

# THE SYSTEM OF STRENGTHENED SAFEGUARDS

BY RICHARD HOOPER

Since the end of the Cold War a series of events have changed the circumstances and requirements of the nuclear safeguards system. The discovery of a clandestine nuclear weapons programme in Iraq, the continuing difficulty in verifying the initial report of the Democratic People's Republic of Korea (DPRK) upon entry into force of its safeguards agreement and the decision of the South African Government to give up its nuclear weapons programme and join the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) have all played a role in an ambitious effort by IAEA Member States and the Secretariat to strengthen the safeguards system.

A major milestone in this effort was reached in May 1997 when the IAEA Board of Governors approved a model Additional Protocol to safeguards agreements. The Additional Protocol was negotiated by an open-ended committee of the Board involving some 70 Member States and two regional inspectorates.

The IAEA is now beginning the process of negotiating the Protocol, State-by-State. It will provide the IAEA with rights of access to information about all State activities related to the use of nuclear material and greatly expanded physical access for IAEA inspectors to confirm or verify this information. This action augments recent Board decisions that have strength-

ened the safeguards regime within the legal authority provided by existing agreements. This article reviews the major elements of the Strengthened Safeguards System and briefly addresses major implementation issues.

The process of strengthening and otherwise improving the safeguards system has been under way for some time. During 1991 the IAEA Board of Governors considered, and in 1992 confirmed, the right of the Agency to use special inspections as provided for in comprehensive safeguards agreements. In 1992 the Board took decisions regarding the early provision and use of design information for facilities handling safeguarded nuclear material, and in February 1993 the Board endorsed a voluntary reporting scheme on imports and exports of nuclear material and exports of specified equipment and non-nuclear material.

Initial implementation of measures under Programme 93+2 (the IAEA safeguards development programme initiated in 1993) began in June 1995 when the Board agreed to the Director General's plan to proceed immediately with the implementation of those measures deemed to be within the legal authority provided by existing comprehensive safeguards agreements. Measures playing a new or increased role

under existing legal authority include additional information from States regarding facilities that once contained or will, in future, contain nuclear material subject to safeguards, the expanded use of unannounced inspections, the collection of environmental samples at locations where inspectors now have access, and the use of advanced technology to remotely monitor the movements of nuclear material.

Safeguards have always required concerted actions by the IAEA Inspectorate, State authorities and nuclear facility operators. The Strengthened Safeguards System places an even greater emphasis on co-operation. Increased co-operation has a number of dimensions. One dimension is a systematic evaluation, considering the interest and capabilities of individual State (or Regional) Systems of Accounting and Control (SSAC), of ways to achieve efficiencies through enabling actions by the SSAC and through a sharing of resources and activities while preserving the IAEA requirement to come to its own independent conclusion. An SSAC questionnaire dealing with the legal basis and

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technical capabilities of SSACs was sent to 59 States and two regional systems. The responses provide the basis for on-going consultations toward increased co-operation.

The early provision of design information now is incorporated in all new and most existing subsidiary arrangements. The Voluntary Reporting Scheme now includes 52 States. A total of 1827 reports on the production of source material or the export of pre-safeguards nuclear material intended for non-nuclear uses and 298 reports on the export of equipment and non-nuclear materials as specified in INFCIRC/254/Part 1, Rev.2 have been received. Letters have been sent to States requesting further information on nuclear fuel cycle operations, prior to the starting point of safeguards, and on certain closed-down or decommissioned nuclear facilities which: (i) were built but where nuclear material was never introduced or (ii) where the facilities were closed down and the nuclear material removed prior to the entry-into-force of the comprehensive safeguards agreement. Most States have responded to these requests.

Initial implementation of environmental sampling has focused on enrichment facilities and certain kinds of hot cells. The objective is to provide increased assurances of the absence of undeclared operations involving enrichments to levels higher than declared or of reprocessing. Baseline sample collections have been carried out in nine enrichment facilities in five States and 39 hot cell complexes in 26 States. The

results of baseline sample collections are discussed with the State and the operator. The IAEA Clean Laboratory for Safeguards for the handling, screening, analysis and archiving of environmental samples was commissioned in December 1995 and was fully operational in July 1996. The Network of Analytical Laboratories has been extended to include laboratories with specialized capabilities for the analysis of environmental samples. The extended network now includes five laboratories in four States, with more expected in the near future.

