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**STRENGTHENING THE EFFECTIVENESS AND IMPROVING
THE EFFICIENCY OF THE SAFEGUARDS SYSTEM AND
APPLICATION OF THE MODEL ADDITIONAL PROTOCOL****INTRODUCTION**

1. In resolution GC(45)/RES/13(2001), the General Conference requested the Director General to report to the forty-sixth session on strengthening the effectiveness and improving the efficiency of the safeguards system and application of the Model Additional Protocol¹. This report responds to that request, updates the information given in last year's report to the General Conference (GC(45)/23) on this Agenda item and covers: the implementation of safeguards strengthening measures; integrated safeguards; and the conclusion and entry into force of safeguards agreements and additional protocols.

A. IMPLEMENTATION OF SAFEGUARDS STRENGTHENING MEASURES**Information Evaluation**

2. The collection, analysis and evaluation of a broader range of information about a State's nuclear and nuclear-related activities and plans have all along been fundamental to efforts to strengthen the safeguards system. They rest on the premise that the more that is known about a State's nuclear and nuclear-related activities and plans, the greater the 'transparency' of its nuclear programme. Transparency provides a basis for enhancing the assurances provided through safeguards implementation regarding the peaceful nature of a State's nuclear activities.

3. As part of safeguards strengthening measures, the Agency now has more information available about the nuclear activities and plans of States with comprehensive safeguards agreements (CSAs) in force, in particular for those with additional protocols. Last year's report identified the main information types: information submitted by States; information obtained by the Agency in carrying out its verification activities; and other available information, for example from open sources including commercially available satellite imagery. The report also described the three-step evaluation process: the first, or 'baseline', evaluation carried out for all States, usually before an additional protocol enters into force; the broader evaluation under an additional protocol – which is crucial to the Secretariat's initial conclusion of the absence of undeclared nuclear material and activities in a State; and the

¹ Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards, INFCIRC/540 (Corrected).

annual updating and review without which any such conclusion cannot be maintained. These three steps take place against a background of a continuous, day-to-day process of information collection, analysis and evaluation by the Secretariat.

4. Since July 2001, the Secretariat has prepared and reviewed a further 42 State Evaluation Reports (SERs)² of which 13 were baseline reports and 29 SERs were updates of previous reports. Twenty-four of the SERs covered States with additional protocols in force. Since the State evaluation programme began in 1997, a total of 122 reports assessing the nuclear activities of 67 States, and also of Taiwan, China, have been compiled and reviewed. The number completed each year has shown a substantial increase over the preceding year and the rapid pattern of growth is expected to continue. This will place further demands on the resources for information collection, analysis, evaluation and review.

Increased Inspector Access

Complementary Access

5. Since last year's General Conference, the Secretariat has continued to obtain experience in carrying out complementary access. Complementary access plays a key role in the process of reaching, and later sustaining, conclusions of the absence of undeclared nuclear material and activities in a State. By the end of June 2002, the Secretariat had carried out complementary access in 14 States and in Taiwan, China. Internal guidelines for implementing complementary access, including at each type of location specified in Article 5 of the Model Additional Protocol, are being implemented on a provisional basis.

Design Information Verification

6. Following acceptance by the Board of Governors, in 1992, of the recommended actions on the provision and use of design information and of the Agency's continuing right to verify design information for facilities, adaptations were made to the relevant subsidiary arrangements. A departmental task force has now completed revision of the guidelines for planning, carrying out and reporting design information examination and verification activities and has also devised a model design information verification (DIV) plan. States have been informed about the Secretariat's intention to perform such activities on a continuing basis and their co-operation sought.

Implementation Trials

7. Field trials to rehearse elements of additional protocol implementation continued in Finland and in the Netherlands. They are providing important experience in issues related to: site definition, declarations under Article 2 of the Model Additional Protocol, the reporting of results and the development of modalities for both the division of responsibility and the channels of communications between the Agency, EURATOM and the respective Member States.

