IAEA Regional Seminar on the Protocol Additional to Nuclear Safeguards Agreements

Lima, Peru
4 - 7 December 2001

SESSION 8: SSACs AND WHAT THEY CAN DO
(States with Nuclear Facilities under Safeguards)

Jaime Vidaurre-Henry
Head, Section for Safeguards Training
International Atomic Energy Agency

INTRODUCTION

The process of introducing a nuclear programme requires a State to take steps to ensure that the use of the nuclear material involved, as well as the nuclear facilities, will be subject to appropriate authorization, coordination, control and supervision. Organizational and technical arrangements to be made by a State in achieving both, national objectives and international safeguards objectives, form the State System of Accounting For and Control of Nuclear Material (SSAC). Such a system can consist of three major components: a legal framework, a State level component and a facility level component. This session will address objectives and principal requirements of the State System of Accounting for and Control of Nuclear Material (SSAC) that arise from the Non-Proliferation Treaty and the Safeguards Agreement with the IAEA.

A safeguards agreement conforming to INFCIRC/153 (Corrected) is required to provide that " ... the State shall establish and maintain a system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement, and that such safeguards shall be applied in such a manner as to enable the Agency to verify, in ascertaining that there has been no diversion of *nuclear material* from peaceful uses to nuclear weapons or other nuclear explosive devices, findings of the State's system. The Agency's verification shall include, inter alia, independent measurements and observations conducted by the Agency in accordance with the procedures specified in Part II below. The Agency, in its verification, shall take due account of the technical effectiveness of the State's system."

Safeguards agreements conforming to INFClRC/66/Rev.2 do not explicitly call for States to establish and maintain an "SSAC", but the fact that the document calls for agreement between the IAEA and the State on a "system of records" and a "system of reports" implies the need for such a system. The establishment of an SSAC is a vital element in carrying out international safeguards. Also as an important tool to improve the operations of a facility an SSAC assists facility operators to improve their effectiveness and efficiency.

An SSAC may have, inter alia, the following objectives:

(a) **A national objective**, to account for and control nuclear material in the State and to contribute to the detection of possible losses, or unauthorized removal of nuclear material.

(b) **An international objective**, in particular, to provide the essential basis for the application of IAEA safeguards pursuant to the provisions of an agreement between the State and the IAEA.

While systems designed specifically for one or the other of these objectives may differ in some details, many technical elements are the same and would contribute to the attainment of both objectives.

The basic elements of an SSAC are set forth in paragraph 32 of INFClRC/153 (Corrected) which calls for an SSAC to be based on a structure of **material balance areas** and includes measures to be specified in the Subsidiary Arrangements.

ELEMENTS OF SSAC

In outlining the State level component of an SSAC, the organizational and functional elements of an SSAC can be addressed in the following six major areas:

a. Authority and Responsibility
b. Laws, Regulations and Other Measures
c. SSAC Information System
d. Establishment of Requirements for Nuclear Material Accounting and Control
e. Ensuring Compliance
f. Technical Support

Each of these areas will be discussed briefly to set a stage for more detailed discussion of some of these topics in other sessions.

Authority and Responsibility

A State will formulate policy, define objectives and assign responsibilities appropriate for both national and international objectives. The authority and responsibilities of a State with respect to the SSAC can be outlined as follows:

A State should:

1) Define its objectives in establishing an SSAC.
2) Designate a nuclear material accounting and control Authority with the responsibility for:

   (a) Establishing provisions governing the possession, transfer and use of nuclear material.
   (b) Ensuring that the State's nuclear material accounting and control objectives are met.
   (c) Serving as the point of contact in implementing Safeguards Agreements concluded with the IAEA.
   (d) Developing and implementing nuclear material accounting and control procedures for the State to discharge its obligations under IAEA Safeguards Agreements.

3) Establish appropriate arrangements for the prompt notification of responsible Government authorities in the event of losses, unauthorized use or removal of nuclear material.

There may be certain advantages in forming the Authority as a single body, but the foregoing responsibilities may be discharged by several separate bodies provided that the duties and responsibilities of each are clearly defined.

Laws and Regulations

Given an SSAC objective to detect loss, theft or diversion of nuclear material, a State needs to have clear knowledge of what material is under its jurisdiction, where it is located, what use is being made of it and who is responsible for it. Further, the State will need measures to assure that this information about the material is accurate. The basis of obtaining this information and for providing assurance of the accuracy of the information can be provided through laws and regulations in the following areas:

1) Definition of the starting point for accounting for and control of nuclear material and the conditions for termination or exemption from accounting and control.