The information available to the Agency through its traditional safeguards activities — augmented by additional information from States, results from environment sampling, information collected from open sources and information from databases available elsewhere in the Agency — is systematically evaluated in States having comprehensive safeguards agreements for indications of nuclear activities in these States which may not be known to the Agency. This process of broader information evaluation will be greatly strengthened with the additional information about a State's nuclear activities provided under the Additional Protocol.

The Agency is preparing, through a series of demonstration field trials, for increased utilization of unannounced routine inspections and the use of advanced technology to remotely monitor the movements of nuclear material. Advanced technology — in the form of digital surveillance cameras, electronic seals and other monitoring devices — is



being tested in conjunction with real time or near-real time transmission to IAEA headquarters of data, appropriately authenticated and encrypted. The equipment is installed at locations in Switzerland, South Africa, and the United States involving semi-static stores of direct-use nuclear material. The transmission of data is through both satellite systems and phone lines. The use of unannounced inspections for several applications is also being tested. The use of remote monitoring provides the possibility of reduced inspection effort even within existing implementation criteria.

As far as new surveillance technologies are concerned, the completion of a testing programme should allow the IAEA to take a decision on the next generation of surveillance equipment. Full of promise in the laboratory, some new digital cameras turned out to be prone to failure in the tougher environment of actual nuclear facilities. Yet such digital equipment is a prerequisite for the widespread use of remote monitoring.

Training courses dealing with the collection and handling of

*Photo: Analysis of safeguards samples at the IAEA's Laboratories. (Credit: IAEA)*

environmental samples, the physical model (*see box, page 30*) and enhanced observational skills are now part of the Department of Safeguards regular training programme. Modules of the Department's Introductory Course on Agency Safeguards for new inspectors are being added or modified to reflect the new implementation initiatives. Other training courses dealing with information evaluation and design information verification at closed-down facilities are under development.

The organizational structure for evaluation and review of safeguards relevant information has been strengthened. An Information Review Committee was established in 1996 with the involvement of key senior managers of the Agency. The Committee is charged with overseeing the process of evaluation of information for each State, which is a continuous task drawing from numerous sources: among them, the inspection results, open media, and in the future the expanded declaration under Additional Protocols.

### THE ADDITIONAL PROTOCOL'S MEASURES

Measures provided for in the Additional Protocol to safeguards agreements (INFCIRC/540) approved by the IAEA Board of Governors on 15 May 1997 include:

- information about, and inspector access to, all aspects of States' nuclear fuel cycles, from uranium mines to nuclear waste and locations where nuclear material intended for non-nuclear uses is present;

- information on, and inspector access to, all buildings on a nuclear site;
- information about, and inspector access to, fuel cycle-related research and development;
- information on the manufacture and export of sensitive nuclear-related technologies and inspector access to manufacturing and import locations;
- the collection of environmental samples beyond declared locations when deemed necessary by the IAEA; and
- administrative arrangements that improve the process of designating inspectors, the issuance of multi-entry visas and IAEA access to modern means of communications.

The Additional Protocol in combination with the safeguards agreement provides for as complete a picture as practicable of a State's production and holdings of nuclear source material, the activities for further processing of nuclear material (for both nuclear and non-nuclear application), and of specified elements of the infrastructure that directly support the State's current or planned nuclear fuel cycle. The elements of the reporting scheme are incorporated in the Additional Protocol as legal obligations.

Increased access for inspectors is provided to help assure that undeclared nuclear activities are not concealed within declared nuclear sites or at other locations where nuclear material is present. Access mechanisms are also provided for instances where there appear to be inconsistencies between all information avail-

able to the Agency and the declaration made by States regarding the whole of their nuclear programme.