² And an evaluation report on the nuclear programme of Taiwan, China.

Advances in Safeguards Technology

Environmental Sampling

8. Results from the analysis of environmental samples collected during routine safeguards inspections, DIV visits and complementary access continue to provide an important source of information about a State's nuclear activities. Between 1 August 2001 and the end of June 2002, 196 environmental samples were collected from 82 facilities in 32 States during routine inspections and DIV visits. Additionally, 87 samples were taken during complementary access in 10 States (and in Taiwan, China), and included 11 samples from uranium mines (in three States) and 15 from uranium conversion plants (in two States plus Taiwan, China). Specific analysis and data evaluation methods were developed and applied to these samples.

9. Since last year's General Conference, three separate air particulate field trials got under way and are at various stages of completion. The first was conducted at a large-scale reprocessing facility in the United Kingdom. The analyses of the samples from this trial are complete and the Secretariat expects to finish its evaluation in autumn 2002. The second trial is being conducted in the vicinity of a uranium enrichment plant in the United Kingdom and samples are still being collected. A third trial was carried out in the vicinity of a small scale reprocessing plant in the Russian Federation, and the analyses of the air filter samples are expected to be completed by mid-2003. These field trials are providing experience in air particulate sampling, analysis and evaluation that is applicable to both location specific and wide area environmental sampling.

Remote Monitoring

10. By the end of June 2002, 33 systems for the remote transmission of safeguards data had been installed and were operating in nuclear facilities in 7 States and in Taiwan, China. Some of the systems are being tested and others are in routine use. In general, the installation of such systems has proceeded more slowly than initially envisaged because of the need to improve their reliability and their cost effectiveness. Work is continuing on finding more cost effective means of data transmission.

Development of Equipment

11. The Secretariat has continued, with Member State Support Programmes, to develop equipment to detect undeclared nuclear material, for use during complementary access. Efforts were concluded for a highly sensitive instrument, now authorised for inspection use, based on gamma measurements. Development of a sensitive, portable neutron device is proceeding. Efforts continued for improving the detection capability for irradiated nuclear material. Improvements were made to the design of the Agency's new digital surveillance equipment to improve reliability. Since the identification of radiation induced failures, the Agency has worked with its equipment developers to reduce the susceptibility of critical parts to neutron radiation. Faults in the disk storage components of the Agency's server-based remote monitoring equipment were solved. A new digital multi-camera system and a battery powered, self-contained portable digital camera system were approved for unattended monitoring inspection use.

Increased Co-operation with State and Regional Systems of Accounting for and Control of Nuclear Material (SSACs)

12. Further progress has been made in developing co-operation with SSACs, which has always been an important element of Agency safeguards and is further emphasised under strengthening measures. In 2001-2002, Canada and the Agency shared the costs of core discharge systems for a multi-unit on-load reactor facility. A Memorandum of Understanding between the Agency and the SSAC of the Republic of Korea regarding the implementation of safeguards at light water reactors was signed in October 2001 and implementation started in January 2002. Assistance is being provided to develop and strengthen SSACs in the Newly Independent States (NIS) and East European Countries. Continuing co-operation with the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials includes an increase in equipment covered by common use agreements; progress towards the implementation of guidelines for joint inspection activity; the on-going development of common auditing procedures and joint training sessions for specific non-destructive assay (NDA) measurement applications; and procedures for unannounced inspections at enrichment plants. Within the framework of the New Partnership Approach (NPA) with EURATOM, progress was made in developing a new generation of electronic seals; establishing specifications for the next generation of multi-camera surveillance systems; and developing non-destructive assay techniques for the verification of spent fuel assemblies. A new training course for Agency and EURATOM inspectors on NPA safeguards arrangements for specific facility types has been well received and will later be expanded to include additional protocol implementation. Additionally, an IAEA/EURATOM working group was established to prepare for additional protocol implementation in the European Union; three meetings have taken place to date. Increased co-operation with State and regional systems of accounting and control continues to be examined as an element of integrated safeguards implementation. It was considered in depth at a dedicated meeting held with Member States and regional organizations in May 2002. The Secretariat is now considering how best to build on the helpful ideas put forward at that meeting, consistent with the Agency continuing to be able to draw its own, independent safeguards conclusions.

