Integrated Nuclear Infrastructure Training

IAEA Support for New and Expanding Nuclear Power Programmes

IAEA
International Atomic Energy Agency

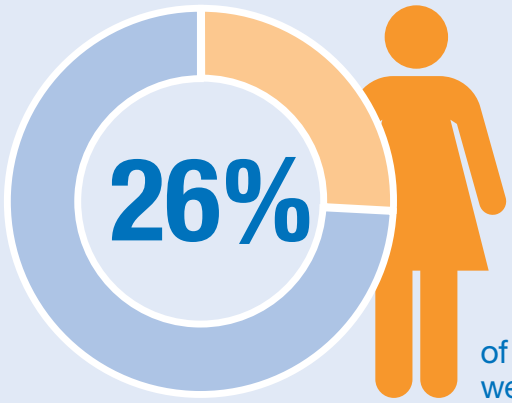
Supporting Knowledgeable Decision-making and Building Capacities to Start and Implement Nuclear Power Programmes

Interregional Technical Cooperation Project INT2018

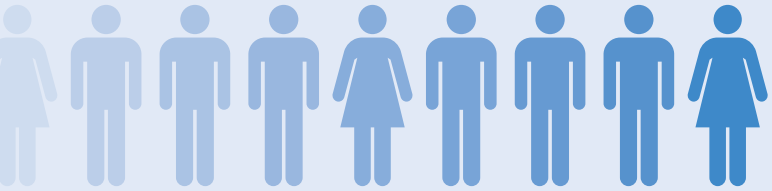
The project in numbers: 2016–2019

4 Year project duration

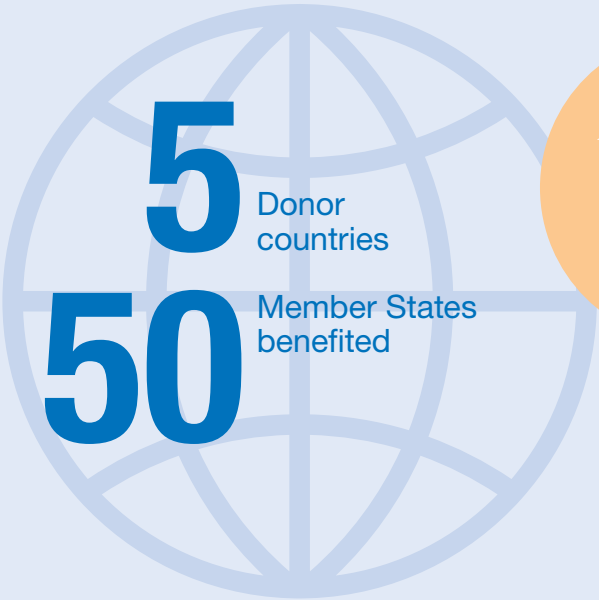
78 Activities implemented



of participants were women



1250 Participants trained



5 Donor countries

50 Member States benefited

17 Host institutions, located in

12 Member States

€6.8 Million total budget, including

€5.2 million extrabudgetary contributions from donor countries

Introduction

Today, nuclear power produces about 10% of the world's electricity, accounting for around one third of all low carbon electricity. It is expected to continue to play an important role in the energy mix of many countries around the world, for energy security, sustainable development, and to address environmental concerns.

A nuclear power programme requires a national infrastructure that provides governmental, legal, regulatory, institutional, managerial, technological, human resource, industrial and stakeholder support throughout its life cycle. The adherence to international legal instruments, internationally accepted nuclear safety standards, nuclear security guidelines and safeguards requirements is essential in establishing a responsible nuclear power programme.

Thirty countries already operate nuclear power plants and several of them are planning to expand their nuclear fleet. About 30 countries are considering or embarking on new programmes. Including nuclear power in a national energy mix is each country's sovereign decision. But when countries opt to use nuclear power, the IAEA supports them to do so safely, securely and sustainably.

