

PNNL-SA-74182

International Safeguards Infrastructure Development

NGSI Lecture Series, 2010

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Structure

- ▶ Overview of the Milestones Process and its three phases
- ▶ National Development of a Safeguards Infrastructure
 - Legislation
 - International Instruments
 - Regulation
 - Safeguards-related infrastructure
 - Human Capital Development
 - Safeguards Culture
- ▶ Continuing Challenges

Nuclear Renaissance

- ▶ 50+ countries pursuing nuclear power to meet energy needs.
 - Driven by increasing energy demand, interest in diverse energy supplies, and concerns about global climate change.
 - Few have experience operating nuclear power plants.
- ▶ Nuclear newcomers face a range of issues before bringing a plant online
 - Nearly all issues are complex and interrelated.
 - Extensive planning required 10 to 15 years before reactor is brought online
- ▶ International interest to collaborate with countries preparing for nuclear power



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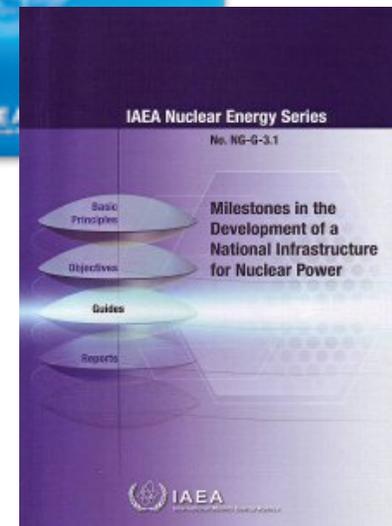
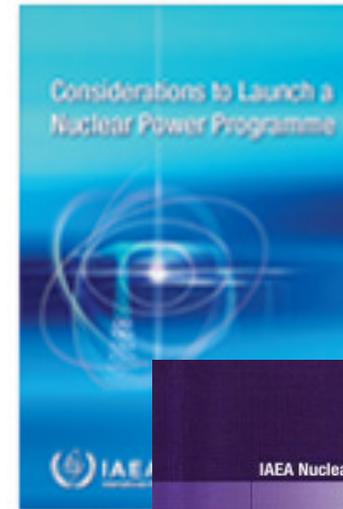
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Where to Begin?

- ▶ Does nuclear power have a place in our energy portfolio?
- ▶ If so, when should our first plant come online?
- ▶ How many nuclear power plants do we need?
- ▶ What size plant can our grid support?
- ▶ How much will it cost us to construct the plant?
- ▶ Where are we going to get the money?
- ▶ How will we train future staff members?
- ▶ What are we going to do with the nuclear waste that is generated?

“Milestones” Documents

- ▶ *Basic Infrastructure for a Nuclear Power Project*, IAEA-TECDOC-1513, IAEA, Vienna (2006)
- ▶ *Considerations to Launch a Nuclear Power Programme*, IAEA, Vienna (2007)
- ▶ *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No. NG-G-3.1, IAEA, Vienna (2007)
- ▶ *Evaluation of the Status of National Nuclear Infrastructure Development* (2008)

