



The Agency's Programme in 2001: Verification

SAFEGUARDS

PROGRAMME OBJECTIVE

To provide the international community, through the application of the Agency's safeguards system, with independent assurance that States are complying with their safeguards commitments.

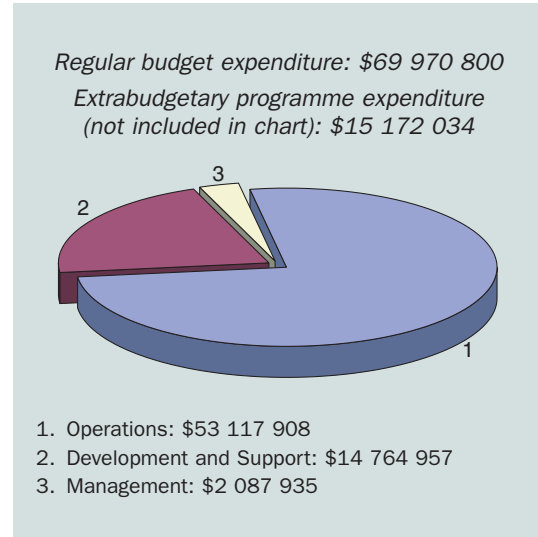
THE SAFEGUARDS STATEMENT FOR 2001

In fulfilling the safeguards obligations of the Agency in 2001, the Secretariat — having evaluated all the information acquired in implementing safeguards agreements and all other information available to the Agency — found no indication of diversion of nuclear material placed under safeguards nor of misuse of facilities, equipment or non-nuclear material placed under safeguards. On this basis, the Secretariat concluded that, in 2001, the nuclear material and other items placed under safeguards remained in peaceful nuclear activities or were otherwise adequately accounted for.

Notwithstanding the conclusion above, the Agency is still unable to verify the correctness and completeness of the initial report of nuclear material made by the Democratic People's Republic of Korea (DPRK) and is, therefore, unable to conclude that all nuclear material subject to safeguards has been declared. The DPRK remains in non-compliance with its safeguards agreement, which is in force and binding. In 2001, the Agency maintained a continuous inspector presence in Nyongbyon to monitor the freeze of the DPRK's graphite moderated reactors and related facilities.

From 1991 to 1998, 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) were implemented as part of the activities carried out by the Agency in that State pursuant to United Nations Security Council Resolution 687 and related resolutions. Since December 1998, the Agency has not been in a position to implement its Security Council mandated activities in Iraq. Pursuant to its safeguards agreement with Iraq, for the year 2001 the Agency conducted a physical inventory verification of the nuclear material placed under safeguards in Iraq and verified the presence of the nuclear material in question.

In 2001, with regard to nine States, the Secretariat — having evaluated all the information obtained through activities pursuant to these States' comprehensive safeguards agreements and additional protocols, and all other information available to the Agency — found no indication of undeclared nuclear material or activities in those States. On this basis, and taking into account the conclusion referred to in the first paragraph of this statement, the Secretariat concluded that all nuclear material in those States had been placed under safeguards and remained in peaceful nuclear activities or was otherwise adequately accounted for. In the case of the other 16 States with comprehensive safeguards agreements and additional protocols in force, the Agency's evaluations for drawing such a conclusion are in progress.



