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The IAEA Strengthened International Safeguards Systems

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INTRODUCTIONS

After the Iraq war, the International Atomic Energy Agency (IAEA) 93+2 Program was developed to strengthen and improve the cost-effectiveness of the existing safeguards system. In particular, the Program aims to enhance the IAEA ability to detect undeclared nuclear activities and materials. The measures considered are divided in two parts: Part 1 measures may be implemented within the existing IAEA authority; Part 2 measures require complementary legal authority, in the form of an additional Protocol (INFCIRC/540) which was approved by the IAEA Board of Governors May, 1997.

This paper describes the differences between the traditional international safeguards system based on INFCIRC/153 (Corrected), the Part 1 measures of the 93+2 Program, and the measures described in the additional Protocol.

TRADITIONAL SAFEGUARDS SYSTEM

Under the Treaty on Non-Proliferation of Nuclear Weapons (NPT), non-nuclear weapon states undertake, inter alia, not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices. Furthermore, they agree to place under the IAEA safeguards all sources or special fissionable material in all peaceful nuclear activities in order to verify their obligations under the NPT that such material is not diverted to nuclear weapons or other nuclear explosive devices.

The basic structure and content of agreements between the IAEA and the States are described in INFCIRC/153 (Corrected). It requires that each State should establish and maintain a system of accounting for and control of nuclear materials (SSAC) subject to safeguards. The SSAC has two principal objectives: one is a national objective to provide for detection of nuclear material losses or unauthorized use or removal of nuclear material in the interest of public health and safety as well as for economic reasons. The other is an international objective, to provide the essential basis for the application of IAEA safeguards. IAEA begins to safeguard nuclear material when it is suitable for fuel fabrication or enrichment and terminates safeguards when the material has been consumed or diluted such that it is no longer usable for any nuclear activity from the point of view of safeguards, or when it has become practically irrecoverable.

IAEA has published a set of nine safeguards technical reports (STRs) giving detailed descriptions of SSACs at the facility level for all types of nuclear fuel cycle facilities. In addition, a report for an SSAC at the State level has also been published. They include detailed descriptions of nuclear material measurements, measurement quality, records and reports, physical inventory taking, material balance closing, containment and surveillance and organization and management.

Under INFCIRC/153, the State periodically provides to the IAEA information relevant to safeguards at each facility, including design information and material accountancy reports. In addition, safeguards relevant records are maintained for

verification. The IAEA verifies the information by, inter alia, examination of the records and reports, verification of physical inventory and inventory changes, design information verification, and material balance evaluation. The IAEA conducts these activities via visits, ad hoc inspections, routine inspections, and special inspections. Special inspections are performed rarely, and then only to verify special reports or when information provided by the State is not adequate. During special inspections, the IAEA may have access to any locations agreed by the State. Disagreement on access shall be resolved by the Board and, if the problem remains, either party can submit the problem to an arbitration tribunal. Finally, the unresolved problems can be reported to the Security Council and General Assembly of UN.

For the IAEA, nuclear material accountancy is the safeguards measure of fundamental importance, and containment and surveillance are important complementary measures. The technical objective of IAEA 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 the deterrence of such diversion by the risk of early detection. Different detection goal parameters for timeliness, detection probabilities, and quantities of materials are used for different types of materials.

To achieve these objectives, the IAEA uses the Safeguards Criteria to plan inspection activities at various types of facilities. The Criteria are also used to evaluate inspection goal attainment for each facility as well as for the State as a whole. Note that, under the traditional safeguards, the Safeguards Criteria also include activities for the detection of undeclared production of plutonium or highly enriched uranium at declared reactors or enrichment plants. However, the IAEA was not expected to verify the completeness of reports or to search for clandestine activities anywhere in the State, except when a special inspection is invoked under extraordinary circumstances.

STRENGTHENED SAFEGUARDS SYSTEM

The IAEA 93+2 Program was developed to strengthen and improve cost-effectiveness of the IAEA safeguards system. It includes:

- A: Increased access to information and its effective use
- B: Increased physical access
- C: Optimum use of the existing system.

The measures considered are divided in two parts: measures in Part 1 are those which may be implemented within the existing IAEA authority; Part 2 measures require complementary legal authority, in the form of an additional Protocol, INFCIRC/540. The interrelationship of the traditional safeguards, Part 1 and the additional Protocol measures are addressed below.

