

SAFEGUARDS SAFEGUARDS

PROGRAMME OBJECTIVE

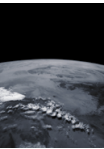
To determine, through the application of the Agency's safeguards system, whether States are complying with the undertakings in their safeguards agreements with the Agency.

OVERVIEW

In fulfilling the safeguards obligations of the Agency in 1999, the Secretariat did not find any indication that nuclear material which had been declared and placed under safeguards had been diverted for any military purpose or for purposes unknown, or that facilities, equipment or non-nuclear material placed under safeguards were being misused. All the information available to the Agency supports the conclusion that the nuclear material and other items placed under safeguards remained in peaceful nuclear activities or were otherwise adequately accounted for.

In 1999, the Agency was in the early stages of implementing protocols additional to safeguards agreements ('additional protocols'). Having completed the evaluation of all the information available to the Agency in respect of two States, including information obtained through activities pursuant to their comprehensive safeguards agreements and additional protocols, the Agency found no indication either of diversion of declared nuclear material or of the presence of undeclared nuclear material or activities in those States. In the case of other States with comprehensive safeguards agreements and additional protocols in force, the evaluation of the information available to the Agency is not yet complete.

The Democratic People's Republic of Korea (DPRK) remains in non-compliance with its safeguards agreement. The Agency is still unable to verify the correctness and completeness of the initial declaration of nuclear material made by the DPRK and is, therefore, unable to conclude that there has been no diversion of nuclear material in the DPRK. Although the safeguards agreement between the DPRK and the Agency remains binding and in force, the



Agency is able to implement only some of the required safeguards measures in the DPRK. These measures include monitoring the "freeze" on the DPRK's graphite moderated reactors and related facilities, as requested by the United Nations Security Council and as foreseen in the "Agreed Framework" of October 1994 between the United States of America and the DPRK.

Since 1991, the Agency's safeguards activities in Iraq under the comprehensive safeguards agreement concluded pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) have been implemented as part of the activities carried out by the Agency in Iraq pursuant to United Nations Security Council resolution 687 and related resolutions. In 1999, the Agency was not in a position to implement its Security Council mandated activities in Iraq and could not, therefore, provide any assurance that Iraq was in compliance with its obligations under these resolutions. In these circumstances, given the requirements of its safeguards system, and pursuant to Iraq's safeguards agreement, the Agency scheduled, for December 1999, a physical inventory verification of the nuclear material subject to safeguards in Iraq with the objective of verifying the presence of the nuclear material in question. The inspection could not be carried out in December 1999 because the Government of Iraq provided the necessary visas for the safeguards inspectors only in January 2000.*

As of 31 December 1999, 224 safeguards agreements were in force with 140 States (and with Taiwan, China) (see Annex, Table A14). At the end of 1999, safeguards agreements, which satisfy the requirements of the NPT, were in force with 128 States. NPT safeguards agreements entered into force with Azerbaijan in April. A safeguards agreement pursuant to the NPT and the Southeast Asia Nuclear Weapon-Free Zone Treaty entered into force with Cambodia in December. The Board of Governors approved draft NPT safeguards

agreements with Kuwait and Oman. These agreements had not entered into force by the end of the year.

By the end of 1999, Protocols Additional to Safeguards Agreements for 46 States had been approved by the Board of Governors (see Annex, Table A17). Eight such Protocols were in force with Australia, the Holy See, Indonesia, Japan, Jordan, Monaco, New Zealand and Uzbekistan. Furthermore, the Additional Protocol with Ghana was being implemented provisionally pending entry into force.

Through an exchange of letters between Brazil and the Agency, it was confirmed that the safeguards agreement concluded between Argentina, Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and the Agency for the application of safeguards satisfies the obligations of Brazil under Article III of the NPT and under Article 13 of the Treaty of Tlatelolco to conclude a comprehensive safeguards agreement with the Agency.