Interregional Projects

In this respect, the interregional projects of the IAEA Technical Cooperation (TC) programme are an important mechanism, delivering support across national and regional boundaries and addressing the common needs of different regions. Experience has shown that the interregional approach is the most effective means to deliver two types of support:

- wide-ranging training and awareness building relevant to all countries embarking on or expanding a nuclear power programme; and
- training targeted to Member States at specific phases in the development of a nuclear power programme.

Additional tailored support is provided through national projects under IAEA Integrated Work Plans (IWP).

Belarus and the United Arab Emirates are the first two nuclear 'newcomer' countries close to commissioning and operating their first nuclear power plants (NPPs). Left: Ostrovets NPP, Belarus (Photo: Ministry of Energy); right: Barakah NPP, United Arab Emirates (Photo: ENEC).

Integrated Nuclear Infrastructure Training

The IAEA interregional project on *Supporting Knowledgeable Decision-making and Building Capacities to Start and Implement Nuclear Power Programmes (INT2018),* over its four-year duration, evolved into a significant, strategic component of the IAEA's support to Member States that are considering, embarking on, or expanding a nuclear power programme.

The project's two primary objectives were to support Member States in making a knowledgeable decision on whether to start nuclear power programmes, and then to support nuclear power capacity building to develop the necessary competencies and key organizations needed for a safe, secure and sustainable nuclear power programme.

Between 2016 and 2019, the project provided direct support to 50 Member States. About 1250 participants received training through 78 individual activities, including training courses, group scientific visits, workshops and fellowships. Seventeen institutions in 12 Member States hosted these training events. They focused on developing nuclear power infrastructure according to the IAEA Milestones Approach (see p. 3), with specific modules addressing its 19 nuclear infrastructure issues, focusing on the roles and responsibilities of three key organizations and how they are interrelated: the government/nuclear energy programme implementing organization (NEPIO), regulatory body and owner/operator.

IAEA Interregional Training Course on Promoting Effective Interaction Among Nuclear Industry, Regulatory Body and Stakeholders in Countries Introducing or Expanding Nuclear Power Programmes, Tokyo and Tsuruga, Japan, 30 September to 11 October 2019. (Photo: JICC)

Group exercise during the Interregional Training Course to Develop Member State Programmes on the Competencies Needed for a Nuclear Power Programme, Argonne National Laboratory, Lemont, USA, 5–23 March 2018. (Photo: ANL)

"This training course helped me to take a comprehensive look at the roles of the NEPIO, the regulatory body and the owner/operator throughout the nuclear power programme."

Katarzyna Kaminska, Ministry of Energy, Poland;
Interregional Training Course to Develop Member State Programmes on the Competencies Needed for a Nuclear Power Programme,
Argonne National Laboratory, Lemont, USA, March 2018

The project was implemented through an interdepartmental matrix approach by the Department of Technical Cooperation, Department of Nuclear Energy, Department of Nuclear Safety and Security, Department of Safeguards and the Office of Legal Affairs.