2) Establishment of conditions for possession and use of nuclear material, including establishment of criteria and requirements for a system of accounting for and control of the material.

3) Establishment of requirements for both routine and special reports to the state of information pertinent to nuclear material, including reports of changes in the facility and incidents affecting material accounting and control and reports of incidents involving loss of nuclear material.

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

Information System

The State should establish and maintain an SSAC information system with the following main activities:

(a) Recording and processing of information on nuclear material, provided by facility operators and reported to the State Authority; and

(b) Collecting, processing and recording of the information by the State Authority and preparing of reports for evaluation internally and for submission to satisfy international and possibly national obligations.

(c) Handling of other information to be received from and sent to the IAEA and others such as shippers or receivers in other states.

The State Authority will need to handle various kinds of information to exercise control of the possession, use and disposition of the nuclear material under its jurisdiction.

The size, cost and type (i.e. manual or computer) of such a system will depend on the volume of information to be handled which will, in turn, depend on the type and variety of nuclear materials and facilities in a State. One measure that has been used in this context is the number of entry lines reported to the IAEA each year. This number is obtained by summing the lines in the relevant reports to the IAEA for a year (i.e. Inventory Change Reports and Physical Inventory Lists). A rough indication of the need for a computer system is that if the entry lines in the IAEA report are more than 10,000, some type of computer may be needed for effective data handling.

Regardless of size and complexity, however, a State Authority information system will need to include at least four categories of information:

1) Design information records,
2) Nuclear material inventory and transaction records,
3) Activity and operations reports and records,
4) Records and reports to and from the IAEA.

Establishment of Requirements for Nuclear Material Accounting and Control

While the functional separation between the State level and the facility level may vary from State to State, in general the State level establishes the requirements and criteria for the SSAC and the facility operator implements the system in compliance with the State requirements and criteria. These technical requirements and criteria to be established are outlines in IAEA/SG/INF/2 and include the following:

1) Starting point, termination and exemption of accounting and control
2) Categorization of nuclear material
3) Material balance areas
4) Records and reports system
5) Measurement system
6) Nuclear material flow
7) Physical inventory taking
8) Shipper/receiver differences
9) Material balance closing
10) Measurement control
11) Application of containment and surveillance measures
12) International transfers of nuclear material.

These topics will be discussed in further detail in the chapter “Technical Requirements for Nuclear Material Accounting and Control”.

Ensuring Compliance

Assurance of operator compliance with the requirements and criteria established for an SSAC by the State Authority can be achieved only by a comprehensive audit and inspection programme. Such a programme should have the following objectives:

1) To ensure that **the capability of, and performance by, the facility SSAC** satisfy the requirements and criteria established by the State Authority to meet the State’s international obligations as well as to meet national objectives for accounting for and control of nuclear material.

2) To assure through verification by the State Authority that the accounting and control measures implemented by the facility operator are effective and to conclude that there has been no unauthorized removal or use of nuclear material.

The objectives adopted by the State depend upon the degree that the State wishes to delegate accounting and control responsibilities. Some States, for example, may limit inspections to routine examination of records; others may integrate State inspection activity with those of the IAEA in order to minimize overall cost and maximize effectiveness of particular inspections; and others may elect to carry out an inspection program that provides independent assurance. Inspection activities associated with safety, radia-

tion protection and construction might to some extent be coordinated with accounting and control inspections in order to minimize intrusiveness and cost and to improve effectiveness. In any case the State should recognize that the IAEA includes both objectives in its inspection programmes and does conduct independent verification activities in its inspections as well as the initial design reviews through the DIQs.

Technical Support

Training of staff

Training of personnel responsible for accounting for and nuclear material, at State and facility levels, is critical for the successful operation of an SSAC.

In many countries, first the State Authority needs to train its own staff, to be able to achieve its selected objectives. In this connection, much use can be made of the training courses, fellowships and scientific visits offered by the IAEA. When the training of the State Authority is completed, the facility personnel can also make use of the training courses offered by the IAEA at its Headquarters or in other Member States.

Technical Assistance to the Plant Operator

The State should facilitate the provision of adequate technical assistance, from external sources if necessary, to facility Operators in the area of material accounting and control in order to enable the Operator to fulfill the requirements placed on him by the State. This assistance could, for example, help in establishing adequate records systems and measurement systems, which may incorporate non-destructive assay techniques as well as data processing and analysis procedures. Assistance should be given also to acquire international standards and to establish containment and surveillance measures.

