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Harnessing Peaceful Uses: Frameworks for Safety, Security, and Non-Proliferation

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Credit: Dean Calma/IAEA

Technologies using nuclear and radioactive materials have the potential to transform agriculture, healthcare, industry, and energy. However, realising these benefits requires robust frameworks to ensure safety, security, and non-proliferation. This brief outlines the essential elements of these frameworks, from international legal instruments and multilateral commitments to national regulatory systems and export controls. It explains how these interconnected mechanisms work together to enable the

peaceful uses of nuclear technology while protecting people, the environment, and global security.

Benefits of Peaceful Uses of Nuclear and Radioactive Materials

Peaceful uses offer transformative benefits. Taken together, the full range of technologies using nuclear and radioactive material have the potential to contribute significantly to achieving national and global development

goals, including the Sustainable Development Goals, offering solutions for food security, clean energy, industrial innovation, and healthcare access.

Ensuring Safety and Security

Nuclear and radioactive materials must be carefully managed to maximise their benefits while protecting people and the environment against the harmful effects of ionising radiation.

Measures that prevent, mitigate, and respond to the accidental release of radiation through human error or natural catastrophes are called “safety measures”. Measures that protect nuclear and other radioactive materials and facilities from humans intending to use these materials for malicious purposes are referred to as “security measures”. These actions include theft and sabotage of nuclear and radioactive materials and facilities.

In most States, a national regulatory body (the “regulator”) is charged with ensuring that activities related to the use of nuclear and radioactive material and technologies are carried out in a safe and secure manner. The establishment of a national regulatory body is a key step for any State that is using or plans to use these materials and technologies.

International Legal Instruments for Nuclear Safety and Security

The international community has developed and agreed on a comprehensive framework of legal instruments governing the safe and secure uses of nuclear and radioactive materials. This framework and the accompanying obligations of States Parties to these instruments form the global nuclear safety and security infrastructure.

Key instruments include:

- [The Convention on Nuclear Safety \(CNS\)](#)
- [The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management \(Joint Convention\)](#)
- [The Convention on Early Notification of a Nuclear Accident](#)
- [The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency](#)
- [The Convention on the Physical Protection of Nuclear Material \(CPPNM\) and its Amendment](#)
- [UN Security Council Resolution 1540](#)
- [The International Convention for the Suppression of Acts of Nuclear Terrorism \(ICSANT\)](#)
- [The Code of Conduct on the Safety and Security of Radioactive Sources and its Supplemental Guidances](#)

Bilateral, Multilateral, and Institutional Support Commitments

Beyond such international legal instruments, States also establish more specific bilateral and multilateral arrangements with relevance to the safety and security of materials and technologies.

Bilateral nuclear cooperation agreements form the backbone of these relationships, establishing protocols for technology transfer, training programmes, and emergency response mechanisms. Such bilateral (and often trilateral with the IAEA as a third party) arrangements encompass nuclear supplier

agreements that regulate the transfer of materials and technology while ensuring their responsible use, and typically include provisions for ensuring the safety and security of the materials transferred.

Regional cooperation frameworks also play a vital role, particularly in emergency preparedness and response. States sharing geographical borders often develop mutual assistance agreements for radiation detection and incident management.

These commitments strengthen the global architecture supporting nuclear and radiological safety and security while fostering international collaboration.

National Responsibilities and Stakeholders

Implementing national frameworks for nuclear and radiological safety and security requires coordinated effort. The range of typical stakeholders includes government ministries, such as energy authorities, health ministries, and environmental protection agencies, as well as nuclear regulators, law enforcement, and intelligence agencies.

These entities work in concert with regional and local emergency management organisations and law enforcement to ensure the safety and security of nuclear and radioactive materials and facilities in a State.

There are also a number of private stakeholders that form part of the national framework supporting nuclear safety and security. Technical support organisations, including nuclear research centres and academic institutions, provide essential scientific expertise and training capabilities to support these government stakeholders.

Industry partners, comprising facility operators, equipment manufacturers, and service providers, implement safety and security measures to meet regulatory requirements. Transport companies ensure the secure movement of nuclear materials within and across national borders.

Role of the Regulatory Body

The national regulatory body for nuclear and/or radioactive material and technologies is responsible for authorisation, assessment, review, and inspection of activities and facilities to ensure regulatory requirements for safety and security are being met. The regulatory body also helps to build public trust through transparent oversight. With these responsibilities, it protects public health and safety as well as the environment.

The authorisation process, a core function of the regulatory body, includes the comprehensive review of safety assessments, evaluation of safety and security plans, and verification of operator competence. Through careful consideration of these elements, the regulatory body issues licenses and permits that enable nuclear activities.

After authorisation, ongoing activities of the regulator, such as review, assessment and inspection, ensure compliance by the operator with the licence obtained. In cases of non-compliance, the regulatory body often has the possibility to take legal action.

In line with IAEA standards and guidance, regulators typically use a “graded approach” to nuclear safety and security, with more stringent requirements applying to higher-risk facilities and activities. This ensures that resources are allocated efficiently and that the highest-risk facilities and activities receive the most attention.

The regulatory body's independence is crucial for objective decision-making and effective oversight, free from undue influence by entities promoting or utilising these technologies.

Non-Proliferation Obligations, International Safeguards, and Export Controls

Nuclear safeguards are a fundamental obligation under Article III of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), applicable to all States Parties to the Treaty, regardless of their nuclear material holdings. Comprehensive safeguards agreements (CSA), based on INFCIRC/153 (Corr.) and concluded between the IAEA and each non-nuclear-weapon State Party to the NPT, are the basis of the modern framework through which States declare their nuclear material and accept IAEA verification measures.

An additional protocol to the safeguards agreement provides the IAEA with access to more information and locations that help to verify the absence of undeclared nuclear material and activities. Safeguards are implemented on nuclear material as defined by the IAEA Statute and INFCIRC/153 (Corr.), and in related facilities, but not on other radioactive materials that are used in a wide range of peaceful applications, such as agriculture, healthcare, and industry.

Export controls are fundamental to preventing nuclear proliferation under the NPT. They are rules and guidelines designed to maintain the peaceful nature of global nuclear trade, preventing nuclear material, equipment, and dual-use items from being diverted for malicious purposes. In this way, they contribute to global confidence in the peaceful use of nuclear materials and technologies as

well as their safety and security.

The guardrails for nuclear trade are created by two multilateral export control regimes.

The Zangger Committee is a group of States that supports the implementation of the NPT by specifying the materials and equipment whose transfer requires IAEA safeguards to prevent nuclear proliferation. The Nuclear Suppliers Group (NSG) has created additional protections, such as controls on dual-use items and restrictions on exports of enrichment and reprocessing technology.

Once agreed in these informal bodies, adopting and implementing the controls is a national competency. UN Security Council Resolution 1540 mandates all UN Member States to establish effective domestic measures, including export controls, to prevent the proliferation of weapons of mass destruction.



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