KEY ISSUES AND HIGHLIGHTS

- A comprehensive safeguards agreement pursuant to the Treaty on the Non-Proliferation of Nuclear weapons (NPT) entered into force for the Lao People's Democratic Republic. An exchange of letters between the Agency and Colombia entered into force which provides that Colombia's safeguards agreement concluded pursuant to the Treaty of Tlatelolco satisfies the requirements of Colombia under the NPT. Comprehensive safeguards agreements pursuant to the NPT with Andorra and Oman were signed and one for Niger was approved by the Board of Governors.
- Since the approval in 1997 of the Model Additional Protocol, activities related to the negotiation and implementation of additional protocols have significantly increased. In 2001, protocols additional to safeguards agreements came into force for Bangladesh, Ecuador, Latvia, Panama, Peru and Turkey. In addition, Andorra, Costa Rica, Guatemala, Mongolia and Nigeria signed protocols additional to their safeguards agreements. Of the European Union (EU) non-nuclear-weapon States (NNWSs), Austria and Portugal notified the Agency that the additional protocol had been ratified by their respective governments, bringing the total number of EU NNWSs having ratified additional protocols to eight (Austria, Finland, Germany, Greece, Netherlands, Portugal, Spain and Sweden). The United Kingdom indicated that it had completed all internal preparations for entry into force of the protocol between it, the Agency and Euratom.
- By the end of 2001, additional protocols for 61 States had been approved by the Board of Governors and subsequently signed. Twenty-four such protocols were in force with Australia, Azerbaijan, Bangladesh, Bulgaria, Canada, Croatia, Ecuador, the Holy See, Hungary, Indonesia, Japan, Jordan, Latvia, Lithuania, Monaco, New Zealand, Norway, Panama, Peru, Poland, Romania, Slovenia, Turkey and Uzbekistan (see Fig. 1). Furthermore, an additional protocol with Ghana was being imple-

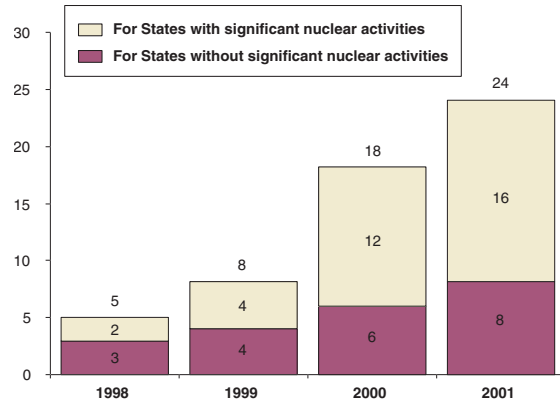


FIG. 1. Number of States with additional protocols in force. (In addition, in Ghana an additional protocol is being applied provisionally since June 1998. Measures foreseen under the Model Additional Protocol were also applied in Taiwan, China.) In the context of this report, "significant nuclear activities" means a State that has any amount of nuclear material in a facility or location outside facilities or nuclear material in excess of the limits in paragraph 37 of INFCIRC/153.

mented provisionally pending entry into force. Measures foreseen under the Model Additional Protocol were implemented in Taiwan, China.

- The development of a conceptual framework for integrated safeguards was completed as a priority item. This framework comprises the set of safeguards concepts, approaches, guidelines and criteria that govern the design, implementation and evaluation of integrated safeguards. When applied, it will ensure that there is consistent, non-discriminatory implementation of integrated safeguards in States with similar types of facility and fuel cycle.
 - Model integrated safeguards approaches were developed for three more generic facility types: for LWRs with mixed oxide (MOX) fuel, for on-load refuelled reactors; and for fabrication plants for depleted, natural and low enriched uranium (LEU) fuel. In addition, the Agency refined the integrated safeguards approaches for LWRs without MOX fuel, for research reactors and for spent fuel storage facilities that had been developed in

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2000. Guidelines for the design of an integrated safeguards approach for a State were developed and are being used to prepare State level integrated safeguards approaches for specific States.

- A significant accomplishment is the first implementation of integrated safeguards in a State, namely Australia, beginning in 2001.
- Introduced as a key safeguards strengthening measure in the mid-1990s, the evaluation of information on a State’s nuclear programme for safeguards purposes is now an integral part of the process of deriving conclusions about the non-diversion of declared nuclear material and, where appropriate, about the absence of undeclared nuclear material and activities in that State.
 - The information available to the Agency for analysing a State’s nuclear activities has increased steadily owing to: the growing number of States providing declarations pursuant to additional protocols; increased access to nuclear sites, including complementary access; information collection through the use of additional open sources and software; exploitation of new technologies such as commercial satellite imagery; and information voluntarily provided by Member States.
 - The Agency allocated substantial resources to meet the new requirements emerging from increased information collection, analysis and evaluation activities, such as the review of declarations¹ pursuant to additional protocols and the preparation and review of State evaluation reports. Forty-one State evaluation reports²