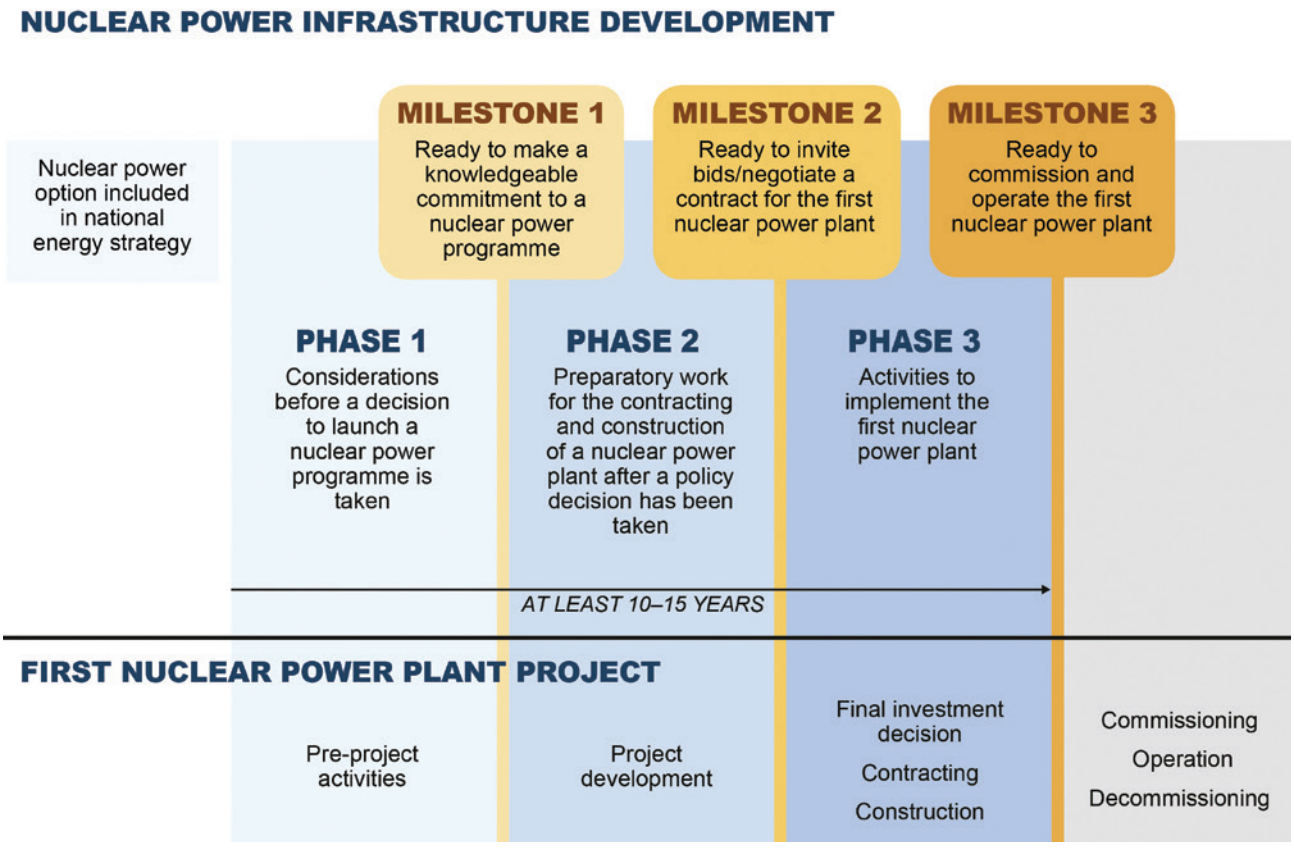
IAEA Milestones Approach

The IAEA Milestones Approach supports countries in creating an enabling environment for the implementation or expansion of a nuclear power programme, and to understand and prepare for the associated commitments and obligations.

This result-oriented approach comprises three phases of programme development (consider, prepare, construct), three milestones to be achieved (decide, contract, commission and operate) and 19 infrastructure issues to be addressed in building a nuclear power programme, such as national position, nuclear safety, nuclear security, safeguards, legal and regulatory frameworks, human resource development, stakeholder involvement, radioactive waste management and others (see p. 8).

The Milestones Approach is documented in the IAEA Nuclear Energy Series *Milestones in the Development of a National Infrastructure for Nuclear Power* (NG-G-3.1 (Rev. 1)) and, together with other supporting documents, is widely used around the world. Its framework and terminology have been broadly accepted.

To apply the IAEA Safety Standards in the development of a sustainable safety infrastructure, the IAEA Nuclear Safety Series *Establishing the Safety Infrastructure for a Nuclear Power Programme* (SSG-16) provides recommendations on progressively meeting safety requirements throughout the three phases of the Milestones Approach.