At the facilities, which perform measurements related to safeguards objectives, especially measurements for nuclear material accounting for in bulk-handling facilities, considerable assistance to the Operator may be necessary. Measurements and measurement control programmes at such facilities on which much of the success of the SSAC depends can be quite complex. Evaluation of SSAC programme results also can be complex. The IAEA has published several volumes of the Safeguards Technical Manual, which could be of assistance to States and facility operators. In addition a series of Safeguards Technical Reports is being prepared to provide assistance in establishing SSACs at various types of facilities. Some of these documents are listed on the References of this paper.

TECHNICAL REQUIREMENTS FOR NUCLEAR MATERIAL ACCOUNTING AND CONTROL

One of the six components of an SSAC at the State Authority level is the establishment of the technical requirements for nuclear material accounting and control. We will now focus our discussion on each of these requirements. The requirements of an SSAC will depend, among other things, on the types of nuclear activity and on the form and quantity of nuclear material. States having extensive bulk handling facilities (enrichment, conversion, fabrication, reprocessing) should have SSACs which include all of the requirements, while States having only research reactors or power reactors would not need all of them.

Starting point, termination and exemption of accounting and control

The Authority should consider the following:

(a) **The starting point** for the application of accounting for and control of nuclear material should

be at least as early in the nuclear fuel cycle as is required by the State's international obligations.

(b) Accounting and control should be **terminated** on nuclear material upon determination under the State's international obligations that the material has been consumed or has been diluted in such a way that it is no longer usable for any nuclear activity or has become practicably irrecoverable.

(c) The conditions for **exemptions** from and **termination** of accounting and control should be specified, consistent with the State's international obligations.

For NPT cases safeguards are not applied to material during mining or ore processing activities. When any nuclear material of a composition and purity suitable for fuel fabrication or for being isotopically enriched leaves the plant or the process stage in which it has been produced in the State or is imported into the State, the nuclear material becomes subject to the full safeguards procedures specified in the agreement with the Agency.

The provisions for termination and exemption of accounting and control are specified in paragraphs 11 and 13 of INFCIRC/153.

Categorization of nuclear material

Categorization of nuclear material should be established in order to enable an appropriate balance to be maintained among the significance of different materials. This categorization should consider characteristics such as the material type and isotopic composition (including in particular the content of fissile isotopes), the irradiation level and the measurement methods and uncertainties associated with the material. The categorization should be used, in conjunction with information on quantities of nuclear material involved, in specifying the intensity if accounting and control measures, including the taking of physical inventories and the determination of MUF. For example, plutonium and high enriched uranium could be in the highest category, followed by low enriched uranium, then natural uranium and finally depleted uranium and thorium.

Materials, which can be converted to nuclear explosives without transmutation or further enrichment are defined as direct-use materials, while materials which must be enriched or transmuted to form direct-use materials are defined as indirect-use materials.

Direct-use materials include Pu, U-233, uranium enriched to 20% U-235 or higher, and mixtures of these. **Indirect-use** materials include forms of uranium enriched to less than 20% U-235, thorium and mixtures of these.

Categorization of nuclear materials is strongly related to the concepts of **quantity of safeguards significance** and **conversion time**.

Material Balance Areas

In order to organize a system of nuclear material accountancy, the concept of material balance area (MBA) is applied. An MBA is, exactly as its name would suggest, a physical area in which a balance of the nuclear materials can be made.

The SSAC Authority should establish the factors to be taken into account and the criteria to be met

in the determination of MBAs. The factors should include the need for Key Measurement Points (KMPs), containment and surveillance possibilities (particularly to help ensure the completeness of flow measurement) and the accuracy with which the material balance can be established. The Authority should approve the facility MBAs. States which concluded with the IAEA a Safeguards Agreement based on document INFCIRC/153 (Corrected) should use a system of MBAs which is compatible with the system agreed in the Subsidiary Arrangements between the IAEA and the State.

Records and Reports System

The Authority should establish the requirements for accounting and operating records and reports for each MBA to provide relevant data on nuclear material transactions and operations that affect the accounting for and control of nuclear material.

These subjects are discussed in more detail in further lectures. This session provides a few definitions that will be useful later:

Accounting records - a set of documents kept at each nuclear facility, showing the quantity of each type of nuclear material present, its distribution within the facility and any changes affecting it. This includes the records showing measurement results.