were prepared by the Agency for the purpose of drawing safeguards conclusions for 2001 compared with 32 for 2000 and 17 for 1999 (see Box 1 and Fig. 2). In addition, there was complementary access (see Fig. 3) to confirm the absence of undeclared nuclear material and activities in 13 States. During 2001, seven States submitted their initial declarations, pursuant to Articles 2 and 3 of their additional protocols, to the Agency for review.

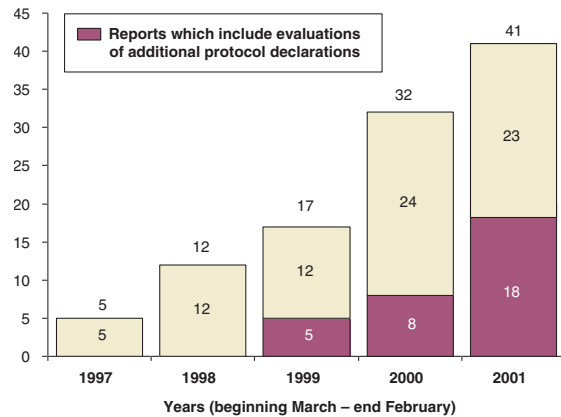


FIG. 2. State evaluation reports (completed and reviewed).

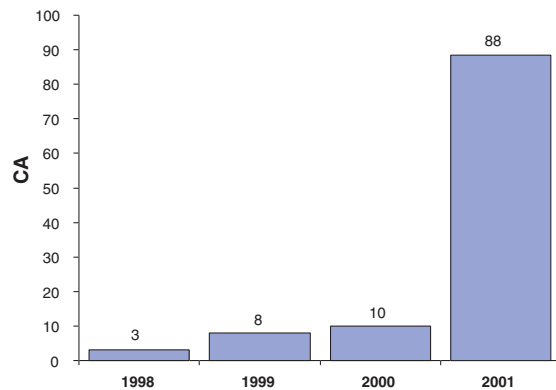


FIG. 3. Complementary access (CA), 1998–2001.

¹ The Model Protocol Additional to Safeguards Agreements (INFCIRC/540 (Corr.)), approved by the Board of Governors in May 1997, provides for a State to *declare* information about all its activities related to the use of nuclear material to the Agency. Furthermore, it provides for expanded physical access (*complementary access*) for Agency inspectors to confirm the State’s declarations

² In addition, one evaluation report was prepared for Taiwan, China.

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- The first phase of the development of software to assist in the review and evaluation of additional protocol declarations was completed. Regarding the use of satellite imagery, commercial sources of high resolution imagery were diversified to enhance quality and independence of the information available to the Agency. Geo-referenced datasets that enable information to be stored and referenced based on global location were expanded.
- The ninth symposium on 'International Safeguards: Verification and Nuclear Material Security' was held in Vienna in October–November 2001, drawing considerable interest from the general public and the media. The topics covered the full spectrum of current nuclear security interests, such as non-proliferation and nuclear material security. Taking note of the September 11 attacks in the USA, a special session on combating nuclear terrorism was added. Experts from outside the Agency were invited to describe the potential threats arising from the possibility of nuclear terrorism.
- The Agency spent \$70.8 million in regular budget funds (equivalent to \$82.9 million at

an exchange rate of 12.70 Austrian Schillings to the US dollar) on activities related to nuclear verification and the security of material, divided between \$70 million for the implementation of safeguards and \$0.8 million for the security of material programme. It should be noted that 18.3% of all expenditures (\$15.1 million for safeguards implementation and \$0.76 million for the security of material) came from extrabudgetary resources. In particular, extrabudgetary funds were used for the procurement of safeguards equipment required for strengthening safeguards and to support Member States, particularly in the areas of physical protection and trafficking. In order to cover staff costs, a significant amount of money originally budgeted for equipment was reallocated, leading to an increased dependence on Member States for extrabudgetary assistance.