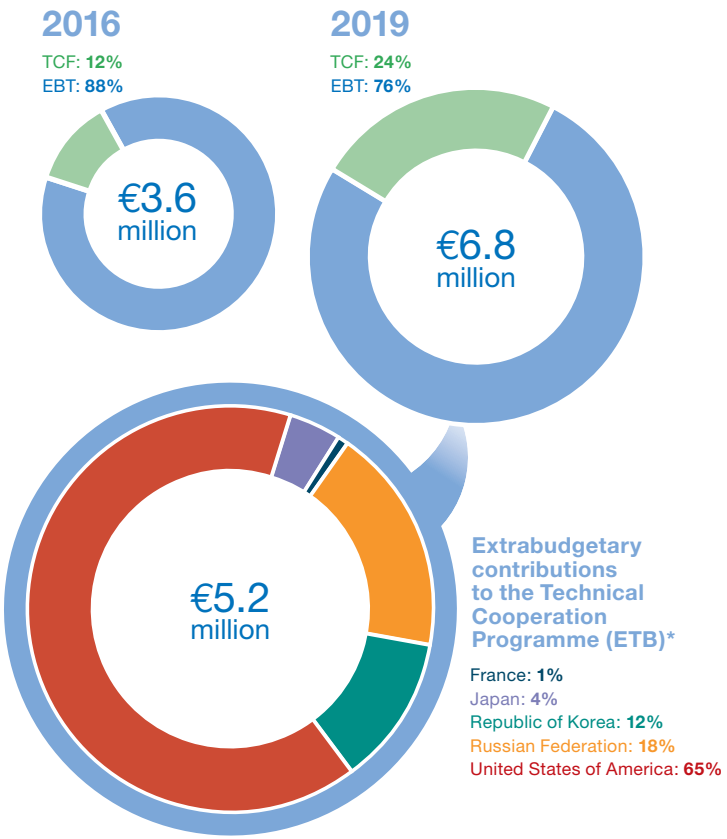
Budget and Donors

The total budget for the project in the period from 2016 to 2019 amounted to 6.8 million Euro. A major share of the budget was provided by extrabudgetary contributions from donor countries, while the remainder came from the Technical Cooperation Fund (TCF).

The number of donor countries increased during project implementation. In 2016, two donors, the Republic of Korea and the United States of America, supported the project. In 2017, the Russian Federation joined the donors group, with Japan contributing as of 2018. By 2019, five Member States provided financial support to the project: France, Japan, Republic of Korea, the Russian Federation and the United States of America. The programme for activities was discussed at annual donors meetings on the sidelines of the IAEA General Conferences. Other countries supported the project through in-kind contributions, such as hosting individual training events.

Technical Tour to Leningrad NPP-2 during the Interregional Group Scientific Visit on Establishing an Owner/Operator for New Nuclear Power Programmes, Saint Petersburg, Russia, 28 Aug to 2 Sept 2017. (Photo: Rosatom)

Four-year Budget Progression



*In-kind contributions from Member States are not included in this graph.

Recipient Organizations

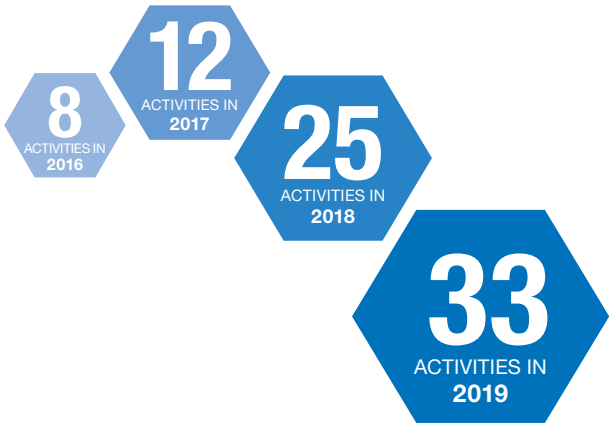
The primary recipients were governments/NEPIOs, owner/operators, regulatory bodies, technical support organizations, institutions involved in emergency preparedness and response, waste management organizations and academia in Member States embarking on or expanding nuclear power programmes.