A. Improved access to information and its effective use

The strengthened safeguards system aims to improve access to information by requiring States to expand their declaration. In addition, the IAEA will collect information via environmental sampling. Information available in public media and

information provided by member states will also be used.

A. I. Expanded Declaration-

The idea behind the expanded declarations is to require States to make comprehensive declaration on all nuclear material and all nuclear-related activities, including

93+2 Part 1 requirements:

- material accounting and operating information related to past activities, including shutdown/decommissioned facilities,
- more timely material accounting and operation information,
- technical resources, capability and legal authority of the SSAC,

INFCIRC/540 requirements:

- additional operating information relevant to safeguards,
- ten-year fuel cycle R&D plan, including R&D activities without nuclear material,
- description of each building on each site,
- scale of operation for nuclear-related equipment,
- U mines and U/Th concentration plants,
- materials previously exempted or terminated from safeguards,
- export/import information about specified equipment and non-nuclear material,
- fuel cycle R&D not directly controlled by the State,
- as specified by the IAEA, activities and identities of persons or entities carrying out fuel cycle R&D.

With complete declarations by the States, the task of detecting undeclared nuclear activities and materials will be easier to achieve; since the detection of any undeclared activity, signature, equipment, or material would constitute a violation. Inter-comparison of declarations of export and import information from all member States would assist the IAEA in assessing if declaration is complete in the States involved.

In effect, the scope of NPT safeguards, which was limited to “all peaceful nuclear activities” (Article III.1 of the NPT), has been expanded by the Protocol. It is important to recognize that the expanded declaration is a major, additional commitment. Under the Non-Proliferation Treaty, even non-nuclear-weapon-states (NNWSs) are permitted to carry out unsafeguarded military nuclear programs, as long as the programs are not related to nuclear weapons or explosives. In addition, INFCIRC/153 allows the withdrawal of safeguarded material for non-proscribed military activity which does not require the application of safeguards, as long as the nuclear material will not be used for the production of nuclear weapons or explosives. The 93+2 Program requires complete declaration, including all nuclear-related activities, past, present and future, peaceful or not; and, more importantly, it requires States to allow access to verify all the declarations.

A.II. Environmental Sampling-

The other important method to collect additional information under the 93+2 Program is via environmental sampling. Under Part 1 of the 93+2 Program, the IAEA states that it may take environmental samples wherever and whenever it has a right of access

to conduct design information verification visits and ad hoc, routine, or special inspections. During ad hoc inspections, access is limited to those sites where the initial report or inspections carried out in connection with it indicate that nuclear material is present. During routine inspections, access is limited to strategic points. However, during design information verification visits, access is not limited to strategic points, but extends to all that are associated with design information for facilities.

Under the Protocol, the IAEA states that wherever IAEA has access under complementary legal authority (see Section B.II below), it also has the right to carry out environmental sampling.

The purposes of environmental sampling are to confirm the absence of, or to detect, identify and characterize, unreported nuclear activities or materials.

Location-specific environmental sampling is intended for the collection of samples at and in the immediate vicinity of a specific location. In addition, the Agency has more limited authority (Article 9 of the Protocol) to conduct wide-area environmental sampling to assist the Agency to draw conclusions about the absence of undeclared nuclear material or nuclear activities over a wide area. Under the Protocol, the Agency shall not seek such access until its use and the procedural arrangements therefor have been approved by the Board and following consultation between the Agency and the State.

A.III. Improved Information Analysis-

The IAEA will look for inconsistencies in the information obtained via expanded declarations, during inspections, information available in public media, and possible additional information provided by member States. For example, internal consistency of the Expanded Declaration, consistency of the Expanded Declaration with information obtained via environmental sampling, consistency of the State's declaration of exports and imports of nuclear, nuclear-related material and equipment,...etc., with other States' declarations will be examined. Advanced computer technology, both hardware and software, if available, would be used to manage and analyze the wealth of information thus obtained.

In addition, a proliferation critical path is being developed by the IAEA to provide a systematic means of categorizing and recording relevant information, and to identify indicators of certain activities, starting from acquisition of source nuclear material to weaponization. In the IAEA, a "Country Officer" has been designated to integrate all information relevant to each state.

B. Increased physical access

Increased access will be achieved via no-notice inspections (randomness in time) as well as access to additional locations previously not available to the Agency.