OPERATIONS

Safeguards implementation. At the end of 2001, safeguards activities were being applied at 908 facilities in 70 States (and in Taiwan,

BOX 1. EVALUATING INFORMATION ON A STATE'S NUCLEAR PROGRAMME — A KEY SAFEGUARDS STRENGTHENING MEASURE

All information available to the Agency on a State's nuclear programme is subject to continuous review. State evaluations take place in three stages:

1. Through baseline evaluation of a State's nuclear programme, a profile is developed against which to compare and assess new information for safeguards purposes.
2. Further evaluation following the implementation of an additional protocol in a State includes consideration of the information contained in the initial declarations of a State pursuant to an additional protocol and the results of other activities conducted, as needed, under the additional protocol. This evaluation is essential for drawing a conclusion of the absence of undeclared nuclear material and activities in a State.
3. Continuing evaluation of the State's nuclear programme, including consideration of updated information regarding a State, as well as updated declarations and activities conducted pursuant to an additional protocol. This ongoing evaluation is critical for maintaining the Agency's ability to regularly reaffirm its conclusions. ■

China). In addition to the activities mentioned above, noteworthy activities included the following:

- A Short Notice Random Inspection scheme was fully implemented at four LEU fuel fabrication facilities in Japan. In this context, short notice inspections were performed for the first time at Japanese LWRs to facilitate the fulfilment of safeguards criteria for LEU fuel fabrication plants.
- The absence of nuclear material in the core of an on-load reactor in Japan was verified prior to the start of decommissioning.
- The Agency successfully maintained continuity of knowledge on 28 fresh MOX fuel assemblies that had been manufactured in Belgium in 2000, re-packed into containers suitable for transportation by sea and subsequently stored in a French facility throughout 2000 and shipped to Japan in January 2001.

Rokkasho Reprocessing Plant (RRP). The safeguards approach for the new large reprocessing plant that is being built by Japan Nuclear Fuel Ltd (JNFL) was further refined. The plant is expected to start operation in 2005. Specifications for the design, procurement, installation, testing and acceptance of safeguards equipment and software systems were produced. The construction of an On-site Analytical Laboratory (OSL) progressed with the installation of glove boxes and hot cells. Agency support for the OSL included carrying out tasks on analytical instrumentation/methods such as hybrid K-edge densitometry, spectrophotometry, alpha/gamma spectrometry and density measurement. In addition, a robotized sample preparation system that had been developed with the assistance of a Member State Support Programme (MSSP) was successfully transferred to Japan. In 2001, more than 100 person-days in the field were required for examination and verification of design information, including tank calibration. When the plant is in full operation, it is expected to require at least 900 person-days of verification in the field per year, which represents an increase of about 10% of the total safeguards inspection activities in the field.

Spent fuel verification. Agency activities related to the verification of spent fuel and the transfer of spent fuel to dry storage are continuously increasing. Significant transfers of spent fuel to dry storage facilities were undertaken in Germany (involving material that was returned from intermediate storage in the United Kingdom), Czech Republic, Belgium, Hungary, Argentina, Canada, India and Switzerland.

Preparations for safeguarding spent fuel transfers from the three shut down reactor units at Chernobyl to on-site storage began in 2001. So far, the design of integrated non-destructive assay (NDA), a containment/surveillance (C/S) monitoring system for the conditioning and storage of spent fuel and user requirements for a monitoring system for the transport of the safeguarded material within the facility have been completed. These preparations required close co-operation between the US MSSP, Ukraine, Framatome and the Agency.