The needs of recipient organizations were identified at two annual IAEA meetings: the Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure, held in January/February, and the Technical Working Group on Nuclear Power Infrastructure in November of each year. In addition, requests from Member States, feedback from

Group discussion during the Interregional Training Course on Technology Assessment, IAEA Headquarters, Vienna, Austria, 8–12 October 2018. (Photo: IAEA)

the different training activities and information collected during IAEA review missions and advisory services, including the Integrated Nuclear Infrastructure Review (INIR) service, helped to focus and, where necessary, adjust the activities.

Increase in Training Activities 2016–2019



Host Institutions

Training activities were held at the IAEA Headquarters in Vienna or were undertaken in partnership with host institutions in several Member States. These institutions provided experts and facilities for training courses, group scientific visits and workshops, or hosted fellowships.

Host Institutions

- **Austria**
  Zwentendorf Nuclear Power Plant Training Centre
- **Costa Rica**
  University for Peace
- **Czech Republic**
  Czech Technical University in Prague
- **Finland**
  Radiation and Nuclear Safety Authority (STUK)
- **France**
  Electricité de France (EDF); Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA)
- **Japan**
  Japan Atomic Industrial Forum (JAIF) International Cooperation Center (JICC)
- **Mexico**
  Laguna Verde Nuclear Power Plant; Instituto Nacional de Investigaciones Nucleares (ININ)
- **Republic of Korea**
  Korea Electric Power Corporation (KEPCO) International Nuclear Graduate School
- **Russian Federation**
  Rosatom Technical Academy; Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor)
- **United Arab Emirates**
  Khalifa University of Science and Technology
- **United States of America**
  Argonne National Laboratories; Texas A&M University; University of Massachusetts Lowell

Training Activities

The project activities were aimed at enhancing and harmonizing capabilities for the introduction of nuclear power, and at establishing a global network and forum for information exchange among countries with new and expanding nuclear power programmes. They also provided a platform for sharing experiences and capturing, preserving and transferring knowledge related to nuclear infrastructure issues.

"This course broadened my knowledge on the development of nuclear power programmes. It gave me the opportunity to meet new colleagues from other countries in the nuclear sector."

Joshua Gbinu, Ghana Atomic Energy Commission; Interregional Training Course on Nuclear Power Infrastructure Development, Toyko, Japan, December 2018

The IAEA developed and provided tools and specific training services and mechanisms, in particular for human resource development, integrated management systems, and programme and project management. These included, for example, the IAEA e-learning modules for nuclear newcomers, the Nuclear Infrastructure Bibliography, Competency Framework, Systematic Approach to Training (SAT) and others.

The 78 different training activities, held at the IAEA Headquarters in Vienna and in Member States, provided a comprehensive introduction to nuclear power and to the development of the infrastructure for a safe, secure and sustainable programme.

Interregional Training Course on Licensing and Construction Preparation and Oversight for New and Expanding Nuclear Power Programmes, Ulsan, Republic of Korea, 18 June to 6 July 2018. (Photo: KINGS)

The training activities also addressed the roles and responsibilities of the three key organizations, i.e. government/ NEPIO, regulatory body and owner/operator in the three phases of the Milestones Approach.

Specific modules either addressed nuclear infrastructure development generically, or focused on one or a combination of several infrastructure issues. These included, for example, establishing a national position, nuclear safety, security and safeguards,

"The training course is unique, because it is not looking at siting in isolation but linking it to other infrastructure issues, such as public and stakeholder engagement."

Emmanuel Wandera, Nuclear Power and Energy Agency of Kenya; Interregional Training Course on Siting Nuclear Power Plants, Vienna, Austria, July 2019

emergency planning, management, funding and financing, regulatory framework, human resource development, stakeholder involvement and communication, siting and supporting facilities, environmental protection and radiation protection.

"I found most useful that the course was interactive, with realistic examples, and that we had an opportunity to share experiences with people from other countries."

Tahreer Al-Qaq, Energy and Minerals Regulatory Commission, Jordan;
Interregional Training Course to Develop Member State Programmes on the Competencies Needed for Nuclear Power Programmes,
Argonne National Laboratory, Lemont, USA, March 2018

Some courses covered a particular theme, for example, reactor technology assessment, and licensing and construction preparation and commissioning of a nuclear power plant.