Safeguards Training

13. Emphasis continues to be placed on the training and new skills required for safeguards implementation, particularly elements of the strengthened safeguards system. The training curriculum has been further modified accordingly; strengthening measures and activities connected with the implementation of additional protocols have been incorporated into both basic and advanced training courses for IAEA staff. The curriculum was further enhanced with new courses in safeguards for support staff; safeguards at bulk handling facilities – with emphasis on DIV activities in a variety of facility types; and a course on fuel cycle facilities to further develop the cognitive skills of country officers.

B. INTEGRATED SAFEGUARDS

14. Last year's report to the General Conference (GC(45)/23) described the progress made in the development of integrated safeguards – the meshing together of traditional nuclear material verification activities with the new strengthening measures, including those of the additional protocol. It explained that the work was being carried out within the Secretariat with help from a group of experts designated by the Director General, advice from the

Standing Advisory Group on Safeguards Implementation (SAGSI) and assistance from a number of Member States.

15. For States with both a CSA and an additional protocol in force, the integration of new measures with traditional ones (see paragraph 16 below), enables the IAEA Secretariat to carry out its verification functions with maximum effectiveness and efficiency³, in other words, in an optimum way. A conceptual framework guides this process.

Conceptual Framework for Integrated Safeguards

16. A major milestone was reached at the end of 2001 with the completion of the 'conceptual framework for integrated safeguards'. The Secretariat uses this term to describe the safeguards concepts, approaches, guidelines and criteria that govern the design, implementation and evaluation of integrated safeguards. The conceptual framework was presented to the Board of Governors at its March 2002 meeting. It emanates from the reaffirmation by the Board, in 1995, that for a State with a CSA in force, the right and obligation of the IAEA is to ensure that safeguards are applied on all nuclear material in all of the State's peaceful nuclear activities. To meet this objective for a State with a CSA and an additional protocol in force, the IAEA carries out both nuclear material verification measures ('traditional' measures) based on INFCIRC/153 (Corrected) and additional protocol measures to draw safeguards conclusions on the non-diversion of nuclear material placed under safeguards and the absence of undeclared nuclear material and activities in the State as a whole.

17. The elements of the conceptual framework are:

- the overall objective and basic principles of integrated safeguards;
- the design of an integrated safeguards approach for a State;
- model integrated safeguards approaches for specific nuclear facility types;
- supporting guidelines for drawing safeguards conclusions for a State and for implementing safeguards procedures; and
- integrated safeguards criteria, evaluation and reporting.

These elements are described in paragraphs 18-28 below.

Overall Objective and Basic Principles of Integrated Safeguards

18. The objective of implementing the measures provided for in comprehensive safeguards agreements and additional protocols together is to provide credible assurance of both the non-diversion of nuclear material from declared activities and of the absence of undeclared nuclear material and activities in the State as a whole. Under a comprehensive safeguards agreement together with an additional protocol, the Agency's ability to draw conclusions of the absence of undeclared nuclear activities in the State as a whole paves the way for reductions in verification effort on declared nuclear material that would need further processing to make it

³ Effectiveness is a measure of the extent to which the IAEA meets its safeguards objectives. Efficiency is a measure of how well the human and financial resources needed for this are used.

nuclear weapon usable, and for other measures designed to optimise the effectiveness and efficiency of safeguards implementation. The implementation of integrated safeguards in any particular State is contingent upon a CSA and an additional protocol each being in force for that State and upon the necessary safeguards conclusions having been drawn. When that point is reached, integrated safeguards implementation can proceed, based on the following principles:

(a) *The same overall objective and basic principles of integrated safeguards are to be applied in a non-discriminatory manner in all States.* Verification of declared nuclear material at facilities will be based on model integrated safeguards approaches developed for specific facility types to ensure consistency; similar procedures will be used in all States. However, the integrated safeguards approach for any individual State will also take account of State-specific features.