Phase I of a canning campaign in Kazakhstan involving the verification of irradiated fuel to be canned for long term storage was completed. The canned fuel is to be maintained under dual C/S measures. Satellite communication equipment installed in January was used for a remote monitoring (RM) test which continued throughout the year to assess the technical and economical feasibility of RM for safeguards at the Kazakh facility. Video and radiation data were received successfully at Agency Headquarters.

New equipment for the verification of spent fuel was developed, including:

- An improved Spent Fuel Attribute Tester system to facilitate the verification of WWER-1000 spent fuel assemblies with low burnup and long cooling time. The system was successfully tested in co-operation with the Finnish Support Programme, Ukrainian facilities and the Ukrainian Government.
- A new type of Fork Detector system for the verification of spent fuel from WWER-1000 reactors. This system was successfully tested at a facility in Ukraine and subsequently put into use during the transfer

campaign of spent fuel assemblies from a reactor at this facility to dry storage.

Co-operation with regional and State authorities. The Agency made progress in negotiating Subsidiary Arrangements in connection with safeguards agreements. A new General Part entered into force for Armenia. Revised General Parts entered into force for the Czech Republic, Estonia, the Islamic Republic of Iran, Hungary, Slovakia, Ukraine and the Federal Republic of Yugoslavia. Ten Facility Attachments entered into force for facilities in Argentina, Armenia, Brazil, the Czech Republic, Japan and Slovenia.

A Memorandum of Understanding between the Agency and the Republic of Korea for enhanced co-operation in safeguards implementation at LWRs was signed in October. Arrangements include: training of State System of Accounting and Control (SSAC) personnel; electronic transfer of encrypted operational/accounting data to Agency Headquarters; use of remote data transmission equipment; joint use of safeguards equipment; and joint inspection procedures. Successful field trials were conducted involving three nuclear sites (one reactor per site); as a result the scheme was implemented as of January 2002.

Substantial contributions were made through MSSPs to Agency safeguards. The following States and organizations have formal support programmes: Argentina, Australia, Belgium, Canada, the European Union, Finland, France, Germany, Hungary, Japan, Netherlands, the Republic of Korea, the Russian Federation, Sweden, the United Kingdom and the USA. There were 246 MSSP tasks under way addressing needs identified by the Agency through its new R&D programme, which also facilitated rationalization of the different tasks.

Entry into force of the additional protocol for the 13 EU NNWSs will only take place following ratification by all 15 EU States. At the end of 2001, ratification by six EU States (Belgium, Denmark, France, Ireland, Italy and Luxembourg) was still lacking. In preparation for the approaching additional protocol implementation, an Agency–Euratom working group was established to draft procedures for information

flow, interface arrangements for complementary access and assistance and advice to EU Member States in compiling their initial declarations. The Agency continued field trials of elements of the additional protocol in Finland and Netherlands initiated in 2000. These trials are intended to test the individual reporting responsibilities of Euratom and Member States.

Activities in nuclear weapon States. Inspections continued to be carried out at plutonium and high enriched uranium (HEU) storage facilities following the decision by the USA in 1993 to submit to Agency safeguards nuclear material specified as no longer required for military purposes (Table I).

The shipment area of a MOX fuel fabrication facility in France was designated for the verification of shipment of MOX fuel assemblies to Japan. The designation of this part of the facility for safeguards will permit more effective allocation of Agency resources for verification activities in Japan.

The possibility of reducing Agency resources allocated to safeguarding two plutonium storage facilities in the United Kingdom was discussed with State authorities. As a result, an optimized safeguards approach has been drawn up, which includes the application of dual C/S measures at the storage facilities together with off-site data review.

In China, limited frequency unannounced access started in the cascade hall of an enrichment plant.

Co-operation with ABACC was intensified, particularly in the form of the common use of safeguards equipment installed and owned by ABACC and the Agency, and in conducting joint inspection activities at facilities in Argentina and Brazil.