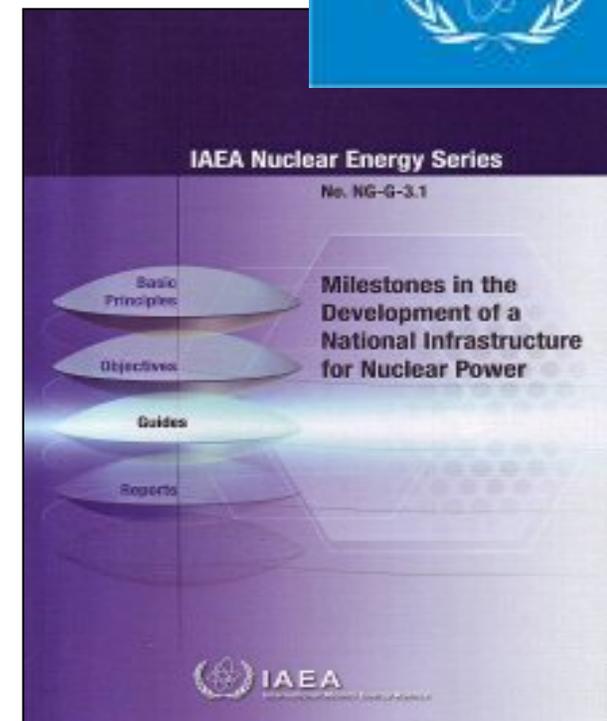


Infrastructure Development Milestones: Overview

Development and implementation of an appropriate infrastructure to support the successful introduction of nuclear power and its safe, secure, peaceful and efficient application

IAEA Milestones document provides guidance in 19 different areas to help countries reach three major milestones.

- 1) Ready to make knowledgeable commitment
- 2) Ready to invite bids
- 3) Ready to Commission & Operate