OPERATIONS

Major developments with regard to the implementation of Additional Protocols included the following:

- Declarations pursuant to Article 2 of the Additional Protocol had been received from five States and were, or are in the process of being, evaluated and any necessary amplifications or clarifications sought. In addition, measures foreseen under the Model Additional Protocol were implemented in Taiwan, China, including receipt and review of declarations pursuant to Article 2.
- Under the authority conferred by the Additional Protocol, complementary accesses were made in Australia, Uzbekistan and Taiwan, China.

* The planned physical inventory verification inspection took place from 22 to 25 January 2000. The inspectors were able to verify the presence of the nuclear material subject to safeguards in Iraq.

- Implementation trials continued in Japan at two sites with the goal of providing experience to the Agency, State authorities and operators in the implementation of measures foreseen under the Model Additional Protocol. The trials were aimed primarily at gaining practical experience in complementary and managed access for complex nuclear sites, including logistical aspects, managed access and environmental sampling.
- Pending entry into force of the Additional Protocol for countries of the European Union and EURATOM, consultations with EURATOM have started for the implementation of measures foreseen under the Additional Protocol on a trial basis at selected sites.
- The United Kingdom voluntarily submitted an initial declaration of information, in anticipation of the Additional Protocol entering into force. This voluntary declaration is being reviewed by the Agency and then discussed with the Government of the United Kingdom. This voluntary initiative, which may include complementary access trials, will assist the Government and industry to gain experience and develop an awareness for its implementation.

As a first step in the strengthened evaluation process, the nuclear programmes of all States with comprehensive safeguards agreements in force are being evaluated. In 1999, evaluations in 18 States had been reviewed, compared with ten in 1998 and four in 1997. In the second stage, these evaluations will provide a benchmark against which information submitted later under Article 2 of an Additional Protocol will be evaluated. To ensure continuing confidence in the conclusions of the evaluations, they will be updated as warranted by changing circumstances and State Evaluation Reports reviewed annually.

In 1999, environmental swipe samples were collected at eight enrichment facilities in five States and at 28 facilities, including those with hot cells in 19 States (and in Taiwan, China). Initial baseline environmental signatures have now been established and environmental sampling is being introduced into routine use at those facilities.

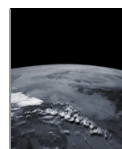
Various measures and equipment for a strengthened safeguards were implemented in a number of facilities:

- A short notice random inspection (SNRI) scheme was implemented at a low enriched uranium (LEU) fuel fabrication facility in Japan. SNRI rehearsals took place at the three other LEU fuel fabrication plants, and after a trial phase, full implementation is foreseen in 2000 at the four facilities.

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A safeguards approach which incorporates the use of SNRIs is being tested at a LEU fuel fabrication plant in Spain. The test phase is almost completed and routine implementation is expected in 2000.

- A new safeguards approach for the verification of CANDU spent fuel transfer to dry storage is under discussion with Canada. This approach is based on obtaining ‘fingerprints’ using non-destructive analysis (NDA) measurements which will provide a unique identity for each canister with spent fuel. The fingerprints will be stored in a database and subsequently used to verify the canister identity at any given time. The approach is aimed at reduction of Agency inspector’s presence at the facility during the transportation of the canisters to the storage site.
- New safeguards measures were introduced at two research reactors in Japan. These measures included the installation of a door valve monitor to detect irradiated fuel movements from the core to the spent fuel pit at one reactor and a thermohydraulic power monitor on the primary coolant lines at the other reactor. The latter equipment will be used to confirm the declared reactor



operations and contribute to assurance of the absence of undeclared plutonium production.