(b) *Information review and evaluation is fundamental to strengthened and integrated safeguards.* Information review and evaluation is essential to reaching, and being able to maintain, the safeguards conclusions on which integrated safeguards implementation is based. It can also contribute to the design of integrated safeguards approaches.

(c) *Under integrated safeguards, all plausible routes by which a State might seek to acquire weapon usable nuclear material (i.e., acquisition paths) are covered by safeguards measures.* The integrated safeguards approach for a State will be designed to provide coverage of acquisition paths involving diversion of declared nuclear material from different stages of the fuel cycle and to address clandestine routes to the acquisition of weapon usable material.

(d) *Nuclear material accountancy* will continue to be the basis for deriving a conclusion on the non-diversion of declared nuclear material in a State. Thus, the Secretariat will continue to evaluate the nuclear material accounting information reported by States for correctness and consistency, although the verification of less proliferation-sensitive types of nuclear material will be at reduced levels compared to safeguards under a CSA alone.

The Design of an Integrated Safeguards Approach for a State

19. An integrated safeguards approach is designed specifically for each State. It sets out the safeguards measures to be applied at each facility and location outside facilities (LOF) in the State and the general level and focus of the complementary access activities to be carried out. Guidelines have been developed for designing State-level approaches to ensure effectiveness and efficiency. The design of an approach includes: (a) consideration of State-specific features and fuel cycle characteristics; (b) adapting model integrated safeguards approaches for application at specific facilities; and (c) a plan for implementing complementary access. Integrated safeguards approaches for States are reviewed on a continuing basis and modifications made as required.

20. Adapting the model integrated safeguards approaches for facility types (see paragraphs 22 to 24) to the features and characteristics of nuclear facilities in a State acknowledges that there could be more than one way of optimising the effectiveness and efficiency aims of the approaches. Accordingly, model integrated safeguards approaches include alternative ways of comparable effectiveness to meet the safeguards requirements. The Secretariat considers such

alternatives carefully, including through a comparative cost analysis, before assessing the most appropriate option to select.

21. Complementary access plays a key role in the process of drawing safeguards conclusions regarding the absence of undeclared nuclear material and activities. However, the Agency is constrained by the Model Additional Protocol to be neither mechanistic nor systematic in verifying information submitted to it under an additional protocol. Within those constraints, State-level integrated safeguards approaches describe the proposed level and focus of the complementary access activities to be carried out in the State.

Model Integrated Safeguards Approaches for Specific Nuclear Facility Types

22. A starting point in developing the conceptual framework for integrated safeguards was the technical objective of safeguards at facilities defined in paragraph 28 of INFCIRC/153⁴ (Corrected) and the measures necessary to achieve it. A major consideration of the Secretariat, in moving forward with the development of model integrated safeguards approaches, was that some facility types warranted attention sooner than others. This was because they were operating in States which were early candidates for integrated safeguards implementation and offered the most potential for reducing verification effort on declared nuclear material.

23. To date, model or generic integrated safeguards approaches have been developed for five major types of nuclear facility: (a) light water reactors, with and without the use of mixed oxide fuel; (b) research reactors; (c) on-load refuelled reactors; (d) spent fuel storage facilities; and (e) depleted, natural and low enriched uranium conversion and fuel fabrication facilities. The development of other model safeguards approaches continues. Those already crafted might need to be refined or adjusted in the light of implementation experience, further evaluation and available technology.

