

**Nuclear Safeguards Concepts, Requirements, and  
Principles applicable to Nuclear Security**

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## **I. Nuclear Safeguards**

### **1. Principles of Safeguards :**

Nuclear safeguards or commonly known as the safeguards implemented by the International Atomic Energy Agency (IAEA) is based on the principles of the Non-Proliferation Treaty ( NPT ). NPT is the centerpiece of global efforts to prevent the further spread of nuclear weapons which entered into force in March 1970 after being ratified by 40 States. Today, it is the treaty most widely adhered to in the field of disarmament and nonproliferation by more than 190 States party.

Although the IAEA is not party to the NPT, it has an essential verification role under the Treaty. Under Article III of the NPT, each non-nuclear-weapon State party to the NPT is required to conclude an agreement with the IAEA in order for the IAEA to verify the fulfillment of its obligation not to develop, manufacture, or otherwise acquire nuclear weapons or other nuclear explosive devices.

An objective of the safeguards is to prevent diversion of nuclear material from peaceful uses to nuclear weapons or other nuclear explosive devices ( Article III. 1 of the NPT ). It is applied to all of a State's source or fissionable material in all of its peaceful nuclear activities, under its jurisdiction, or carried out under its control anywhere ( Article III.1 NPT ). It also requires that a comprehensive safeguards agreement needs to be agreed with the IAEA and entered into force ( Article III.4 ). Although there are various types of safeguards agreements ( Comprehensive Agreement, Voluntary Offer Agreement, Item Specific Agreement( INFCIRC 66 ) ), the vast majority of States have undertaken to conclude the safeguards agreement and to allow the IAEA to verify that undertakings.

The State's motivation for concluding the safeguards agreement is clear. It not only gives assurance of nonproliferation but also receives benefit of peaceful uses of nuclear technology. It also helps to create regional confidence building and an international norm of nuclear nonproliferation and peaceful use of nuclear energy.

Therefore the acceptance and implementation of the safeguards serve as important confidence building measures, through which a State can demonstrate – and other

States can be assured – that nuclear energy is being used only for peaceful purposes.

## **2. Safeguards Concepts :**

The safeguards regime is based on the concept of nuclear material accountancy and verification by the IAEA. A variety of verification activities are performed at a facility including the verification of nuclear material accountancy and the verification of facility design.

The objectives of the nuclear material accountancy verification are to ensure that the nuclear material accounting records of a facility are compared for consistency with what has been reported by the State to the IAEA and are verified that the nuclear material is actually at the facility as declared. Facility design is also examined for its accuracy and compared with the data described in the design information questionnaire that the State had submitted to the IAEA.

When all of this information has been verified as correct and complete, it can be evaluated for the purpose of drawing safeguards conclusions. Inventory of nuclear material is verified using a range of techniques. These include the counting the items present and making measurements, using radiation detectors and/or taking samples for more detailed analysis at IAEA headquarters. Domestic and international transfers of nuclear material as well as other inventory changes are also verified. It must also be confirmed that the facility is operation as declared and it has not been misused to produce undeclared material. Facility design information provided by the State to the IAEA is examined and verified in accordance with established IAEA procedures.

Containment and surveillance techniques such as seals, surveillance cameras and detectors may be used to provide continuity of knowledge over nuclear material and facilities between inspections by preventing undetected access to nuclear material or undeclared operation of the facility. Environmental samples may also be taken for analysis in order to verify that the facility has been used as declared by confirming the traces of nuclear material present.

It is also a part of the safeguards approach to examine the potential strategies that a State might engage in clandestine nuclear activities in contravention of the agreement to a potential diversion of nuclear material or the misuse of a facility as well as to ensure there has been no tampering with the installed containment and surveillance equipment.

### **3. Strengthened Safeguards and Current Development :**

It is well known that the IAEA's experience in the early 1990s in Iraq and in the DPRK highlighted the limitations of safeguards implementation and it has dramatically changed the safeguards system. The strengthened safeguards system currently implemented is based on the Additional Protocol (Protocol additional to the Safeguards Agreement).