- At an enrichment plant in the United Kingdom, an additional continuous enrichment monitor was commissioned in the plant extension, and process load cell readers were calibrated and brought into routine use. Implementation trials of unannounced inspections were carried out at an enrichment facility in Brazil. Routine implementation is expected in 2000.
- A new safeguards approach which includes unattended NDA measurements for a MOX

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fuel fabrication plant in Belgium was implemented. The approach incorporates 'New Partnership Approach' (NPA) arrangements with EURATOM. A similar approach is being tested in a second MOX fuel fabrication plant in Belgium and is expected to be implemented during 2000.

- Unattended NDA measurement equipment is being used routinely in a facility in Germany where spent fuel elements are loaded into dry storage and transport casks for long term storage. Safeguards approaches based on extensive containment and surveillance (C/S) measures have been approved for medium term storage installations in Belgium and in Germany which store spent fuel in dry storage containers. The nuclear material under these specific measures do not have to undergo re-measurement as long as the C/S measures provide continued assurance on the status and containment of the material.
- Strengthened safeguards measures were introduced at a high enriched uranium (HEU) storage in South Africa, which included the installation of motion detec-

tion and a surveillance system with remote monitoring capability.

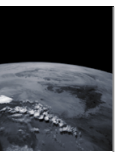
- Independent or authenticated systems were introduced at a reprocessing plant in Japan to measure and monitor plutonium product solutions and verify transfers of high active solid waste and vitrified waste.
- Shipments of MOX fuel assemblies from Europe to Japan were verified and sealed in Belgium, France and the United Kingdom. Verification and sealing of the MOX fuel assemblies at the fabrication plant is effective and cost efficient, minimizing verification of receipts at the receiving facilities.

Other inspection activities of particular note were as follows:

- Inspections in Yugoslavia resumed without any major problem after an interruption of four months owing to the security situation. A physical inventory verification and baseline environmental sampling were carried out.
- The Agency maintained a continuous presence at the fast breeder reactor in Kazakhstan since October 1998 to verify the fuel canning campaign. More than 2000 assemblies had been measured and packed by October 1999, at which time stabilization of abnormal assemblies and their canning started. This process is due to be completed by the end of 2000.

Co-operation with regional or state authorities was pursued:

- Within the framework of the NPA with EURATOM, co-operation in the area of R&D for safeguards continued as follows: (a) the development of an in situ verifiable transponder seal that could replace metal seals, as well as a new generation of electronic seals; (b) development of a new generation of authenticated digital surveillance systems; (c) development of several NDA techniques for the verification of spent fuel assemblies under Member State Support Programmes; and (d) remote monitoring and data transfer trials were carried out in one facility in Germany and one in Sweden.



- The co-operation between ABACC and the Agency continued. Procedures were developed for the joint use of equipment for carrying out unannounced inspections and for holding joint training courses.
- The Agency's co-operation with the State's Systems of Accounting and Control (SSAC) of Japan and the Republic of Korea to promote inspection efficiency includes the joint use of safeguards equipment and development of joint use procedures. Discussions on further enhanced co-operation with the SSACs are continuing.

Activities carried out in nuclear weapon States included:

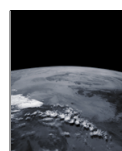
- A Tripartite Enrichment project between China, the Russian Federation and the Agency was completed. This project was aimed at developing an improved safeguards approach in an enrichment plant in China that uses Russian gas centrifuge technology. The measures suggested are now being implemented.
- Following the decision by the USA in 1993 to submit to Agency safeguards nuclear material removed from its nuclear

weapons programme, the Agency continued inspections of HEU and plutonium in three facilities. In 1999, the USA submitted an additional 50 tonnes of HEU (for down-blending to LEU) to Agency safeguards. A new safeguards approach was developed and implemented in a newly selected facility.