24. The model facility-type integrated safeguards approaches reflect the types of nuclear material involved. However there are common denominators such as:

- Retaining the current practice of evaluating the material balance annually for all types of nuclear material (using random selection of facilities as appropriate). This stems from the basic principle that nuclear material accountancy remains a safeguards measure of fundamental importance.
- Extending the timeliness goals for certain types of nuclear material where appropriate, given the Agency's increased ability to detect undeclared nuclear material and activities. The timeliness goal for irradiated fuel has been extended from 3 months to 1 year. For fresh, mixed oxide (MOX) fuel assemblies, it has been extended from 1 month to 3 months.
- Random, interim inspections, including on an unannounced basis where possible and cost effective, to detect and deter undeclared activities at facilities and to provide a capability for early detection of diversion of nuclear material.

⁴ '.... the objective of 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 the risk of early detection'.

- Less intensive verification requirements where specific types of nuclear material so warrant.
- Modifying verification procedures for specific nuclear material types in a way that enables the Agency to re-establish the inventories of those materials within the applicable, traditional timeliness period if there is any indication of possible diversion or of undeclared nuclear material or activities.
- Increased co-operation with an SSAC under specific conditions.

Supporting Guidelines

25. An important aspect of any new process or procedure is providing appropriate guidance on implementation. In the context of integrated safeguards, such guidance aims at effectiveness, consistency and non-discrimination in each step of the process. Guidelines have been developed for drawing the necessary safeguards conclusions which underpin integrated safeguards implementation; information review and evaluation; conducting complementary access; and conducting unannounced, routine inspections. Work is proceeding on guidelines for enhanced co-operation between the Agency and SSACs.

Integrated Safeguards Criteria, Evaluation and Reporting

26. In addition to supporting guidelines for integrated safeguards implementation, more **specific criteria** are required, at both the facility and State level. Given that nuclear material accountancy remains a measure of fundamental importance in integrated safeguards, there is an on-going need for such facility-focused criteria as those dealing with the examination of records and reports, physical inventory verification and material balance evaluation. At the State level, criteria are required for nuclear material verification activities that are not specific to individual facilities, e.g., the matching of data on transfers of nuclear material. In addition there will be broader requirements, for example related to the updating and reviewing of State Evaluation Reports (SERs).

27. **Evaluation** under integrated safeguards is, as described, an on-going process leading to an annual assessment of safeguards performance. It takes into account the results of all safeguards activities conducted under an integrated safeguards approach, the results of follow-up actions to resolve anomalies, questions and inconsistencies, and continuing review and evaluation of all other information available to the Agency. The results of these evaluations, documented annually in SERs, are reviewed as appropriate by the interdepartmental Information Review Committee. SERs provide the basis for safeguards conclusions.

28. **Reporting** to individual States on activities under safeguards agreements and additional protocols continues under integrated safeguards. Under the provisions of the safeguards agreements, the Agency provides States with statements on inspection results and on the conclusions it has drawn. Under an additional protocol, the Agency also provides statements on the activities performed during complementary access; the results of activities regarding questions or inconsistencies; and conclusions drawn from additional protocol activities. The collective results of safeguards evaluation processes are reported annually in the Agency's Safeguards Implementation Report (SIR).

Cost and Resource Implications

29. The resource implications of integrated safeguards may eventually be less than those required for the implementation of safeguards under a CSA alone in States with large nuclear programmes. However, in view of the crucial role of safeguards for international security it is important that the system continues to be driven primarily by consideration of effectiveness and not by cost considerations. Integrated safeguards represent a collective effort to maximise the effectiveness and efficiency of the strengthened safeguards system within available resources. During the current phase of initial implementation of additional protocols, more resources are needed to carry out the activities which must precede and are involved in integrated safeguards implementation, whether at Headquarters or in the field. The current, overall assessment is that additional resources will be needed for at least the next five years.

Next Steps

30. Although the conceptual framework for integrated safeguards is now complete, elements of it will be further developed or refined in the light of experience, further evaluation and technological developments. Integrated safeguards implementation was initiated in one State in 2001 and the goal now is to widen the scope of implementation as more additional protocols enter into force and the necessary safeguards conclusions can be drawn. The Secretariat will continue to maintain close dialogue with Member States as implementation and further development work proceeds.