The Additional Protocol greatly adds to the value of the collection of environmental samples through increased access for inspectors. In addition to so-called location-specific application of environmental sampling, the Additional Protocol also provides for the future application of environmental sampling in a monitoring or wide-area mode. Procedures to implement wide-area environmental sampling will require approval by the IAEA Board of Governors.

The Additional Protocol also contains measures that address three long-term administrative problems. States will be obliged to provide inspectors with multi-entry visas covering at least a time period of one year and to accept simplified inspector designation procedures whereby an inspector approved by the Board is automatically designated to a State party to the Additional Protocol unless the State objects within three months of the Board's action. Further, the Agency is assured of access to modern means of communication (i.e., satellite) existing in a State or, if satisfactory means do not exist, the State is obliged to consult with the Agency regarding other ways to meet Agency communication needs.

The relationship between the Additional Protocol and the safeguards agreement is specified in Article 1. The safeguards agreement and the Additional Protocol are to be read as a single document with, in cases of conflict, the

provisions of the Additional Protocol prevailing. States' concerns regarding the confidentiality of sensitive information to be provided to the Agency under the Additional Protocol were addressed through requirements that the Agency maintain a stringent regime for the protection of such information and that the regime be periodically reviewed and approved by the Board of Governors.

### **IMPLEMENTATION ISSUES: HOW FAR, HOW FAST?**

At this juncture, it is not possible to predict how rapidly the Additional Protocol will come into force but initial indications are positive. The first opportunity for parties to safeguards agreements to adopt the Additional Protocol was the September 1997 meeting of the Board of Governors. Following Board approval, six States — Australia (first), Armenia, Georgia, the Philippines, Poland and Uruguay signed an Additional Protocol. Armenia and Georgia announced their intention to apply the Additional Protocol provisionally pending parliamentary ratification. A number of other States, several with large nuclear programmes, have indicated their intentions to proceed quickly. (Lithuania since then has accepted the Additional Protocol.)

Programme 93+2 was designed for States with comprehensive safeguards agreements with the IAEA. However, it was acknowledged early in the Programme that the implementation of certain measures in other States (i.e., the nuclear-weapon States and the

INFCIRC/66 States) could both enhance the effectiveness of Programme implementation in States having comprehensive safeguards agreements and improve the effectiveness and efficiency of the safeguards that is implemented in these other States. This so-called “universality” issue was a central feature in the negotiation of the Additional Protocol.

Each of the nuclear-weapon States indicated which of the measures contained in the Additional Protocol they are prepared to accept during the 15 May 1997 meeting of the IAEA Board. Both the Board and the open-ended committee of the Board that negotiated the Protocol expressed their expectation that adoption of the Additional Protocol in States having comprehensive safeguards agreements (the Additional Protocol in its entirety) and in States having non-comprehensive safeguards agreements (selected measures) would maintain a certain “parallelism”. Several States having comprehensive safeguards agreements indicated that evidence of action toward adopting the Additional Protocol in other States would be necessary to obtain approval of the Additional Protocol in their parliaments.

Another significant implementation issue relates to the application of the Additional Protocol in the large number of States having comprehensive safeguards agreements that includes the Small Quantities Protocol (this suspends the implementation of a significant portion of Part 2 of INFCIRC/153). In principle, the Additional Protocol applies to these States. However, an

educational effort will be required as a basis for their action in this regard.

Preparations by the IAEA Secretariat to implement the Additional Protocol involve the development of a new infrastructure.

In the near term, this includes:

- arrangements for concluding Protocols with States;
- guidelines and format for preparation and submission of declarations pursuant to Article 2 of the Additional Protocol;
- the development of model language in anticipation of the need to incorporate certain measures in subsidiary arrangements and the development of model language for required communications to and from States; and
- the development of detailed internal procedures for complementary access and for the conduct of activities associated with technical measures specified in the Additional Protocol.

An initial version of the guidelines for the Article 2 declarations was distributed to States in early September 1997. Much of the other work is planned for completion by the end of March 1998.

However, evolution of the IAEA's safeguards implementation criteria — to provide for a full integration of the near-term measures with elements of a full integration of the near-term measures with elements of the traditional system — will take time and experience.