The Additional Protocol requires not only to verify that State declarations of nuclear material subject to safeguards are 'correct', i.e. they accurately describe the type(s) and quantity(s) of the State's declared nuclear material holdings, but that they are also 'complete', i.e. they include everything that should have been declared. This determination was a major catalyst for efforts to equip the safeguards system with important new tools to verify 'completeness'.

The purpose of all of the measures is to increase transparency (i.e. knowledge and understanding) about a State's nuclear material, activities and plans by

- (i) increasing the scope and depth of safeguards relevant information available ;
- (ii) enhancing access to safeguards relevant locations in States beyond declared facilities ; and
- (iii) using state of the art technical verification measures.

The overarching aim is to provide credible assurance regarding the non-diversion of nuclear material from declared activities and the absence of undeclared nuclear material and activities for a State as a whole.

Currently, the safeguards approach taken by the IAEA is more towards a holistic approach in the safeguards implementation which is applicable to all States and is based on a comprehensive State evaluation and a State-level approach taking into account specific safeguards measures for an individual State. Considering the

State as a whole provides the opportunity to take State-specific factors into consideration in all stages of safeguards implementation. Implementation of the State-level concept is responsive to changes in the analysis and more emphasis is given to collection and evaluation of the information about the State's relevant nuclear activities.

#### **4. Cooperation with State Authorities :**

In order to implement an effective safeguards, the safeguards system needs to count on a State to cooperate with its implementation. The importance of such cooperation is reflected in safeguards agreements, which require a State to establish and maintain a State System of Accountancy and Control (SSAC). In two cases, (the European Union and Argentina–Brazil) there is a Regional System of Accountancy and Control (RSAC).

SSACs can have a variety of functions and have many obligations with regard to safeguards requirements. They are responsible for submitting design information to the IAEA, making sure that nuclear facility operators maintain the correct records and providing for physical access to facilities and other locations. They must also make sure that nuclear plant operators are able to measure quantities and types of nuclear material precisely and accurately and that their equipment and measuring systems meet the highest international standards.

SSACs can also help to resolve any problems that arise during in-field verification activities. For its part, the IAEA is required, in its verification activities, to take account of the technical effectiveness of the SSAC. Most States with significant nuclear activities have SSACs that are capable of supporting the IAEA's basic verification activities effectively and the best SSACs have a high degree of technical expertise and experience.

## **II. Safeguards and Security**

## **1. Legal Framework :**

The legal framework of the safeguards is the Non- Proliferation Treaty (NPT), Safeguards Agreements ( Comprehensive Agreements, Voluntary Offer Agreements, INFCIRC 66 Type Agreements, SQP Type Agreements) and Additional Protocols.

Under the Comprehensive Safeguards Agreement ( INFCIRC 153 corr. ), safeguards are applied on all source or special fissionable material in all peaceful nuclear activities within the territory of State, under its jurisdiction or carried out under its control anywhere.

The objective of the safeguards is the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by risk of early detection.

On the other hand, the security regime is based, inter alia, on Convention on the Physical Protection of Nuclear Material & Amendment, Convention on the Suppression of Acts of Nuclear Terrorism, Security Council Resolutions ( 1540, 1373 ) and Code of Conduct. Based on these legal instruments, the Security regime is aimed at protection of nuclear material and other radioactive material against theft during use, storage or transport, and to retrieve and return of the lost material, and to protect facilities, location and transports against acts of sabotage, to fulfill the obligations from international instruments in implementing international norm and guidance.

Particularly INFCIRC 225 delineates that the objectives of the State' physical protection system should be 1) to establish conditions which would minimize the possibilities of unauthorized removal of nuclear material and /or sabotage, and 2) to provide information and assistance in support of rapid and comprehensive measures by the State to locate and recover missing nuclear material and to cooperate with safety authorities in minimizing the radiological consequences of sabotage.

## **2. Governance Requirements :**

Both safeguards and security have similar requirements for governance in order for States to carry out their obligations and responsibilities. States need to develop and implement nuclear policy on safeguards and security. There need to be relevant nuclear laws and regulations, which will be implemented by competent regulatory bodies for licensing, monitoring, inspection and enforcement.