- In June, technical discussions were held between the Agency and the USA for establishing a safeguards approach for the stabilization of safeguarded plutonium. The stabilization campaign is planned to start after June 2000 and last about six months, after which plutonium will be stored in another facility.
- The implementation of safeguards in the United Kingdom was reviewed to take account of changes in bilateral safeguards agreements. As a result, safeguards at a spent fuel storage facility was discontinued.
- Work continued on developing a system for Agency verification of weapon origin fissile material and other fissile materials determined by the Russian Federation and the USA to no longer be required for defence purposes. In addition, work on a model

Verification Activities

	1997	1998	1999
Inspections performed	2 499	2507	2 495
Person-days of inspection	10 240	10 071	10 190
Seals applied to nuclear material or safeguards equipment, detached and subsequently verified (including seals applied jointly with EURATOM)	24 943	26 824	28 044
Optical surveillance films reviewed	1 500	932	1 271
Video tapes reviewed	4 010	4 884	5 033
Nuclear material samples analysed	888	645	664
Nuclear material analytical results reported	2 150	1 610	1 587
Environmental samples analysed	585	497	511
Nuclear material under safeguards (tonnes)			
Plutonium contained in irradiated fuel	565	593	609
Separated plutonium outside reactor core	57.6	62.4	67
Recycled plutonium in fuel elements in reactor cores	5.7	7.2	8.0
High enriched uranium	20.5	21.4	21.2
Low enriched uranium	49 282	49 483	49 408
Source material	108 648	90 622	91 647



verification regime proceeded and the basic technical measures to be employed for the verification of plutonium with classified characteristics, including nuclear weapon components, advanced to the point where full-function prototypes are now under development. Financial arrangements

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were examined and further work is under way in preparation for the steps required for the adoption and implementation of new bilateral agreements between the Agency, the Russian Federation and the USA.

- In anticipation that the Conference on Disarmament would commence negotiations on a treaty banning the production of fissile material for use in nuclear weapons and other nuclear explosives, the Agency reviewed the technical aspects of relevant verification. The Director General informed the President of the Conference on Disarmament that the Agency was prepared to respond to any request for assistance in the context of a United Nations General Assembly resolution that calls upon the Agency to provide such assistance.

Progress was made in the negotiation of Subsidiary Arrangements to Safeguards Agreements: one new General Part of Subsidiary Arrangements, as well as 117 new or revised Facility Attachments entered into force. The General Part of the Subsidiary Arrangements to the safeguards agreement

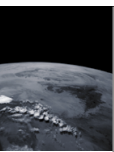
with EURATOM (INFCIRC/193) was revised and brought up to date. It is expected that this will enter into force in the near future. In addition, the General Part of the Subsidiary Arrangements for an Additional Protocol entered into force for one State.

The Safeguards Analytical Laboratory (SAL) and the Network of Analytical Laboratories (NWAL) analysed 664 samples of nuclear materials and heavy water and provided 1384 results for the material accountancy verification of declarations of facility operators. An additional 181 samples were measured for other safeguards purposes. SAL received and performed screening measurements on 165 environmental samples prior to their distribution to the network of analytical laboratories.

The analytical instrumentation in SAL was improved by the acquisition of a thermal ionization mass spectrometer for nuclear material analysis and a secondary ion mass spectrometer for the measurement of uranium and plutonium in microscopic particles coming from environmental swipe samples. The scanning electron microscope in SAL was upgraded by the addition of two X ray analysing crystals, allowing more sensitive measurements of uranium, plutonium and americium in microscopic particles collected inside hot cells.

The activities of the JNFL project continued to develop a safeguards approach. Work continued on the preparation of the specifications for design, procurement, installation, testing and acceptance of the required equipment and data collection and evaluation systems and the planned on-site analytical laboratory for the JNFL Rokkasho fuel reprocessing plant.

Two rounds of technical discussions took place between the Agency and the DPRK in 1999. While these discussions allowed day-to-day problems to be settled, no major progress was made in resolving long outstanding issues. However, some tangible progress was made on the issue of the preservation by the DPRK of information that the Agency deems necessary for verification of the correctness and completeness of the DPRK's initial declaration. The Agency is still unable to



conclude that no diversion occurred of nuclear material that should have been subject to safeguards.

