the impact of the T&T actions was more challenging because systematic individual feedback was not collected from attendees. However, several feedback mechanisms were put in place by the EC, including periodic coordination meetings with partner countries. The review found that the impact of T&T cooperation was recognised as favourable by participants and their regulatory authorities and technical support organisations world-wide. The attention given in training and tutoring to regulatory responsibilities was fully in line with the objectives of the INSC Regulation and provided added-value as compared to other courses. The T&T projects were able to attract staff from nuclear regulatory authorities and technical support staff from all regions of the world. Responses by partner countries provided at the coordination meeting in 2016 showed continued interest in T&T actions.

Continuation of the T&T projects was considered highly appropriate in the future European Instrument on International Nuclear Safety Cooperation (INSC-III) in view of its substantial added-value, unique regulatory perspective and global reach worldwide. The recommended plan of action was largely to continue with ‘business as usual’, as project planning already incorporated feedback and evolving experience. The inclusion of two short 3-day courses for senior management was one highlighted development: one for the regulator and its TSO on leadership, decision making and conflict management; and another for the government authorities addressing financial resource planning and the remuneration of staff.

Annex 6. The Main Steps in Implementing One Annual Cycle of the Instrument

The main steps in implementing one annual cycle of the Instrument are illustrated in Figure A6-1 (i.e., receipt of requests for cooperation, development and approval of an AAP, contracting and follow-up of implemented projects), with indicative timescales for each step.

Requests for cooperation can be made at any time and are evaluated by the programme at a level and depth appropriate to their nature, scope and urgency. Requests from 'new' countries (i.e., those not having previously cooperated under the INSC) are subject to more detailed evaluation, in particular: whether the country is compliant with the provisions of the Regulation; the need for, and urgency of, enhancing nuclear safety in the country; whether the proposed scope and nature of the requested cooperation are likely to achieve the improvements sought; whether the End Users have sufficient capacity to effectively absorb the transfer of knowledge and experience; the level of cooperation or support being provided by other sources. For countries already participating in the programme, the level of evaluation is reduced, taking due account of experience from earlier cooperation with the End Users, and focuses more on the potential of the proposed cooperation for achieving its objectives.



Note
1. Typical duration
2. Range of time during which contracting/negotiation must be completed
3. Can start as soon as previous step completed
4. Assuming an implementation period of 4 years – may be shorter or longer

Figure A6-1. Indicative project lifecycle

Action Programmes are developed on an annual basis taking account of: requests received for cooperation; their potential and urgency for enhancing nuclear safety; and the content of the INSC strategy and relevant MIP. In the event that the number or volume of requests exceeds the available annual budget, priorities are established and some requests either reduced in scope or carried over to the following annual cycle when they are reconsidered along with new proposals.

AAPs and their associated ADs are generally prepared in the final quarter of each year and subjected to various levels of internal and external scrutiny (e.g., inter-service consultation within the EC and EEAS, the INSC Committee, etc.) prior to approval through a European Commission Decision, typically in the second quarter of the following year. The timescale for preparing the AAP, undertaking necessary consultation and approval is typically about 6 months; *in extremis* (i.e., an urgent need to enhance nuclear safety), this timescale could be shortened (for example, using 'special measures', as provided for under Article 7 of the Instrument). Each AAP contains a number of AD, each setting out the objective of cooperation with a country or region and the activities to be carried out to meet the

objectives. Indications are given of how the cooperation is to be implemented (e.g,, by open or restricted tendering or by a negotiated agreement, whether or not a Financing Agreement will be required, whether cooperation will be provided through a services or supplies contract or both, the budget, etc.).

The time between approval of an AAP and contracting of projects (i.e., 'time to contract') depends on whether or not a Financing Agreement is deemed necessary for the cooperation. A Financing Agreement is used where it is considered necessary to assure the commitment of the partner country to achieve the objectives of the cooperation, to remove liability on the Contractor and the EC in respect of any supplies provided, and to avoid duties/taxes on supplies. Projects implemented without a FA must be contracted by the end of the year following that in which the AAP was approved by the EC (the so called 'N+1' rule); for projects implemented with a FA, the FA must be agreed by the end of the year following that in which the AAP was approved, and the project must be contracted within three years of the date of signature of the FA (the so called 'D+3' rule). In general, therefore, the 'time to contract' is much longer for projects implemented with a FA owing to the time needed to negotiate a FA and the longer timeframe available for contracting.

What is evident from Figure A6-1 is that time between a request for, and the start of, cooperation can be long, sometimes very long. This has implications for the efficacy of cooperation and these are addressed in Section 4.2.5.