The project's programme was adjusted annually, based on Member States' feedback and requests, and increasingly, where relevant, also addressed the relationship among the three key organizations.

Practical exercises and technical visits to nuclear facilities in Member States were found very useful by the participants. During several events, participants highlighted the need for specific practical activities tailored to national requirements. In response, national workplans were adjusted, providing Member States with additional targeted training upon their requests.

Conclusions

The IAEA interregional project on *Supporting Knowledgeable Decision-making and Building Capacities to Start and Implement Nuclear Power Programmes (INT2018)* has been an effective and efficient mechanism to provide support to embarking and expanding countries. The IAEA has continually worked to optimally align available donor support to the needs of Member States. The contributions of experts from donor and host countries were key in carrying out the activities successfully. The IAEA is striving for a steady enhancement in the interregional project planning process, which will be of benefit for a follow-up interregional project (INT2021), to be implemented from 2020 to 2023 (see p. 8).

Facility visit and inspection exercise at the Olkiluoto nuclear power plant during the Interregional Training Course on the Implementation of National Requirements for Nuclear Power Programmes, Helsinki, Finland, 20–24 Aug 2018. (Photo: STUK)

International Nuclear Leadership Seminar, Texas A&M University, College Station, USA, 25 March to 3 April 2019. (Photo: Texas A&M University)

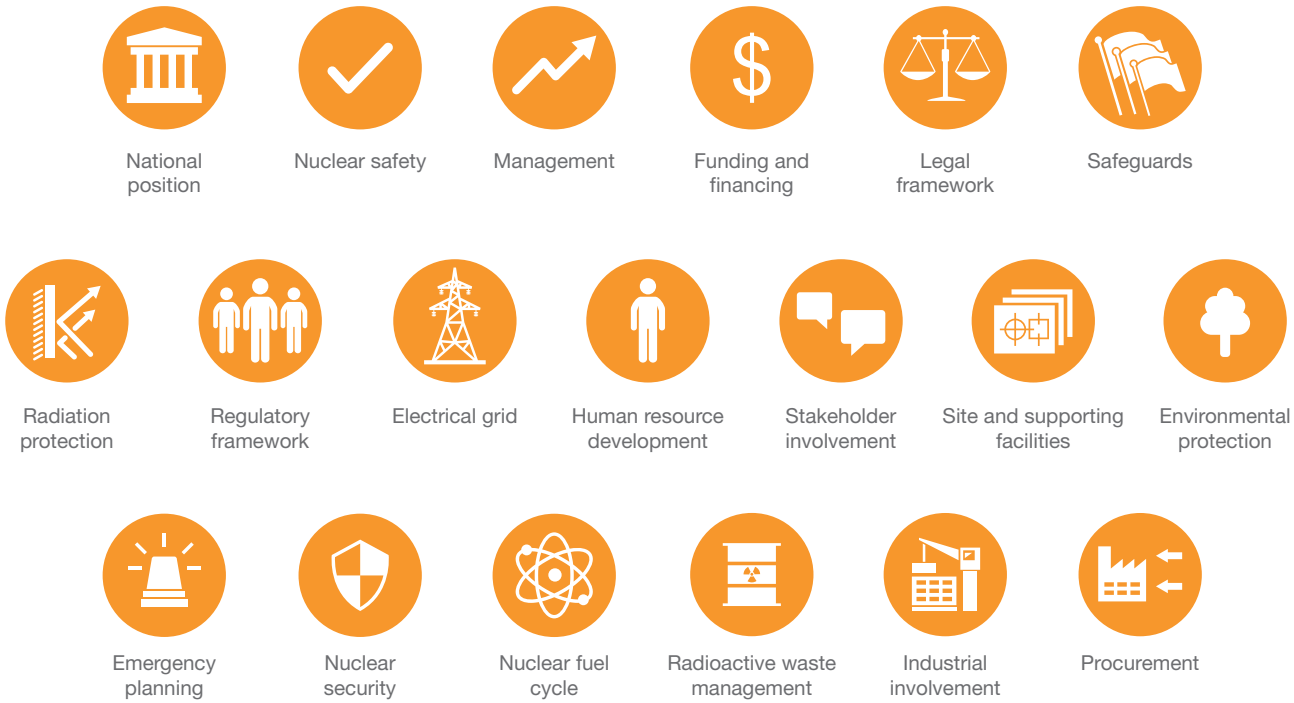
IAEA's Integrated Nuclear Infrastructure Training Continues: 2020–2023