Trilateral Initiative. Some progress was made towards the resolution of the legal, technical and financial issues associated with the verification of weapons origin and other fissile material specified by the Russian Federation and the USA as released from defence programmes. The verification methodologies for classified forms of fissile material, including nuclear weapon

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components, were agreed at the conceptual level, and development work related to specific systems to be employed in both States was initiated. The work under way is shifting from the development and testing of concepts to the construction of specific systems intended for use in specified facilities.

DEVELOPMENT AND SUPPORT

The first phase of developing software to assist in the review and evaluation of Member State additional protocol declarations was completed. With this software, documents, image review results and other types of data can be transferred electronically and integrated with additional protocol declarations.

Material balance evaluation is an important component of safeguards implementation. In order to describe the statistical methodology and ensure consistency in the evaluations, a

new guide documenting the material balance evaluation process within the Agency was issued. Furthermore, the Agency started development of software for the quality control of Member State nuclear material accounting reports to the Agency. The software can be used by Member States to improve the quality of their accounting reports.

The collection and evaluation of both open source information and information declared by States was electronically supported for State evaluations and the review of safeguards implementation. The open source system was expanded to over 3.7 million documents. New software was introduced to improve the organization of this large quantity of information and to facilitate its analysis.

The Agency's Satellite Imagery Analysis Laboratory produced 34 reports documenting analyses of satellite images. The EU Support Programme has developed Geographical Information

TABLE I. VERIFICATION ACTIVITIES IN 2001

	1999	2000	2001
Person-days of inspection	10 190	10 264	10 314
Number of new or revised Subsidiary Arrangements negotiated			
— General Parts	2	2	9
— Facility Attachments	118	26	10
Nuclear material accountancy measures			
Number of nuclear material samples analysed	650	621	831
Number of nuclear material analytical results reported	1356	1401	1747
Number of environmental swipe samples taken	149	224	263
Nuclear material under safeguards (in tonnes)			
Plutonium contained in irradiated fuel (including recycled plutonium in fuel elements in reactor cores)	617	654	690
Separated plutonium outside the reactor core	67	72.2	77.5
High enriched uranium	21.2	21.8	20.9
Low enriched uranium	49 408	48 974	50 079
Source material	91 647	91 686	94 940

System (GIS) software for associating satellite imagery with other information relevant to declared nuclear sites. Under the German MSSP, a system has been developed which can be applied to the GIS to detect significant changes over time at declared sites. Altogether, eight MSSPs are involved in the Agency's activities in satellite imagery analysis.

In 2001, software to support inspection activities in the field was developed and configured for 23 facilities. Functions include the on-site support of the examination of accounting records and updating of inventories, verification of the physical inventory, and comparison of records with State reports. In addition, software for data gathering and evaluation to be used in tank calibration activities was developed, part of which is now in use at reprocessing facilities in Japan.

In order to increase the security of information within the Agency's safeguards network, the firewall configuration has been enhanced. In addition, current electronic security measures were evaluated and improvements were initiated. Further security measures are in the test phase (e.g. biometric authentication). The Agency's secure communications structures for processing nuclear material accounting reports have been expanded to allow the receipt of data from several States via e-mail.

With regard to quality assurance, the Agency's safeguards software development process was certified as being compliant with Level II of the Capability Maturity Model for software engineering developed by the Software Engineering Institute of Carnegie Mellon University in the USA. The assessment was performed by accredited external auditors.

Development and installation of equipment. The implementation of remote monitoring continued at a reduced rate due to the need to improve its cost effectiveness and reliability. In 2001, solutions were found to reduce the radiation susceptibility of the digital camera module and, as a result, the replacement of obsolete film and video surveillance systems resumed. During the year, 62 digital cameras, connected to 32 systems, were installed, either replacing ageing and obsolete film and videotape surveillance

units, or as new installations. By the end of the year, 350 digital cameras were in operation, connected to 206 surveillance systems. Thirty of these systems were operating in an RM mode in Belarus, Japan, the Republic of Korea, South Africa, Sweden, Switzerland and Ukraine, and in Taiwan, China.