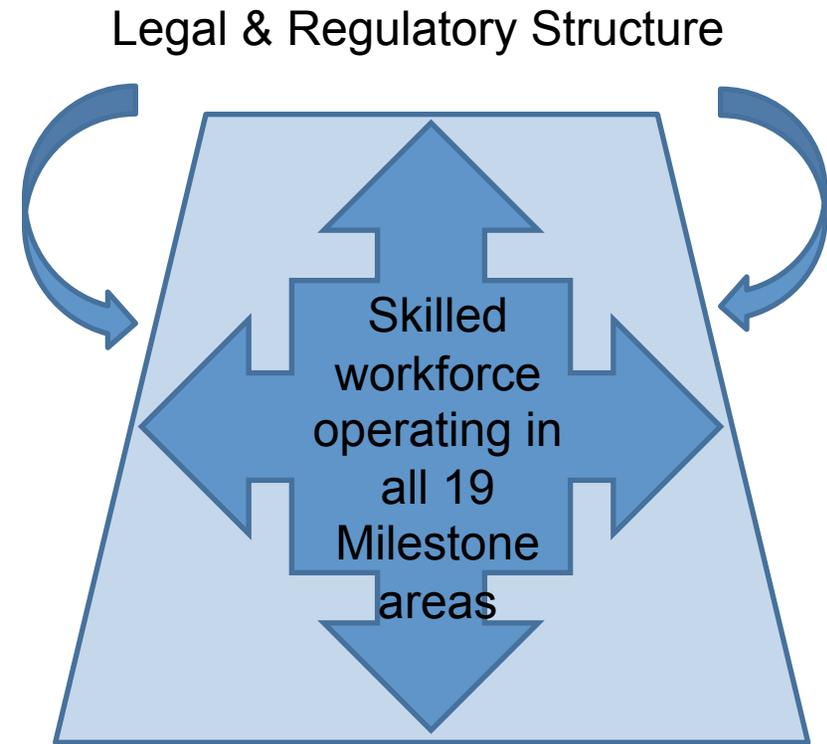


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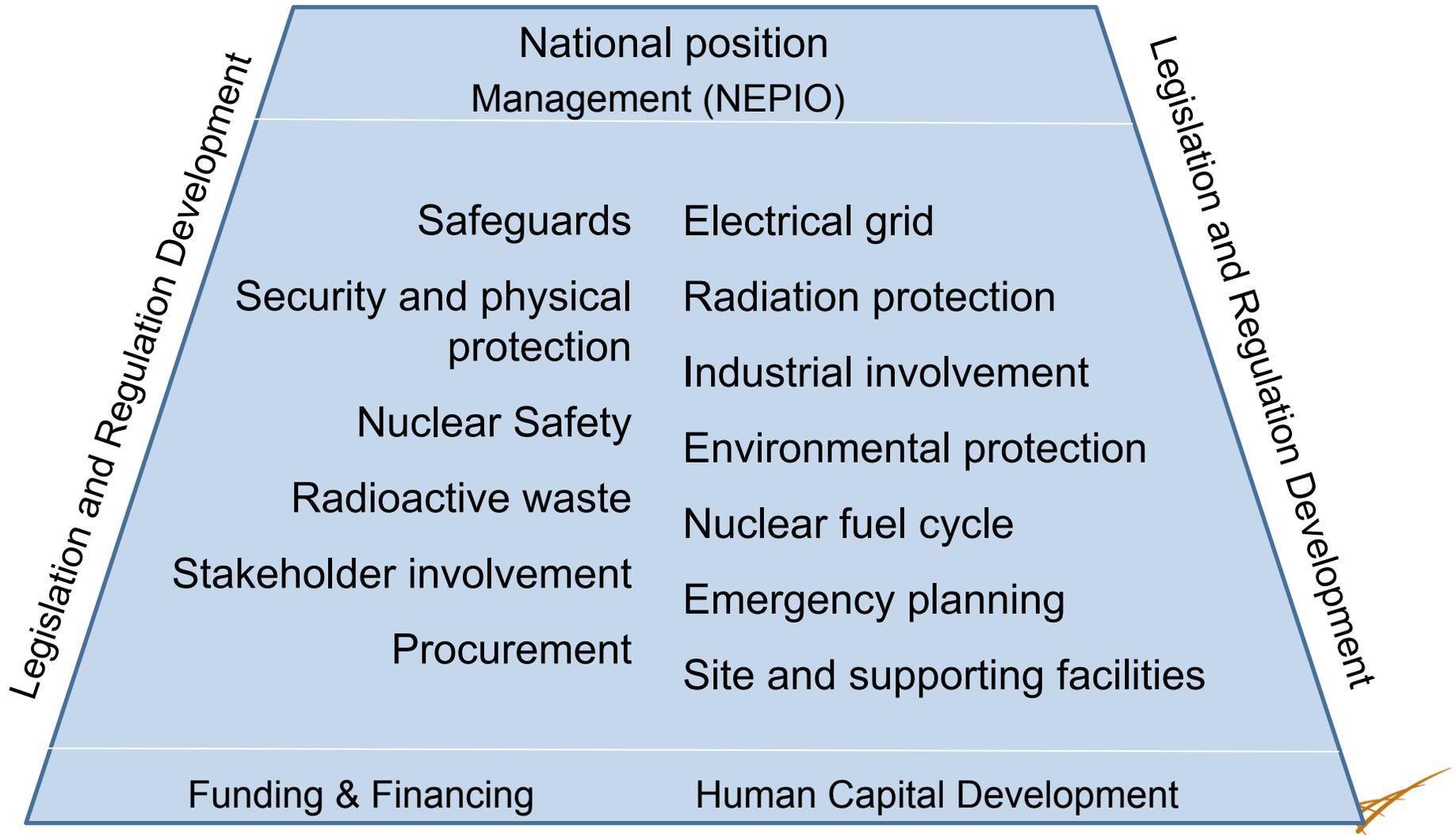
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A System of Infrastructure Elements

- ▶ System -- set of interacting or interdependent entities forming an integrated whole.
 - Structure
 - Behavior (inputs/outputs)
 - Interconnectivity



Milestones Framework

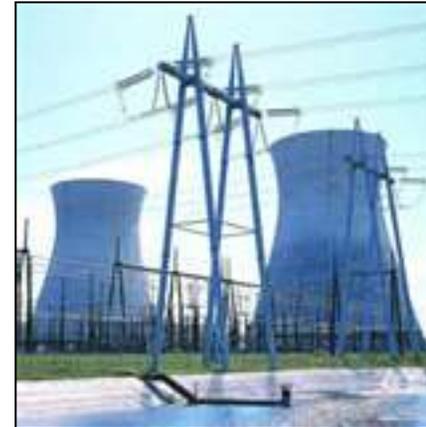


Milestone 1: Ready to Make a Knowledgeable Commitment

- ▶ Adopt a clear statement of intent
- ▶ Establish a NEPIO to oversee nuclear planning and preparation of all 19 Milestone areas
- ▶ Establish a stakeholder involvement program
- ▶ Establish SSAC
- ▶ Begin development of safety (security and safeguards cultures)
- ▶ Understand international obligations that must be addressed through national laws and regulations
- ▶ Begin development of national legislation and regulations pertaining to the oversight of the nuclear facilities
- ▶ Conduct HCD needs and resource assessment