The Agency's Action Team was unable to implement its mandate with regard to Iraq under the relevant United Nations Security Council resolutions and, as a consequence, to provide any assurance that Iraq was in compliance with its obligations. The team focused on upgrading its computerized information system and its analytical and inspection support tools. It also performed advanced analyses of information accumulated through years of inspections.

A physical inventory verification inspection was scheduled to take place in December 1999 under the Safeguards Agreement between Iraq and the Agency pursuant to the NPT. The inspection was intended to verify nuclear material subject to this agreement at the Tuwaitha storage facility. The verification inspection was performed in January 2000.

DEVELOPMENT AND SUPPORT

With the remote monitoring (RM) project completed in December 1998, implementation began of these systems for safeguards applications. Of particular note were the following:

- Seventeen systems were installed and ten were commissioned. A further 25 systems were purchased for installation in 2000. A cost-benefit analysis was carried out in support of future RM implementation planning.
- An RM system was installed at a large research reactor in Canada as part of a new safeguards approach.
- The second phase of an RM project at a MOX fuel fabrication plant in Japan neared completion. The project included the transmission of NDA data from the facility to the Agency's regional office.
- Field trials continued at one LWR in the Republic of Korea and LWRs in Japan. RM systems for routine safeguards use were also installed at two LWRs in Switzerland and at two LWRs and a spent fuel storage

in South Africa, with routine implementation planned at all LWRs in Switzerland during 2000.

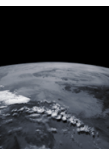
- Field trials of a complex RM system for the verification of CANDU spent fuel transfer to dry storage in Argentina continued under a joint support programme.
- Plans for the setup of an RM test facility at Agency Headquarters were completed.

Frame relays for the secure transfer of data were implemented in the Agency's Toronto regional office as well as in South Africa.

In the area of equipment development (see Annex, Table A21), ten equipment systems and software were modified and upgraded, 19 were developed and evaluated, and 6 authorized for inspection use. The development of new software for the mini multi-channel analyser, upgrading of the existing electronic VACOSS seal, and development of new electronic sealing devices, and of an improved cadmium-zinc-telluride detector for short-cooling-time spent fuel measurements are in progress. Additionally, a new underwater ultrasonic sealing system was applied on the spent fuel storage at the Cernavoda reactor in Romania.

The introduction of new generation multi-channel analysers proceeded, at the same time as the withdrawal of the ageing ones. A new generation of unattended radiation monitoring systems in CANDU reactors started to replace the aged systems. Digital image surveillance systems continued to be installed. At the end of 1999, 118 digital systems operating 163 cameras were in use. A further 93 systems were purchased for installation in 2000. The first multi-camera digital system was installed for a field trial. Further steps to optimize safeguards equipment utilization were also performed.

A new inspection scheduling system was developed to assist the three operations divisions in the scheduling of inspections. A new system was developed to assist Member States in preparing declarations under Articles 2 and 3 of the Additional Protocol that allows the data to be entered in an electronic format suitable for submission to the Agency.



A number of electronic and physical security measures were implemented to strengthen in-house security, including: measures to reduce the risks of access to the LAN via modems; development of an information security policy and operating procedures; implementation of technical measures, which include implementation of an intrusion detection system; provision of secure remote access and development of a disaster recovery plan; and increased physical protection of one floor by restricting access to authorized staff only.

“A new system was developed to assist Member States in preparing declarations under Articles 2 and 3 of the Additional Protocol.”

All applications and information technology infrastructure were made Y2K compliant. In addition, a seminar was held in February to assist Member States in identifying Y2K related problems, and some Member States were given assistance in resolving these issues.