Operating records - a set of documents kept at each facility consisting of organized data on the operation of the facility in connection with the use or handling of nuclear material. The operating records of a nuclear reactor show, for example, the integrated thermal power produced by the reactor for a given period and the associated data of the reactor operation for that period. The operating records of a bulk handling facility include quality control on the measurements.

Accounting report - a statement to the IAEA on the status of nuclear materials subject to safeguards in a defined environment and on the changes in that status since the previous report. Accounting reports are submitted by the State at times specified in the agreements or subsidiary arrangements.

For NPT safeguards three types of routine accounting reports for each MBA are called for: Inventory Change Reports (ICRs), Material Balance Reports (MBRs), Physical Inventory Listings (PILs).

Measurement System

The Authority should establish requirements for a measurement system and measurement uncertainties, including provisions for the determination of nuclear material received, produced, shipped, lost or otherwise removed from inventory and for the determination of inventory quantities based on sampling and chemical or non-destructive analysis, as appropriate.

The measurement system includes personnel, procedures and apparatus used for accounting measurements and should provide for:

- Identification of the key measurement points in the process and the characteristics of the nuclear material to be measured;
- Specification of measurement performance desired;
- Specification of the measurement technique(s) to be employed;
- Equipment maintenance provisions and procedures;
- Operator’s qualifications and provision for training;
- Calibration standards and procedures;

- Routine measurement and data analysis procedures;
- Procedures to control the quality of measurements and to maintain performance at the desired level.

Nuclear Material Flow

The Authority should establish requirements, when relevant, for the accounting and control of the flows of nuclear material, taking into account the degree of assurance to be obtained from containment and surveillance measures. Requirements for measuring, including corresponding uncertainties, and for identifying receipts, shipments, and transfers within a facility should be defined as necessary to provide for periodic material balances.

Physical Inventory Taking

The physical inventory taking is the benchmark of nuclear material accounting and control since it provides conclusive evidence of the physical presence of the material.

The Authority should establish the requirements, including the completeness, frequency and allowable limits of measurement uncertainty, for the different categories of material, of the physical inventories to be taken by the facility operators, taking into account the degree of assurance to be obtained from containment and surveillance measures. Provisions should be made to notify the IAEA in advance of dates when physical inventories will be taken.

Authority requirements for physical inventories should include:

a) a system of stratification of the nuclear material in the inventory;
b) criteria for accepting measurements already made, including provision for the use of seals to assure the validity of the previous measurements;
c) criteria for limiting the quantity of nuclear material in difficult-to-measure forms;
d) criteria for complete or partial clean-out of plants, including criteria to determine the degree of completeness of the clean-out required and methods to assure that those criteria are met; and
e) criteria for taking of a special physical inventory in case, for example, unusually large MUF, an operating accident or unusual loss.

Shipper/Receiver Differences

It is the difference between the quantity of nuclear material as stated by the shipping material balance area and as measured at the receiving material balance area. The Authority should:

a) establish the requirements for identifying, reviewing, evaluating and resolving differences in all shipper/receiver measurements and for deriving the limits of measurement uncertainty of transfers between MBAs within its control; and

b) describe the procedures to be followed when shipper/receiver differences or their limits of measurement uncertainty exceed specified values.

Material Balance Closing

While it is the physical inventory taking that provides evidence of the physical presence of the

material, the material balance based on the physical inventory permits the determination of whether significant losses or discrepancies have occurred undetected. Data, not only from the physical inventory, but also from all components of the material balance must be based on measurements of known uncertainties so that the material balance and MUF resulting from the data can be evaluated and meaningful conclusions reached.

The Authority should:

a) Establish the requirements:
   - for the striking of material balances, and for calculating MUF together with the limit of its uncertainty;
   - for the determination of the components of the material balance through the use of measurements or derived estimates based upon measurement; and
   - for the evaluation of accumulations of unmeasured inventory and unmeasured losses and their limits;
b) Require that MUF should be held to the lowest practicable level;
c) Specify limits for MUF and for the measurement uncertainties associated with MUF, conforming substantially with (or being better than) the latest international standards;
d) Specify procedures to be followed to routinely monitor conformance to these standards; and
e) Prescribe procedures to be followed when MUF or the measurement uncertainties associated with MUF exceed the specified level.