Milestone 2: Ready to Invite Bids

- ▶ Owner/operator designated; assumes responsibility
- ▶ Enact appropriate laws
- ▶ Establish independent regulatory body
- ▶ Provide adequate funding and staff for SSAC to begin early reporting to IAEA.
- ▶ Establish policies for spent fuel and nuclear waste management
- ▶ Develop plan for human capital development to address recruitment, education and training for all 19 areas.



Milestone 3: Ready to Commission and Operate

- ▶ Basic infrastructure to license, regulate and operate a NPP has been established.
- ▶ Major implementing bodies (regulator, SSAC etc) are fully staffed and funded
- ▶ Staff are adequately trained and can fulfill responsibilities and meet international standards
- ▶ Funding and financing plans cover entire lifecycle of nuclear power program.

Legal Framework

National Constitution
National Legislation
International Instruments

Development & Infrastructure

- National Policies on Peaceful Uses
- National Support Structure (SSAC)
- Integration with other national programs
- Emergency Response
- Liability Regime
- Decommissioning & Disposal

Regulatory Regime

- Statutory Authority
- Implementing Regulations
- License (inspection & enforcement)
- Industry Codes
- Guidance Documents
- Operator's Procedures and Plans



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National Legislation Development

Nuclear Law –

“The body of special legal norms created to regulate the conduct of legal or natural persons engaged in activities related to fissionable materials, ionizing radiation and exposure to natural sources of radiation”

– *Handbook on Nuclear Law*, ch. 1.2 (IAEA 2003)

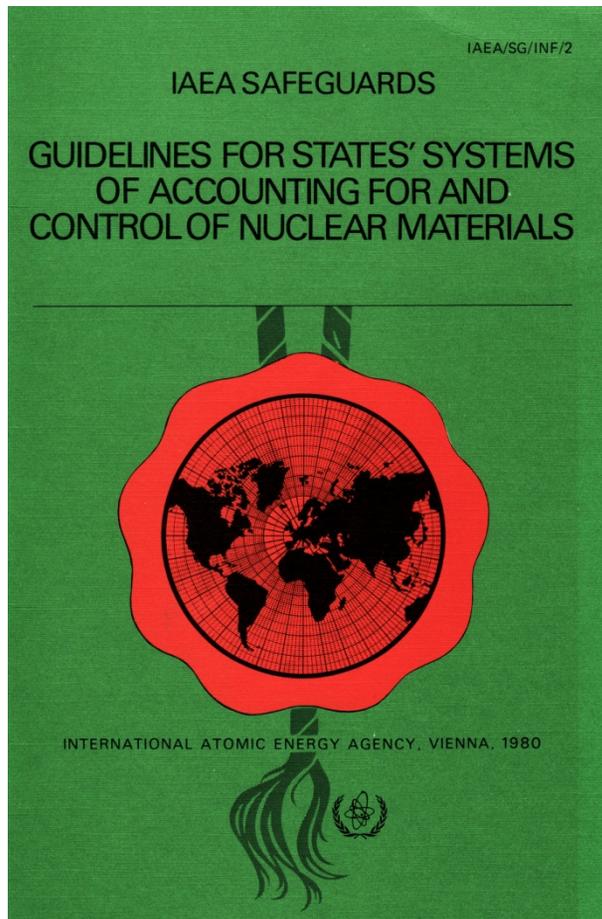
- ▶ Energy policy, economic and commercial considerations
- ▶ Establishes independent regulatory body and system of licensing, inspection and enforcement
- ▶ Foreign investment, roles of vendors and suppliers
- ▶ Defines national government structure, roles, and responsibilities
- ▶ Fuel cycle issues, nuclear material ownership
- ▶ Human resource development provision
- ▶ Commitment to use nuclear power for peaceful purposes.



