Creating capacity

- legislation & regulation
- control of exposure
- emergency preparedness

through technical cooperation
Established in 1957, the IAEA is the world’s centre of nuclear cooperation and works for the safe, secure and peaceful use of nuclear technologies. Its key roles contribute to international peace, safety and security, and to the Millennium Development Goals for social, economic and environmental development.

Three main pillars underpin the IAEA’s mission:

- **Safety & Security** - The IAEA helps countries to upgrade their infrastructure for nuclear and radiation safety and security, and to prepare for and respond to emergencies. Work is keyed to international conventions, the development of international standards and the application of these standards. The aim is to protect people and the environment from the harmful effects of exposure to ionizing radiation.

- **Science & Technology** - The IAEA is the world’s focal point for mobilizing peaceful applications of nuclear science and technology for critical needs in developing countries. The work contributes to alleviating poverty, combating disease and pollution of the environment and to other goals of sustainable development.

- **Safeguards & Verification** - The IAEA is the nuclear inspectorate, with more than four decades of verification experience. Inspectors work to verify that nuclear material and activities are not diverted towards military purposes.

Three cross-cutting networks address specific needs related to the IAEA’s mission. Coordinated research projects encourage research on, and development and practical application of, atomic energy to foster the exchange of scientific and technical information, as well as the exchange of scientists. Knowledge management initiatives offer nuclear professionals direct access to scientific and technical expert knowledge. The technical cooperation (TC) programme helps Member States realize development priorities through the application of appropriate nuclear technologies. TC builds national capacity through training, expert advice and delivery of equipment.

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Every year, the IAEA technical cooperation (TC) programme provides more than US $70 million worth of training services, and equipment in approximately 100 countries and territories throughout Africa, Asia and the Pacific, Europe and Latin America. TC projects span an ever increasing range of sectors that have direct links to human and environmental health.

Wherever nuclear and other radiation based technologies are applied, protecting the safety and health of employees, medical patients and the public at large is a top priority and a demanding responsibility. One of the primary aims of the TC’s radiation protection programme is to help Member States fulfil their safety and security obligations.

NEW OPPORTUNITIES, NEW CHALLENGES...

Rarely in the history of the IAEA has radiation based technology provided so much opportunity. Just as Member States — particularly developing countries — acquire the expertise needed to utilize technologies that contribute to social and economic development, they need to ensure that they have an adequate national infrastructure for radiation safety and security. Beyond the existing infrastructure for radiation safety and security, other factors increasingly call for attention.

They are, on the one hand:
- The development and deployment of new nuclear technologies
- Renewed interest in large scale nuclear energy production

and on the other hand:
- Geopolitical instability and global terrorism, which create a black market for radioactive materials
- Ongoing attempts to acquire capacity in nuclear weapons.

If the world is to realize the potential of radiation based technologies for peaceful purposes, each country must be prepared to confront the associated risks.

The nature of today’s global environment is such that a significant threat can arise virtually any time, anywhere. Thus, there is a pressing need to strengthen the safety and security network at every level.

The TC programme is committed to building a global safety regime for nuclear technology, country by country. Since 1994, the IAEA has helped more than 90 Member States establish the infrastructure needed to support all aspects of radiation protection.

The IAEA has the expertise and experience to guide Member States through every step of the capacity building process, as well as a range of tools to improve efficiency and enhance sustainability.
... AND INCREASED NEED FOR NATIONAL KNOW-HOW

To realize the potential of nuclear technology, nations must be prepared to shoulder full responsibility for the safety and security of radiation sources and radioactive materials. In fact, demonstrated capacity in these areas is a condition for technology transfer.

This involves a ‘life cycle’ commitment. Sources of radiation with an activity that is above exemption levels that are set by national and international standards must be accounted for from the moment they are acquired to the day they are retired — at which point standards for waste disposal must be strictly followed.

The requirements for an adequate national radiation safety infrastructure, in compliance with international safety standards, comprise five thematic safety areas (TSAs):

- National regulatory infrastructure
- Radiological protection in occupational exposure
- Radiological protection in medical exposure
- Public and environmental radiological protection
- Emergency preparedness and response to radiological accidents

This brochure aims to help Member States better understand the breadth and depth of each TSA — and how developing capacity creates new opportunities to derive socioeconomic benefits through the strategic use of nuclear technologies.