A four-year follow-up interregional project, *Supporting Member States Considering or Planning to Introduce or Expand Nuclear Power Programmes in Developing the Sustainable National Infrastructure Required for a Safe, Secure and Peaceful Nuclear Power Programme (INT2021),* starts in 2020. Open to embarking and expanding Member States, it will support them in creating an enabling environment that facilitates the safe, secure and sustainable introduction or expansion of nuclear power.

Activities will include training courses, scientific visits, schools, workshops and seminars, each addressing individual nuclear infrastructure issues as well as providing a comprehensive overview of all elements required to establish or expand a nuclear power programme.

Similar to the previous project (INT2018), the new activities will be jointly implemented by the Department of Technical Cooperation, Department of Nuclear Energy, Department of Safety and Security, Department of Safeguards and the Office of Legal Affairs, with financial support from the TC Fund and extrabudgetary and in-kind contributions from donor countries and those hosting individual training events.

The 19 Nuclear Infrastructure Issues of the IAEA Milestones Approach



The IAEA Integrated Nuclear Infrastructure Training covers nuclear infrastructure development generically, or addresses one or a combination of several of the 19 nuclear infrastructure issues of the Milestones Approach.

Planned Training Activities 2020–2023*

Annual Events

Training Courses

- Human Resource Development and Workforce Planning for New and Expanding Nuclear Power Programmes
- Leadership and Management for Safety
- Stakeholder Interaction and Institutional Strength in Depth
- Establishing Arrangements and Capabilities for Emergency Preparedness and Response
- Licensing and Construction Preparation and Oversight
- Management Issues Including Safety Culture

Seminar

- International Nuclear Energy Leadership

Scientific Visit

- Emergency Preparedness and Response

Semi-annual Events

Training Course

- Nuclear Infrastructure Development

Workshop

- Fundamentals of Regulatory Inspections of Nuclear Power Plants (Inspection Walk Down Workshop)

Events to be Held Every Even Year

Training Courses

- Establishing a National Position for a New Nuclear Power Programme
- Industrial Involvement in a Nuclear Power Programme
- Nuclear Power Plant Contract Specifications and Reactor Technology Assessment
- Nuclear Power Plant Financing and Risk Allocation
- Implementation of National Requirements for a Nuclear Power Programme
- Design Safety and Safety Assessment
- Communication and Consultation with Interested Parties by the Regulatory Body

Workshop

- Construction and Manufacturing Oversight by the Regulatory Body

Scientific Visits

- Nuclear Power Plant Training and Qualification Programmes
- Regulatory Enforcement and Corrective Actions

School

- Drafting Regulations

Events to be Held Every Odd Year

Training Courses

- Policies and Strategies Related to the Nuclear Fuel Cycle and Radioactive Waste Management
- Electrical Grid Considerations and Interactions with the Nuclear Power Plant
- Siting for Nuclear Power Plants
- Radiation Protection Considerations for Embarking Countries
- Environmental Protection Considerations for Embarking Countries
- Approaches to Financial Modelling for Nuclear Power Projects
- Human Resource Development and the Systematic Approach to Training (SAT)
- Stakeholder Involvement for Nuclear Power Programmes

Scientific Visits

- Commissioning
- Licensing Process for Nuclear Power Plants
- Responsibilities and Capabilities of Owner/Operators

** Detailed planning of annual activities will be discussed at the Donors meeting each year.*

For More Information

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