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National Legislation and Regulations

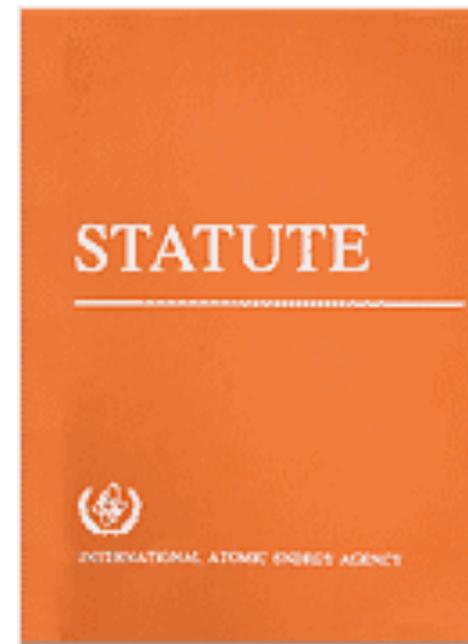


“The State should make (and regularly review) the necessary laws, regulations or other measures to ensure that the requirements for [safeguards] are met throughout the area within its jurisdiction. These laws, regulations or other measures should include the requirements in respect of nuclear material, facilities, international transfers.”

-- IAEA SSAC Guidelines

IAEA Statute

- ▶ Approved: 23 October 1956
- ▶ Entry into force: 29 July 1957
- ▶ Amended 3 times
- ▶ Establishes the IAEA
- ▶ Sets forth IAEA authorities, functions and responsibilities:
 - ▶ to establish and administer safeguards
 - ▶ examine facility designs to ensure they permit effective application of safeguards
 - ▶ Establish staff of inspectors
 - ▶ Access for inspectors
 - ▶ Receive reports



NPT, Article III

- ▶ Date of adoption: 12 June 1968
- ▶ Date of entry into force: 5 March 1970
- ▶ Prevent spread of nuclear weapons
- ▶ Promote peaceful uses of nuclear energy
- ▶ Call for disarmament and an end to the nuclear arms race
- ▶ Under Article III
 - ▶ NNWS agree to accept safeguards, as set forth in an agreement with the IAEA, for the exclusive purpose of verification of the fulfillment of their NPT obligations
 - ▶ Safeguards are implemented in accordance with article IV of the treaty
 - ▶ NNWS conclude agreements with the IAEA in accordance with the IAEA statute



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IAEA Safeguards Agreements

- ▶ Non-Nuclear Weapon States are required to conclude a [comprehensive safeguards agreement](#) (INFCIRC/153) with the IAEA on all nuclear materials and activities in the State.
 - Subsidiary attachments – specify how procedures will be applied
 - Facility attachments – details procedures for a specific facility
- ▶ Nuclear Weapons States implement [Voluntary Offer safeguards agreements](#) with the IAEA to cover parts of their civil nuclear fuel cycles.
- ▶ Non-NPT Member States implement [item-specific safeguards agreements](#) (INFCIRC/66), which cover specified materials, facilities and other items.
- ▶ Multi-lateral Safeguards Agreements (e.x. Quadripartite Agreement)

Small Quantities Protocol

- Eligibility requirements include:
 - Little or no nuclear material and
 - No nuclear material in a nuclear facility
- Holds in abeyance much of State's reporting and access requirements
- Does not hold in abeyance:
 - Obligation not to divert nuclear material to proscribed uses
 - Requirement to establish State System of Accounting for and Control of Nuclear Materials (SSAC)
 - Report annually imports and exports of nuclear material to IAEA