Work continued to prepare for implementation of Additional Protocols and practical experience was gained through actual implementation and through an implementation trial of protocol measures. A simplified set of guidelines for the submission of declarations under Articles 2 and 3 of the Additional Protocol was issued in April for use by States that have little or no nuclear material and/or nuclear activities. Such States have usually concluded a ‘Small Quantities Protocol’ which holds in abeyance most of the detailed provisions of Part II of a comprehensive safeguards agreement. The Secretariat continued to develop, for internal use, guidelines which seek to ensure that complementary access under the Additional Protocol is carried out in an efficient, technically effective and non-discriminatory manner. Guidelines for sites were completed and are now in use; they include

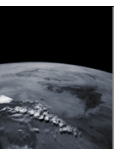
recommendations for selecting places for access within a site. Guidelines for complementary access to decommissioned facilities are being finalized, as are guidelines for other locations declared as having nuclear material.

Work on the strengthened safeguards system was pursued with particular emphasis on integrating traditional nuclear material verification activities with the new strengthening measures. A programme was established for further developing concepts for integrated safeguards as well as the necessary guidelines, approaches and implementation criteria. The first priority for consideration is the development of an integrated safeguards approach for LWRs without MOX fuel. The development programme is being undertaken within, and coordinated by, the Department together with the assistance of a group of safeguards experts, with advice from the Standing Advisory Group on Safeguards Implementation and with the support of a number of Member State Support Programmes. Two technical co-ordinating meetings with participation of experts from nine Member State Support Programmes were held in Vienna to discuss progress in the development of integrated safeguards approaches and to define the direction of future activities.

Under additional protocols concluded on the basis of the Model Additional Protocol (INFCIRC/540), Subsidiary Arrangements are not compulsory but may be requested by a State or the Agency. Model language was prepared and used for the negotiation of such Subsidiary Arrangements.

Model language was also prepared and used for formal reporting under Article 10 of the Model Additional Protocol to States on the Agency’s activities performed. Such statements were issued to one State (Australia) concerning the performance of complementary access to sites in that State and the conclusions drawn from these activities.

Quality assurance support was provided to enhance the effectiveness and efficiency of the Agency’s verification activities. In particular, the Departmental inspection documentation packages (IDP) tracking system became fully



operational, allowing the user to track, on a real time basis, an IDP and to alert the responsible party(ies) to problems requiring corrective action. In 1999, about 3500 IDPs were produced by the inspectorate and were subject to systematic quality control checking. The quality of the seals verification system continued to be monitored through the use of deliberately altered seals and blind testing, with 91 such blind tests performed. In addition, the quality of surveillance review was monitored through re-review of randomly selected films and tapes and in-depth reviews of the surveillance application. During the year, such re-reviews were performed for 7 inspection reports.

The safeguards training curriculum was further enhanced with new training courses that address the need for increased skills and knowledge of safeguards staff and Member State personnel. In addition to regular courses for inspectors on 'traditional' safeguards, training on the implementation of strengthened safeguards was conducted, particularly in the fields of: evaluating information from States and preparing State evaluation reports; fulfilling security requirements for information; updating and upgrading inspector knowledge of strengthened safeguards principles and practices; and further enhancing inspector knowledge of

nuclear fuel cycle and proliferation indicators. Member State personnel also received training to assist them in fulfilling their obligations under safeguards agreements. International and regional training courses were conducted for SSAC personnel and the topics included strengthened safeguards, with focus on the Model Additional Protocol, Member State requirements arising from Articles 2 and 3 of the Model Additional Protocol and other related subjects.

At the request of the Board of Governors, new reports were prepared that provided additional information on the legal, technical and financial implications of the various options to address the proliferation potential of neptunium and americium. In September, the Board decided to authorize the implementation of an approach to monitor neptunium. By the end of 1999, the Agency had initiated an exchange of letters with the concerned States for the receipt of information and the application of measures required for the monitoring scheme for neptunium. With regard to americium the Board concluded that at present there is practically no proliferation risk, but asked the Director General to report, when appropriate, relevant developments as to the availability of the material and programmes in States which may lead to acquisition of such material.