ESTABLISHING A NATIONAL REGULATORY INFRASTRUCTURE

One of the statutory functions of the IAEA is to provide assistance in the application of the standards in Member States — helping Member States develop a sustainable national infrastructure that meets the standards.
In its bid to bring nuclear and radiation based technologies to developing countries, the TC programme strictly adheres to two fundamental principles, specifically that:

- Safety is a prerequisite of technology transfer to Member States;
- All radiation sources and all radioactive material with activities that exceed exemptions levels must be ‘trackable’ through the entire life cycle, i.e. from ‘manufacture to disposal’.

**TSA 1: REGULATORY INFRASTRUCTURE**

The first step is to establish legislation that allows beneficial (justified) uses of ionizing radiation and provides for adequate protection of people and the environment. This legislation must also provide a mechanism that achieves this aim through the establishment of a regulatory body or authorities entrusted with an appropriate range of functions and responsibilities and provided with adequate human and financial resources. The legislation also provides enforcement instruments to address non-compliance. Regulations provide further detail on the application of the laws. One of the most important tasks of the regulatory authority is to have a system of notification, authorization, inspection and enforcement. This includes the creation and maintenance of an accurate national register of all radiation sources.

- Establishing ‘notification’ procedures for individuals and organizations wishing to acquire radiation sources or having the intention to carry out a practice;
- Granting authorizations for such sources and practices;
- Performing inspections to ensure that practices are carried out and sources are used in accordance with the requirements of relevant regulations and with any authorization conditions;
- Enforcing legislation and regulations to correct non-compliance with regulatory requirements, primarily through the suspension or revoking of licences, if the regulatory body can no longer conclude that operations are likely to be safe.

This complex mandate requires the establishment of an effectively independent national regulatory body that is adequately empowered through legislation, enabled through appropriate financial support and staffed by highly trained individuals.

The IAEA has a vision, strategy and policy for the systematic strengthening and acceleration of its activities relating to the establishment of an adequate regulatory infrastructure in Member States.
Each standard is the starting point for procedures that match risk levels of natural and artificial radiation sources and appropriate measures to protect people against external and internal exposure.

**TSA 2:**
**RADIOPHILICAL PROTECTION IN OCCUPATIONAL EXPOSURE**

Every day, millions of employees around the globe come into contact with, or actively apply, radiation sources. Recognizing that radiation protection in the workplace involves the rights and obligations of both employees and employers, the IAEA joined forces with the International Labour Organization to develop standards in this area. Employers and licensees hold full responsibility for employees’ health and safety, including individual monitoring and workplace monitoring; health surveillance and occupational exposure records; general radiation protection information and training for workers; providing protective equipment and following strict procedures for personal exposure monitoring.

The regulatory body must oversee regulations that cover both dose limits and the implementation of a systematic approach to optimizing radiation protection. It must also ensure that monitoring and measurement services are duly accredited or approved and capable of delivering reliable results. The regulatory authority plays a vital role in protecting workers through its power to carry out inspections and to suspend or revoke the licences of facilities that fail to maintain standards set out in the BSS.

**TSA 3:**
**RADIOPHILICAL PROTECTION IN MEDICAL EXPOSURE**

Medical procedures constitute the commonest means through which people are exposed to artificial radiation sources. Use of radiation based technologies in health care is expected to increase sharply in the near future. There is an urgent need to bring basic radiology and radiotherapy tools into developing countries to diagnose and treat diseases that are considered manageable in other areas of the world.
Medical practitioners have the prime responsibility for ensuring the radiological protection of patients. This involves the justification for the particular use of radiation — that the exposure provides a net benefit for the patient in terms of clinical management and that the use of radiation is optimized. For diagnostic procedures, this means that the diagnostic images are obtained with a dose to the patient that is as low as reasonably achievable. For therapy procedures, optimization also means ensuring that the dose to normal tissue is as low as reasonably achievable, consistent with delivering the prescribed dose to the target volume.