An SQP “expires” once a state acquires a quantity of nuclear material exceeding amounts specified in its CSA OR once a state has decided to “construct or authorize construction of a facility”



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Additional Protocol (INFCIRC/540)

Increased access to and information about

- ▶ All aspects of a State's nuclear fuel cycle,
- ▶ all buildings on a nuclear site (short-notice inspector access),
- ▶ other locations where nuclear material for non-nuclear uses is present,
- ▶ fuel cycle-related R & D
- ▶ manufacture and export of specified equipment and non-nuclear materials, manufacturing and import locations
- ▶ Collection of environmental samples beyond declared locations
- ▶ Administrative arrangements (multi-entry visas, inspector designation)



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Promoting Universal Acceptance of AP

Agency Perspective

- ▶ Information Driven Safeguards: relies on a much broader set of information about a state's nuclear activities to provide an overall picture of safeguards within a state and broad conclusions with respect to potential undeclared nuclear materials and activities
- ▶ IAEA State Evaluations: a continuous process of evaluating all information available to the IAEA about a State's nuclear program and related activities

State Perspective

- ▶ Integrated Safeguards: the optimum combination of safeguards measures to ensure the effective and efficient implementation of safeguards in a state.
- ▶ Demonstrates nonproliferation bona fides
- ▶ Facilitate reactor and equipment transfers

Regulatory Framework

- ▶ Regulatory body
 - Effectively independent of organizations or bodies charged with the promotion of nuclear technologies or responsible for facilities or activities
- ▶ Regulations
 - Mandatory
 - Internationally recognized standards and recommendations
 - Establish requirements with which all operators must comply
 - Provide framework for more detailed conditions and requirements in individual authorizations
 - Serve as basis for inspection
- ▶ Guides
 - Non-mandatory
 - Guidance on how to comply with regulations



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International versus Domestic Inspections

- ▶ International inspection – a set of activities carried out by IAEA inspectors at a facility or a location outside facilities to verify that NM declared and placed under safeguards remains in peaceful nuclear activities or is otherwise adequately accounted for**
- ▶ Domestic inspection – a set of activities carried out by inspectors of the regulatory authority to determine whether licensee’s NMAC program meets regulatory requirements
 - Licensee has responsibility to establish and implement NMAC program to control and account for NM to prevent and detect loss, theft, or diversion
 - Domestic inspector’s role is to ensure licensee’s NMAC program is adequate

National Inspections

Regulatory system is “an illusion” if it lacks adequate licensing, inspection and enforcement mechanisms.

- **Licensing:** any activity related to the use of NM and technology that could pose unacceptable risk to public health, safety or the environment must be authorized.
- **Inspection:** Announced and unannounced inspections ensure all work practices comply with regulations and license conditions and deficiencies are addressed.
- **Enforcement:** Prevents non-compliance with health, safety, security and environmental requirements specified in regulations and license.
 - Written warnings
 - Civil monetary penalties
 - License revocation
 - Criminal penalties

SSAC

- ▶ A national safeguards system typically has both an international objective –
 - To provide the essential basis for application of IAEA Safeguards
- ▶ As well as a national objective –
 - To account for and control nuclear material in the State and to help detect possible losses or unauthorized use or removal of nuclear material

	International Safeguards	Domestic Safeguards
Purpose	Verify international nonproliferation commitments	Protect nuclear material
Threat	State with jurisdiction over nuclear material and activities	Sub-state actors (could be directed by another State)
Means	Material accountancy, containment/ surveillance, strengthened safeguards measures	Material control and accounting; physical protection
Responsible parties	IAEA, State, facilities, persons required to report under Additional Protocol	State, facilities
Key international drivers	NPT, CSA or VOA, Additional Protocol	UNSCR 1540

SSAC Requirements

- ▶ IAEA has access to operating and accounting records, NM, and relevant locations.
- ▶ Operator submits design information via DIQ as soon as decision is made to construct facility
- ▶ Operator submits Operational Program, incl. PITs
- ▶ Users of NM maintain NMC&A system
 - Operating and accounting records
 - Categories of nuclear material for accounting and control purposes
 - Material Balance Areas with key measurement points, C/S possibilities, type of accounting
 - Measurement system that meets international standards
 - Operating and accounting records and reports
- ▶ Exports and import notification