Among the new equipment developed was a portable digital surveillance system. In addition, a new multi-camera digital surveillance system was tested and is expected to be authorized for inspection use in early 2002. New electronic seals to replace the current VACOSS electronic seals were developed by the German and French MSSPs and by a commercial company from the USA. They will be tested in 2002.

More VXI Integrated Fuel Monitor (VIFM) based monitoring systems were installed. These play a key role in the spent fuel monitoring of on-load refuelled reactors. Presently, 23 VIFM systems are installed in seven facilities worldwide. In addition, problems regarding reliability and usability were resolved.

In support of strengthened safeguards and the implementation of additional protocols, the Fieldspec (HM-5) handheld monitor was authorized for use. This portable, lightweight, sodium iodide based instrument can determine the presence of radioactive materials. It is useful for both inspection verification activities and complementary access. It also has direct application in searches for indications of the illicit trafficking of nuclear material.

The Agency further standardized equipment, thereby reducing the number of equipment types being utilized in the field. Also, an improved preventive maintenance programme for safeguards equipment was initiated. Significant preparatory work included analysing maintenance records in order to establish the service history of each instrument, which serves as the basis for devising preventive maintenance plans for each equipment type.

Safeguards analytical laboratories and capabilities. In the Safeguards Analytical Laboratory (SAL) at Seibersdorf and the Network of Analytical Laboratories (NWAL), 842 samples of nuclear materials and

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heavy water were analysed and 1769 results for the material accountancy verification of facility operators' declarations were provided. In addition, 151 samples were measured for other purposes such as for the Agency's Iraq Action Team under UN Security Council Resolution 687 and for validation of the in situ verification method of uranium mining. In support of Agency activities in relation to the illicit trafficking of nuclear material, SAL provided results of nine samples from an illicit trafficking incident and participated — in collaboration with the Austrian Research Centers — in an interlaboratory round robin comparison exercise organized by the International Trafficking Working Group involving the characterization of HEU oxide powder.

A major achievement is SAL's ability to analyse neptunium and curium in spent fuel and highly radioactive liquid waste samples. Neptunium analysis will be used for flowsheet verification of facilities, with the potential to separate neptunium to confirm that the facilities are being operated as declared. Curium analysis is for the support of in situ NDA measurements.

The Clean Laboratory of SAL received 263 environmental samples, including 20 samples of air filters, soil, swipes and vegetation from a field trial of air particulate sampling. The staff of the Clean Laboratory also collaborated with experts from the Khlopin Radium Institute in St. Petersburg, Russian Federation, and the Los Alamos National Laboratory, in the USA, on the development of new sample preparation procedures. Techniques were developed for the indexing and relocation of micrometer sized particles with scanning electron microscopy and secondary ion mass spectrometry (SIMS), permitting both the elemental and isotopic analysis of selected particles. SAL also participated in a

round robin exercise on particle analysis with the Institute for Transuranium Elements, in Karlsruhe, Germany, preparing a number of test samples to be measured by seven SIMS laboratories in the NWAL.

A revised and updated version of International Target Values (ITVs) for uncertainty components in measurements of nuclear materials was published. The ITVs reflect the current state of measurement capabilities achievable for all major destructive and NDA measurement techniques used in safeguards verification activities. They are intended for use by facility operators and safeguards organizations as a reference of the quality of measurements achievable in nuclear material accountancy.

Training. The safeguards training curriculum was enhanced with updated training courses. The 45th and 46th introductory courses on Agency safeguards were organized for 29 new safeguards inspectors. A new training course for Agency and Euratom inspectors on New Partnership Arrangements concerning safeguards for specific facility types took place in Vienna. Workshops and training on special aspects of safeguards, such as nuclear material accounting, additional protocol related issues and new safeguards concepts were held with the financial assistance of Member States

With the assistance of the Swedish MSSP, a satellite imagery awareness course designed for inspectors and other Agency users of imagery was developed and conducted in Vienna.

In preparation for the application of quality management techniques to all safeguards activities, a workshop on a quality management system was developed and four workshops were held.