For safeguards, there are legal obligations under relevant Agreement to maintain adequate nuclear material accounting and control system, sending regular reporting and information, and providing access for international inspections. In safeguards, legally binding systems of nuclear material accountancy and control, and verification are the two key components of the effective governance.

On the other hand, most of the international norms and guidance for security are not legally binding but States are expected to conform to its contents through establishing appropriate security structures to implement necessary security measures. States' responsibilities also include coordination among various regulatory bodies and law enforcement offices in regulation of the physical protection system.

At facility level, the responsibilities of the operators are also similar for safeguards and security. They have to implement all requirements and regulations of nuclear material accounting and control, physical protection, necessary reporting, maintaining quality management through adequate national license. Performance assessment and audit of activities as well as training of personnel will be a common requirement for both safeguards and security. For safeguards, depending types of facilities, there will be scheduled or unscheduled international inspections by the IAEA.

### **3. Technical Objectives**

In comparing the technical objectives of safeguards and security, there are some different points. For safeguards, the focus is on the State and its nuclear activity regarding its compliance with the legal obligations under relevant safeguards Agreement. Accordingly, the safeguards activities are aimed at State's nuclear

activities as a whole. The scope of the safeguards is focused on all nuclear material applicable to the nuclear explosive. The timeliness concern for the detection of diversion and misuse is set in the order of a month or more based on a possible conversion time to the nuclear explosives.

For security, the concern for threat is more on non-state actors, criminals, terrorists and acts of sabotage by insiders. Scope of the material is broader to cover all nuclear material and radiological substances. The timeliness concern is much shorter to be real time or immediate concern.

#### **4. NMA&C and Security**

Nuclear material accountancy and control (NMA&C) is an essential element in the implementation of safeguards and it is also an important factor for successful security undertakings. NMA&C manages the registration of sensitive nuclear material through maintaining accurate bookkeeping and balance of the inventory of material. Comprehensive measurements of nuclear material and information of operating data at the facility are applied to obtain up-to-date information. Furthermore NMA&C not only maintains the bookkeeping of nuclear material inventory but also keeps track of their locations, movements and changes of characters. It is also set up to perform regularly a material balance evaluation for a fixed time period in order to identify any material unaccounted for (MUF).

In safeguards, the records and reports made by the MNA&C are subject for audit and examination by national and international inspection bodies. They often make an independent measurement and verification of nuclear material and confirm correctness and completeness of the NMA&C declarations.

The facility operators dealing with NMA&C are closely connected with the nuclear safeguards activities but they are normally not part of the nuclear security environment. Interaction between these groups and exchange of relevant information is of particular importance in view of the nature and sensitivity of information.

## 5. Synergy between Safeguards and Security :

In considering synergy between safeguards and security, there are some common points : They are both aimed to deter and detect unauthorized removal of nuclear material, to provide assurance that all nuclear material is accounted for, to provide a timely detection of material loss or diversion, and to determine amount and location of any missing material.

There are areas where safeguards and security can interact to improve effectiveness and efficiency in achieving their objectives :

- R&D of NDA equipment and surveillance system
- Analysis capability ( i.e. Nuclear forensics, DA )
- Nuclear trade and Illicit trafficking analyses
- Advisory Missions ( i.e. ISSAS, IPPAS Missions )
- Training and Outreach programs
- Safeguards and Security by-design
- IT security and prevention of damages
- Risk Assessment and Emergency Response
- Quality Management System

In these areas, there are already some interactions and exchange of information between safeguards and security but the level of cooperation is still limited. It will be a mutual benefit to identify specific issues in these areas which can be enhanced for further cooperation. Particularly it will be useful to examine common areas for improvement regarding governance, policy and management systems.

Another aspect of the synergy is the interaction between IAEA and States. In safeguards, IAEA is the primary actor based on the legally binding safeguards agreement and States are required to cooperate in its implementation. In security, States are regarded as primarily responsible actors while IAEA is requested to provide guidance and best practices. In both cases there are tendency to be more increased and balanced share of cooperation and responsibility between States and IAEA.

In any case, the role of the IAEA is critical as a focal point of interaction and for a possible integration between safeguards and safety. IAEA can provide various technical supports and advices in a coordinated manner to bring safeguards and security closer and more effective.

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