The IAEA believes that training (through workshops, fellowships, etc.) a broad range of health professionals on protection matters related to radiology, nuclear medicine and radiotherapy is one of the most effective means of achieving patient protection. In addition, IAEA assistance is provided through projects aimed at implementing particular actions in optimizing radiation protection in each of general radiology, mammography, computer tomography, interventional procedures, nuclear medicine and radiotherapy.

As with all uses of radiation, medical exposures are under regulatory control, with appropriate authorizations by the regulatory body specifying, through regulations, licence conditions and standards, the requirements for radiation safety. The regulatory body performs inspections to ensure compliance with requirements.

**TSA 4:**

**PUBLIC AND ENVIRONMENTAL RADIOLOGICAL PROTECTION**

Public and environmental exposure control has the same aim, as control of occupational and medical exposures, i.e. of ensuring that people are adequately protected from the adverse effects of radiation, but with the additional dimensions of ‘everywhere’ and for ‘now and the future’. People and the environment are constantly exposed to low levels of ionizing radiation — most from natural sources, some resulting from human activities.

Potential sources of public and environmental radiation exposure from human activity can be divided into two categories: radioactive effluents (in gas or liquid form) that are discharged into the atmosphere or into water and radioactive waste that represents all disused materials and equipment that contain some element of radioactive substances.

Radioactive effluents are most commonly associated with nuclear power plants and other nuclear installations. Other sectors such as industry, agriculture and research contribute to effluents to a lesser degree. All countries produce radioactive waste through nuclear programmes and/or medicine, industry and research. In both cases, the risk factors relate directly to the characteristics of the substance: its activity concentration, its condition and its location (i.e. its proximity to population centres, drinking water and farming areas).

Effective control of public and environmental exposure relies on the establishment of a regulatory infrastructure, which clearly defines policies for clearance from regulatory control, discharge control and waste management. Regular monitoring — both at the source of the discharge and in the receiving environment — is an essential element of public and environmental exposure control. It is generally applied to check the release of radio nuclides from specific sources such as nuclear reactors, research or industrial facilities, waste storage and disposal, uranium mines and mill tailings, and land affected by radioactive residues.

As use of radiation expands, it is imperative that each country establish and enforce regulations regarding transport, control of public radiation exposures and the safety of radioactive waste management.
Emergency preparedness and response means being ready to react to a broad range of situations that can occur anytime, anywhere. A national emergency preparedness plan, executed by a skilled national coordinator, can help to ensure that any radiological emergency, incident or accident will be handled in a consistent manner, mitigating health risks to people and the impact on the environment.

EMERGENCY RESPONSE AND MITIGATING THE IMPACT OF ACCIDENTS

TSA 5:
EMERGENCY PREPAREDNESS AND RESPONSE

The TC programme’s concerted efforts to build capacity are already delivering the desired results: many countries already have the capability to respond rapidly and effectively to a radiological emergency, incident or accident.

These factors create a situation in which radiological accidents and incidents can occur virtually anytime, anywhere.

Minimizing the impact of radiological emergencies requires fast action on the part of many individuals — from first responders (police, firefighters, civil defence and medical personnel) to the regulatory body and senior level government representatives. Establishing procedures and training personnel for emergencies is a vital aspect of the radiation protection infrastructure. In addition to mitigating health risks to people and to the environment, effective response can reduce the psychological and economic impacts often associated with radiological accidents.

While nuclear power plants still pose the primary large scale risk, today’s reality is that more radiation sources are applied in more sectors, more sources are in transport on a daily basis and more radioactive waste is produced year after year. In addition, it would be unwise to disregard the threat posed by the use of ‘dirty bombs’ — explosives laced with radioactive material.
As nuclear technology evolves, so must people’s knowledge and expertise. Because of the prime importance of know-how, the IAEA has a strategic plan for education and training, endorsed by the General Conference. Tools to implement the strategy include an advisory Steering Committee, standardized training packages, distance learning, intercentre networks, e-learning and ‘train-the-trainers’ programmes.

The IAEA offers a range of education and training opportunities for individuals and groups at the local, national and regional levels:

- Radiation Protection and the Safety of Radiation Sources is a postgraduate education course offered on a regular basis by universities in each TC region. It is delivered in Arabic, English, French, Russian and Spanish.

- Fellowships, scientific visits, expert assignments and on-the-job training provide an opportunity for professionals in nuclear related areas to engage in intensive training areas to educational programmes.