Measurement Control

The Authority should require a measurement control programme with the objectives of ensuring that the adequacy of routine operation of the measurement systems is confirmed; that measurement systems are re-calibrated at appropriate intervals; that random and systematic errors are properly estimated for propagation so that the limits of measurement uncertainties associated with MUF can be established; and that clerical errors are, so far as practicable, detected and corrected. The Agency's technical conclusion depends, among other things, on these measurement uncertainties.

The measurement control programme should include:

a) evaluation on a continual basis of the random and systematic errors associated with weight, volume, sampling, and analytical measurements and the use of the evaluation to establish limits of accuracy for all quantities of nuclear material in the material balance;
b) definition of the statistical methods to be used to evaluate measurement and calibration data, estimate limits of accuracy and to combine (propagate) limits of accuracy for S/R differences, inventory changes, physical inventory and MUF; and
c) establishment of criteria for significance testing of limits of accuracy and bias for each measurement and for significance testing of MUF.

Application of Containment and Surveillance Measures

Containment and surveillance measures are necessary or convenient in some situations to enable the Authority, as part of its nuclear material control function, to monitor flows, to confirm the integrity of stores, and in general to detect when material present in an MBA or facility is removed without appropriate accounting action.

When containment and surveillance or accountancy measures have failed or indicate possible unauthorized removal of nuclear material, the facility operator should be required to conduct a comprehensive

investigation and to take appropriate corrective actions, which may include re-measuring of corresponding inventories.

Review of the design of facilities permits the most cost-effective combination of accountancy, containment and surveillance procedures, equipment and features of facilities to be determined.

C/S measures will become more important for large facilities of the future where safeguards objectives cannot be realized exclusively through nuclear material accountancy measures.

International Transfers of Nuclear Material

The Authority should establish requirements for international transfer of nuclear material with time specifications on necessary arrangements for advance notifications, accounting and control responsibility, and reporting on nuclear material shipped and received.

There are some practical problems involved in international transfers especially from the international safeguards viewpoint of the IAEA. Two of these in particular are transfer of accounting and control responsibility and continuity of material identity.

States involved in international transfers should agree upon the point of the transfer of accountability and control responsibility.

Shipping states will provide shipment identification, i.e. batch identity, which will be reported to the IAEA in ICRs. Receiving states should use this same identification in reporting receipt of the material in their ICRs even though the receiving state may use a different identity for domestic purposes. This will enable the IAEA to close the record on an international shipment.

THE ROLE OF SSACs IN STRENGTHENED AND INTEGRATED SAFEGUARDS

Overview

In this section we will provide a broad overview of the Secretariat's proposals for the further development of the role of State or regional systems of accounting for and control of nuclear material (SSACs). This part is focused primarily on such a role under integrated safeguards, but recognizes that many aspects of increased co-operation can be undertaken under traditional safeguards.

Implementation of international safeguards requires concerted actions by the Agency, State authorities and nuclear facility operators. With experience and improving technology, implementation of safeguards at the facility level has improved dramatically. The various innovations over time that have improved the implementation of safeguards have largely been in technical methods and tools (e.g., NDA and C/S instruments and unattended verification systems). However, increased co-operation with Euratom, ABACC and single State systems has demonstrated that further improvements via increased co-operation with SSACs are possible.

With the advent of integrated safeguards, consistent with the changing requirements of the safeguards system, and the overall objective of more effective and efficient safeguards, it is appropriate to re-examine the roles of the respective parties in the implementation of traditional nuclear material accountancy safeguards. To a large extent, changing assumptions and the corresponding changing role of the Agency is

already being addressed in the implementation details of integrated safeguards currently under development. This paper addresses the role of State or regional systems of accounting and control in integrated safeguards. The term "SSAC" has traditionally been used to denote both (a) the State authority, office or persons designated as providing, on behalf of the State or several States, the formal technical interface for safeguards implementation with the Agency and with facility operators; and (b) the system of nuclear material accounting procedures laid down by the State authority and implemented by the facility operator.

The related issues of independent verification, intensity of verification and the role of SSACs are examined from a historical perspective and a rationale is presented, consistent with the intent of INFCIRC/153 and the objectives of integrated safeguards, for defining and dealing separately with the concepts of a technically "effective" SSAC and a technically "capable" SSAC. This provides a useful framework for addressing a variety of quality and co-operation-related issues.