.B.I. No-notice inspection-

A no-notice inspection, as the name implies, requires no advance notification and thus

the IAEA inspectors can arrive at the entrance of a site at any time, although access inside the facility may be delayed slightly (e.g., two hours in practice). No-notice inspections can be carried out to more effectively:

- verify flows at large facilities,
- confirm the status of shut-down, decommissioned facilities, facilities under construction,
- confirm the non-operating status of nuclear facilities, and,
- confirm that facilities are not used for clandestine purposes, e.g., unreported irradiation at reactors or production of HEU at enrichment plants.

Under Part 1, no-notice inspections are limited to access strategic points in routine inspections, and are not applicable to ad hoc inspections, special inspections or design information verifications. In addition, no-notice inspections may also be used to confirm the information in an Expanded Declaration regarding the absence of nuclear material at de-commissioned, closed down, under construction, or non-operating facilities and to confirm the absence of undeclared activities such as unreported irradiation at reactors or HEU production at enrichment plants.

No specific provisions about no-notice inspections were prescribed in the Protocol. Access under the Protocol requires advance notice. Thus, by definition, no-notice inspections are not applicable under the Protocol, although access within two hours (or shorter) notice is possible.

B.II. Access to additional locations-

Under Part 1, increased access is that associated with design information verification visits and ad hoc, or special inspections. For routine inspections, the access is limited to strategic points, which the Agency has the right to select at any location where, under normal conditions and when combined with the information from all strategic points taken together, the information necessary and sufficient for the implementation of safeguards measures can be obtained and verified.

Under the Protocol, increased access is described as follows:

B.II.a: To assure the absence of undeclared nuclear material and activities, the IAEA shall have physical access to the following:

1. Any place on a site,
2. Any location with:
 - a. U mines, U/Th concentration plants,
 - b. U/Th processing plants up to enrichment/fabrication, or non-nuclear applications,
 - c. material previously exempted from safeguards,
 - d. material previously terminated from safeguards,
3. Any decommissioned facility or decommissioned LOF.

B.II.b: To verify the completeness and correctness of declarations, the IAEA shall have access to:

1. locations of nuclear fuel cycle related, State authorized, R&D not involving

- nuclear material,
- 2. locations where nuclear-related equipment is manufactured,
- 3. locations for certain imported equipment and material listed,
- 4. locations similar to those in Point 1 above but without State authorization,
- 5. any location identified by the IAEA as related to a site.

B.II.c: To carry out environmental sampling at any other locations specified by the IAEA.

There are subtle differences in the requirements for the three classes of access. For the access to detect undeclared material or activities, there is no qualifier. For the access to verify the completeness and correctness of declarations, a State could satisfy the IAEA requirements through other means if the State cannot provide the access requested. For access to carry out environmental sampling at any other locations, a State could satisfy the IAEA requirements at adjacent locations or through other means.

The activities for the above access are similar, including environmental sampling, visual observation, use of seals or NDA, radiation detection and examination of records.

Advance notice for increased access shall be in writing and shall specify the reasons for access and the activities to be carried out. For access to any place on a site that is sought in conjunction with design information verification visits or ad hoc or routine inspections on that site, the notice shall be given at least two hours in advance. However, in exceptional circumstances, it may be less than two hours. For access to any other areas, the notice shall be given at least 24 hours in advance.

C: Optimum use of the traditional system

They include:

- Technology advances, e.g.,
- Randomized inspections,
- Remote monitoring,
- Unattended equipment,
- Remote transmission of data,
- Making full use of SSACs,
- Adjustment of safeguards parameters.

These activities, except for the last item, are well underway and will not be addressed in this paper.

OUTLOOK

According to the Protocol, the IAEA will not mechanistically or systematically seek to verify information obtained under the Additional Protocol. Implementation of the Additional Protocol will be event driven, on a case-by-case basis. It is expected that parts of the strengthened safeguards system -e.g., application of remote monitoring, unattended measurement systems, randomized inspections, and making full use of SSACs, will lead to savings in costs of traditional safeguards. As more experience is accumulated, confidence gained from the strengthened safeguards system may lead to

the development of an integrated safeguards system in which some of the traditional safeguards measures may be omitted since their objectives are achieved through the new measures. Such an integration is being developed via careful comparison of the relative effectiveness of the new measures with the traditional measures, particularly regarding detection and deterrence.