- Regional training focuses on specific areas of radiation protection, often with the aim of building capacity to address issues that are characteristic of a particular region.

The standardized training material developed by the IAEA covers a broad range of topics and can be easily adapted to reflect national needs and unique considerations. Most materials are available in all six official UN languages.

All of our professional development programmes are based on a ‘train-the-trainer’ philosophy. Our aim is to ensure that course participants are well prepared to apply new knowledge and to expand and strengthen the knowledge network within their home countries.
To realize more quickly its goal of helping Member States become self-sustaining in radiation protection, the IAEA has developed a number of tools that improve efficiency and support international cooperation and harmonization.

**REGULATORY AUTHORITY INFORMATION SYSTEM (RAIS)**

The IAEA has developed the RAIS software as an information management tool for the day-to-day activities of the regulatory body in a Member State. It has two main components, a national register of radiation sources and a system for the daily management of regulatory activities. It is based on experience gained in the field, international standards (the BSS and GS-R-1) and guidance provided by the Code of Conduct on the Safety and Security of Radioactive Sources, together with other IAEA publications, in particular those relating to the categorization and security of radioactive sources. RAIS has been translated into various languages including Arabic, Chinese, French, Georgian, Russian, Spanish, Vietnamese and Ukrainian. More than 200 people have been trained in using the system.

**RADIATION AND WASTE SAFETY INFRASTRUCTURE PROFILES (RaWaSIPs)**

RaWaSIPs contain the up to date status of the safety infrastructure in a given country, based on all thematic safety areas. The real value of the RaWaSIPs is in their use for planning, monitoring and evaluating assistance given by the IAEA to Member States. A quantitative assessment scheme, using performance indicators, is applied to the information in the RaWaSIP that gives a measure of a Member State’s progress towards achieving compliance with the standards of radiation safety in each of the thematic safety areas. The analyses of RaWaSIPs are used to prepare regional ‘packages’ for future assistance under TC, regular budget and extrabudgetary funds.

**PEER REVIEWS**

At the request of a Member State, the TC programme supports an assessment of the national radiation, transport and waste safety infrastructure by a team of independent experts, adding credibility to Member State and IAEA assessments. These peer reviews are entirely based on international standards and guidance.

The IAEA also encourages and supports periodic self-assessment of the national infrastructure by Member States. Self-assessment tools, based on these peer reviews, will be used by Member States to measure their continuing improvement against international standards and guidance.
INTERNATIONALLY CONNECTED

The IAEA has a long history of partnership with other agencies and organizations to ensure that all aspects of safety and security are fully taken into account. Among others, TC has long standing relationships with the following bodies:

**FAO**
Food and Agriculture Organization

**ILO**
International Labour Organization

**NEA**
OECD Nuclear Energy Agency

**UNEP**
UN Environment Programme

**WHO**
World Health Organization

The IAEA is actively strengthening existing partnerships and seeking to establish new links with both public and private sector institutions.

REGIONALLY INTEGRATED

Recognizing that each corner of the globe has unique characteristics and faces specific challenges, the TC programme has a strong regional component designed to promote knowledge sharing, capacity building and technology transfer across borders. The four regions are:

- Africa
- Asia and the Pacific
- Europe
- Latin America

BUILDING ON A SOLID BASE OF MEMBER STATES

Increasingly, Member States are contributing to regional networks and to the international activities of the IAEA.

Since 1996, more than 90 countries around the world have made significant progress in establishing a radiation protection infrastructure. The knowledge and expertise they are gaining is vitally important to the ongoing development of nuclear science and of associated safety and security standards.
The IAEA needs to tap into these dynamic resources. Standards are effective only when they are broadly applied. In order to address the challenges faced by both developing and developed nations, the IAEA’s expert and user committees must be representative of all Member States. We are seeking individuals from all related sectors — science, policy, public institutions and private industry — who can contribute to IAEA activities and calling on governments to support broader participation.

The return on investment is substantial and mutually beneficial. Each country that establishes a radiation protection infrastructure adds strength to the global safety regime. Increased capacity at the national level enables the IAEA to fulfil its international mandate.

The net gain to all is increased capacity to realize the advantages of radiation based technologies while minimizing the risks.

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