The authority to conduct unannounced inspections has always been available under comprehensive safeguards agreements. Today, under the additional protocol, there are numerous circumstances where the impediments to the use of these inspections no longer exist and unannounced inspections are being incorporated in the integrated safeguards approaches being developed for generic facility types. The efficiency and effectiveness gains possible through implementation of this regime require that certain conditions be established in the State. This dimension of the role of SSACs in integrated safeguards is also addressed in this paper. The Requirement for Independent Verification by The Agency and the Role Of Ssacs

Throughout the lengthy negotiations of the NPT (Article 3) and INFCIRC/153, among the most contentious aspects of the then envisioned system of comprehensive safeguards, were the related issues of independent verification by the Agency and the role of SSACs. Acceptance of what were termed the "three principles" of independent verification in the negotiations of INFCIRC/153 avoided an impasse regarding the mandatory requirement of Article 3 of the NPT that NNWS parties to the NPT accept safeguards and were eventually incorporated in Paragraph 7, INFCIRC/153[1] . The three principles were that:

- safeguards under the NPT for all non-nuclear-weapon States should be such that all parties to the NPT can have confidence in their effectiveness;

- those safeguards, to be established by an agreement with the IAEA in accordance with the Statute of the IAEA and its safeguards system, must enable the IAEA to carry out its responsibility of providing assurance that no diversion is taking place; and

- in order to avoid unnecessary duplication, the IAEA should make appropriate use of existing records and safeguards, provided that under mutually agreed arrangements the IAEA can satisfy itself that nuclear material is not diverted to nuclear weapons or other nuclear explosive devices.

The primacy of independent verification as the process through which the Agency would unilaterally ascertain that there has been no diversion of nuclear material is established by Paragraph 7, the negotiating record and more than 25 years of practice. The role of SSACs has been to provide the Agency with accountancy

1 The Agreement should provide that the State shall establish and maintain a system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement, and that such safeguards shall be applied in such a manner as to enable the Agency to verify, in ascertaining that there has been no diversion of *nuclear material* from peaceful uses to nuclear weapons or to other nuclear explosive devices, findings of the State's system. The Agency's verification shall include, *inter alia*, independent measurements and observations conducted by the Agency in accordance with the procedures specified in Part II below. The Agency, in its verification, shall take due account of the technical effectiveness of the State's system.

data and related information which can be efficiently employed in the process of independent verification. These data and related information have been considered to be the "findings" of the State's system referred to in Paragraph 7 of INFCIRC/153. The Agency may supplement these data with its own (e.g., C/S data) and will work with a SSAC to correct any problems with information being provided. In terms of day-to-day implementation, the Agency has always taken the concept of independent verification to mean that all safeguards relevant materials and events are subject to verification under circumstances to be prescribed by the Agency.

Early proposals for the language of Paragraph 7 contained the specification that "the intensity of verification … shall be related to the degree of technical effectiveness" (of the State system). Objections to this formulation were that it provided too mechanistic or direct a linkage between intensity of verification and technical effectiveness. The compromise language provided only that the Agency "shall take due account of the technical effectiveness of the State's system". What this might mean in practice is not clearly defined, but Paragraph 81(b) lists some factors linking effectiveness of the SSAC with verification intensity, including, among others, the extent to which SSACs are independent of the facility operator and the extent of implementation of the measures of Paragraph 32 (this paragraph identifies various accountancy and measurement procedures that could be implemented). Historically, within the framework of basic implementation parameters, the intensity of verification has been governed by **uniform** implementation criteria. Still, there is nothing, in principle, to prevent a linkage between verification intensity and technical effectiveness of the SSAC (per INFCIRC/153) as long as requirements regarding independent verification by the Agency are met. Certainly a "quid pro quo" kind of connection between verification intensity and greater transparency and effectiveness of SSACs was foreseen throughout the course of Programme 93+2.

The case for Increased Co-Operation

Throughout the development effort toward more effective and efficient safeguards, it was widely recognized that, while the Secretariat needed to improve in its implementation of nuclear material accountancy safeguards, other elements of that system needed improvement as well. There was an opinion, also widely held, that any attempt to formally address these improvements (i.e., amendments to INFCIRC/153) would be controversial and could threaten progress needed in other areas. As a result, improvements in the quality of accountancy systems, timing and content of State's reports to the Secretariat and other related issues were only generally dealt with under the heading of increased co-operation with SSACs. This is most clearly visible in Committee 24's decision to incorporate Article 2.a.(ii), addressing the provision of information on operational activities at facilities and LOFs when agreed to by the State, in the additional protocol.