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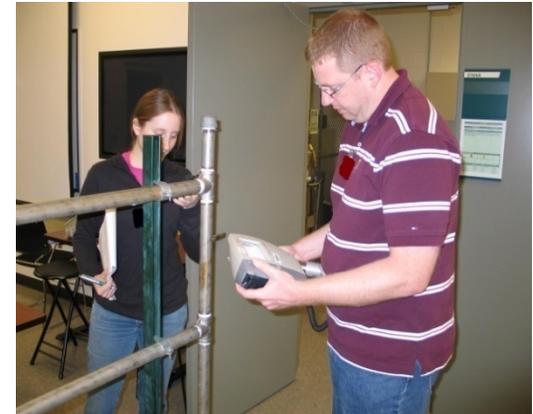
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Human Capital Development

The development of “knowledge and skills necessary to purchase, properly construct, license, operate maintain, and comply with regulations of a nuclear power plant...”

Milestones (3.10)

- ▶ Varies widely, depending on national needs
- ▶ Is required for indigenous development and turn key operations
- ▶ Start early in the planning process and be considered for the long term
 - Needs and resource assessments, development strategies, action plans
- ▶ Focus on education and training in a variety of areas supporting a nuclear power program
- ▶ Utilize a variety of national and international partners



Human Resources for Safeguards Implementation

Areas of Expertise

- Engineering
- Materials science
- Physics
- Health Physics
- Chemistry
- Radiochemistry
- Hydrology
- Geology
- Nuclear Law
- Political Science
- Management
- Accounting
- Statistics
- Construction
- Information Technology

Job Categories

- ▶ First Responders
- ▶ Safeguards Practitioners
- ▶ Physical Protection/Security specialists
- ▶ Law enforcement
- ▶ Emergency planners and responders
- ▶ Safety experts
- ▶ Plant Managers
- ▶ Operators
- ▶ Regulators
- ▶ Financial Planners
- ▶ Energy Planners
- ▶ Operators

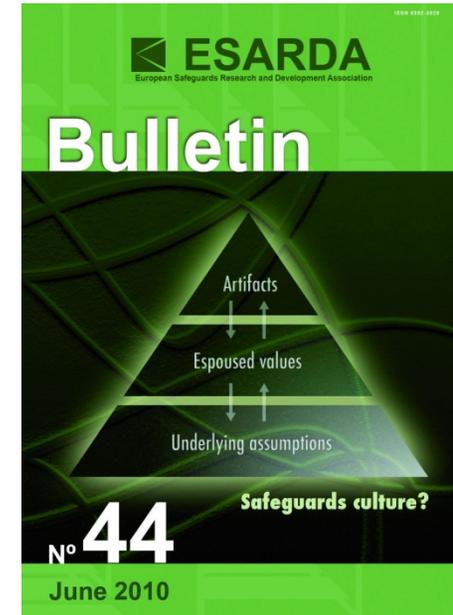


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A Final Note: Safeguards Culture

- ▶ In states with strong safeguards cultures, safeguards is instilled in the people and organizations responsible for implementation.
- ▶ Safeguards is no longer viewed as an activity that must be done to please someone else or meet someone else's standards. It has become part of the personal values and beliefs system.



A shared belief among individuals, organizations, and institutions that strict attention to international safeguards requirements and affirmative cooperation with safeguards authorities will enhance their nonproliferation stature and benefit their missions.



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Challenges

- ▶ Prioritization of investment – how to make safeguards a top priority
- ▶ Timelines – understanding factors that impact implementation timeline
- ▶ Limited resources for training safeguards specialists
 - In NWS, retiring workforce
- ▶ Appreciating importance of investing in developing of safeguards infrastructure



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