C. THE CONCLUSION AND ENTRY INTO FORCE OF COMPREHENSIVE SAFEGUARDS AGREEMENTS AND ADDITIONAL PROTOCOLS

31. Since last year's General Conference, two comprehensive safeguards agreements with non-nuclear-weapon States (NNWS) have entered into force⁵, one NNWS has signed a comprehensive safeguards agreement⁶ and the Board of Governors has approved a comprehensive safeguards agreement with one other NNWS.⁷ The Board has also approved additional protocols for ten States⁸. Eight States have signed an additional protocol⁹, and additional protocols have entered into force for four States¹⁰. Thus, to date, the Board has approved additional protocols for 68 States, 64 of which have been signed, 26 of which have entered into force. In addition, one¹¹ is being provisionally applied¹². These increases, although welcome, fall behind expectations.

Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols

32. Resolution GC(45)/RES/13 recommended that the Director General, the Board of Governors and Member States continue to consider implementation of the elements of the

⁵ Kuwait (7 March 2002) and the Former Yugoslav Republic of Macedonia (16 April 2002).

⁶ Niger.

⁷ Tajikistan.

⁸ Costa Rica, Guatemala, Haiti, Jamaica, Kuwait, Nicaragua, Panama, Paraguay, South Africa and Tajikistan.

⁹ Costa Rica, Guatemala, Haiti, Kuwait, Mongolia, Nicaragua, Nigeria and Panama.

¹⁰ China, Czech Republic, Ecuador and Panama.

¹¹ Ghana.

¹² The measures foreseen in the Model Additional Protocol are also being implemented for Taiwan, China.

action plan to which resolution GC(44)/RES/19 referred. Among these elements are: intensified efforts by the Director General to conclude safeguards agreements and additional protocols, especially with those States that have substantial nuclear activities; coordination with Member States in that regard; and provision of knowledge and technical assistance to States as required.

33. As explained in GC(45)/23, the Secretariat's action plan distinguishes between its own activities, Member States' activities and joint activities. It also distinguishes between States with safeguarded nuclear material or activities and States with little or no nuclear activities, as the needs of the two groups are inherently different. For both groups of States, the Secretariat has taken every opportunity to maximize the potential of overseas visits of staff of the different Agency programmes to bring outstanding correspondence regarding safeguards agreements and additional protocol to the attention of the relevant authorities. Where necessary the Secretariat has followed up with further correspondence. The Secretariat has also made further efforts to promote and facilitate consultations with State representatives, in Vienna and abroad. At the first session of the Preparatory Committee for the 2005 Review Conference of the States Party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in April 2002, the Secretariat again urged the fifty non-nuclear-weapon States Party to the Treaty that have not yet concluded such agreements to do so prior to the commencement of the review conference. It also called upon NPT parties that had yet to do so to conclude and bring additional protocols into force. The IAEA office in New York continues to be a useful conduit in contacts with Permanent Missions of States that are not represented in Vienna.

34. The major activities that were carried out by the Secretariat in cooperation with Member States were regional seminars to promote the conclusion of safeguards agreements and additional protocols. A seminar workshop on the additional protocol took place in Vienna with representatives of the Czech and Slovak Republic (September 2001). Seminars were conducted in Kiev (November 2001), Lima (December 2001), Almaty (January 2002), Tallinn (January 2002) and Johannesburg (June 2002). The Secretariat also provided technical assistance to national nuclear authorities around the world to facilitate the provision of the information required by safeguards agreements and additional protocols. It also made a preliminary assessment of the main clusters of factors preventing States from concluding safeguards agreements and additional protocols with the Agency and continues to help Member State efforts to move forward in this regard. The Secretariat will be involved in a meeting in Japan, planned for December 2002, to evaluate the outcome of the regional and sub-regional seminars and to assess the factors still impeding progress.

35. It is hoped that activities to date and those envisaged will provide further impetus towards universal adherence to comprehensive safeguards agreements and additional protocols without which the full potential of the Agency's strengthened safeguards system cannot be realized.