Under integrated safeguards, the Safeguards Criteria for nuclear material accountancy safeguards, in the presence of a conclusion of the absence of undeclared nuclear material and activities in a State, will be optimized to reflect a changed emphasis on coverage of certain diversion scenarios, timeliness verification goals, probabilities of detection and other implementation parameters. The entailed redistribution of Agency resources is justified in the context of increased overall assurances expected with the additional protocol. However, it does not follow that the effectiveness of nuclear material accountancy safeguards must suffer as a result. The advent of integrated safeguards provides an opportunity to address a number of deficiencies in safeguards on declared nuclear material and increased co-operation between the Agency and SSACs can play an important part in this process. It should be recognized, however, that many of the improvements discussed below do not and should not depend on the existence of an additional protocol. Certainly the successful implementation of the additional protocol requires a different kind of co-operation than that which has typically accompanied implementation of safeguards agreements. The point has been made time and again that the broad political, security and commercial benefits from a strengthened safeguards system has at its basis, increased levels of co-operation between the Agency and SSACs. Increased co-operation

between the Agency and SSACs has long been recognized as an avenue toward more effective and efficient safeguards.

SAGSI, (The Standing Advisory Group on Safeguards Implementation) following its report to the Director General in April 1993 on strengthened, more efficient safeguards, was requested to provide a more detailed assessment of co-operation between the Agency and SSACs. It identified three levels of possible co-operation:

a) the "*enabling" level* which is comprised of activities carried out by the SSAC that have the objective of enabling the Agency to meet its mandate in an efficient and effective manner. This can involve a wide variety of activities but certainly includes advance reporting, assuring the quality of accountancy and measurement systems, assuring that nuclear material is available for verification and presented in a way that facilitates the verification task ¾¾ all things that reduce the duration of inspections and increase Agency flexibility regarding when and how inspections are carried out. The SSAC activities under the "enabling" level could in principle be carried out either by the State or regional authority or by the facility operator acting on its behalf;

b) the "*joint activities*" level where there is a sharing of activities such that both sides gain efficiencies. This includes such things as shared procurement of safeguards equipment, joint use of containment/surveillance measures, joint training programmes and, under appropriate circumstances, the joint conduct of inspection activities. "Joint activities" would be carried out by the State or regional authority and would imply an inspectorate with the necessary equipment, expertise and resources acting independently of the operator; and

c) the "*SSAC inspection*" level where the Agency, again under appropriate circumstances, would use the results of SSAC inspection activities in drawing its safeguards conclusions. "SSAC inspections" would be carried out by the State or regional authority and, as for the joint activities, would imply an inspectorate with the necessary equipment, expertise and resources acting independently of the operator.

The three levels of co-operation are not mutually exclusive and any specific instance of co-operation between the Agency and a SSAC could include elements from all three levels. In fact, the levels represent a hierarchy with each successive element of co-operation building on and benefiting from those that came before. Thus, joint activities are built on a foundation of enabling activities and the SSAC inspection level is built on a foundation of joint activities. As stated previously, a SSAC can be technically effective without extensive technical capabilities. However, a technically capable SSAC that wishes to carry out joint activities with the Agency or joint activities and SSAC inspection level activities must also have met the requirements for technical effectiveness before it can do so.

The Agency, with an expanded mandate under strengthened safeguards and without, at least for the foreseeable future, significant additional resources, must find ways to meet its mandate while maintaining the confidence in the effectiveness of the safeguards system. The resource redistribution due to integrated safeguards and the increased use of new technology may provide part of the answer but improved performance of SSACs and a corresponding increased co-operation between the Agency and SSACs is indispensable.

Bibliography:

- IAEA Safeguards Glossary, IAEA, Vienna, 1987, IAEA/SG/INF/1 (Rev. l)
- Guidelines for States' Systems of Accounting for and Control of Nuclear Material, IAEA, Vienna, 1980, IAEA/SG/INF/2
- The Structure and Content of Agreements between the Agency and States required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/153 (Corrected)
- Model Protocol Additional to the Agreement(s) between State(s) and the IAEA for the Application of Safeguards, INFCIRC/540
- The Application of Quality Assurance Techniques in Integrated Safeguards, Stephen Francis, ESARDA, April 2000.
- System Audit and Fraud Detection in Integrated Safeguards, Stephen Francis and Mike Beaman, INMM, July 2000.