In summary, the ingredients are now in hand for a greatly strengthened and more efficient safeguards system. □



# INTEGRATING LINKS

With the IAEA Board of Governors' approval of the Additional Protocol to safeguards agreements in May 1997, an extensive three and one-half year development programme (called "Programme 93+2") for strengthened and more efficient safeguards came to conclusion. Programme 93+2 has been a major effort by the IAEA Secretariat and included the direct involvement of the Standing Advisory Group on Safeguards Implementation (SAGSI) and a large number of Member States.

Ultimately the strength of the safeguards system depends upon three interrelated elements:

- the extent to which the IAEA is aware of the nature and locations of States' nuclear and nuclear-related activities;
- the extent to which IAEA inspectors have physical access to relevant locations for the purpose of providing independent verification of the exclusively peaceful intent of a State's nuclear programme;
- the will of the international community, through IAEA access to the United Nations Security Council, to take action against States that are not complying with their non-proliferation commitments.

Since 1991, IAEA access to the Security Council has been re-affirmed and the IAEA Board of Governors has approved a number of specific measures that greatly increase IAEA access to information and to locations. Some of the new measures are being implemented under existing safeguards agreements. Other measures requiring new legal authority now are provided for in the Additional Protocol approved by the Board of Governors in May 1997.

## NEW VANTAGE POINT

Traditional material accountancy safeguards has developed through the definition of observables/indicators of diversion or of circumstances where the possibility of diversion cannot be excluded. These indicators are constantly tested against a State's declarations of nuclear material inventories, flows and facility operations. Strengthened safeguards provides for a new kind of "observational vantage point" comprised of State declarations regarding nuclear and nuclear-related activities that constitute the whole of their nuclear programme and the utilization of nuclear material, increased inspector access, new technical measures and broadly based analysis of information. An important development in this regard is the so-called "Physical Model".

Nuclear material suitable for the manufacture of weapons does not exist in nature. It must be manufactured from source material through a series of discrete and definable steps (i.e., mining and milling, conversion, enrichment, fuel fabrication, irradiation, reprocessing). Each step can be

accomplished through any one of several processes where the choice of the process for a given step depends, to some extent, upon the processes chosen for both the preceding and succeeding steps. The Physical Model, is an attempt to identify, describe and characterize every known process for carrying out each step necessary for the production of weapons-usable material. Thus, any possible route from source material to special fissionable materials is describable as some combination of processes identified and characterized in the Physical Model. Each process for carrying out a given step is described and then characterized in terms of indicators of the existence of that process. The indicators of the existence of a process may be specialized and dual-use equipment, nuclear and non-nuclear materials, environmental signatures, requirements for specific technical skills and so on. The model was the combined work of Department staff and a small group of experts from Member States. It will always be a work-in-progress subject to periodic review and update. However, a form of closure was achieved recently with a Consultants' Meeting where each component was subjected to a detailed review by additional experts from ten Member States.

Just as the overall technical objective of traditional safeguards translates to the testing of the hypothesis of "no diversion", the objective of strengthened safeguards is met through a country-level evaluation taken to be the testing of the hypothesis that "there are no undeclared nuclear activities". It is a detailed technical evaluation of first the internal consistency of the State's declaration and secondly, a point-by-point comparison between indications of activities from all information available to the Agency and what the State says they are doing or plans to do.

The process of information evaluation and the inspection process are inextricably linked: many of the sub-hypotheses (or questions) regarding the absence of nuclear activities (including facility misuse) are, or only can be, tested through direct observation. Some hypotheses to be tested through direct observation are by design, others arise through the need to resolve inconsistencies between information collected by the Agency and a State's declaration. Information is relevant to this technical evaluation only to the extent that it indicates, directly or indirectly, the existence of a nuclear activity or the presence of nuclear material. The conclusion that there are no undeclared nuclear activities can only be inferred from the absence of any evidence to the contrary. This absence does not prove that there are no undeclared nuclear activities. It says that from all information available none has been observed and, in the absence of such observation, there is no reason to reject the hypothesis that "there are no undeclared nuclear activities".