



# ARMS CONTROL & VERIFICATION SAFEGUARDS IN A CHANGING WORLD

**L**ike a locomotive climbing mountainside rails, the world's regime to disarm the atom has steamed along over the past quarter century, twisting, turning, rolling, rising, sometimes without much fuel and on uneven tracks. Historic events of the past decade have tested the mettle of its frame and engineers.

States regard the IAEA as a key part of that global engine. The Agency's international safeguards system — the world's first for on-site verification of arms-control commitments — serves to ensure that States comply with their legal undertakings not to develop or produce nuclear weapons. Its elements include technical measures and on-site inspections carried out under safeguards agreements to verify the peaceful nature of nuclear activities.

Of all the events over the past decade, the case of Iraq challenged the engine's limits, and sought to exploit them. Unknown to the IAEA and undisclosed by any State that had strong suspicions, Iraq secretly pursued a nuclear-weapons programme in the 1980s, breaching its commitment under the Treaty on the Non Proliferation of Nuclear Weapons (NPT) and its safe-

guards agreement with the IAEA. The attempt was discovered in 1991, after Iraq's invasion of Kuwait triggered a UN response and the ensuing Gulf War. In the spring of 1991, the UN Security Council, under a ceasefire resolution, moved to dismantle and destroy Iraq's capabilities for weapons of mass destruction, setting up a Special Commission and authorizing the ways and means to do the job. The Council granted the IAEA unprecedented inspection rights to root out and eliminate the nuclear-weapons programme — rights that involved unlimited access to any place and any person at any time, unrestricted use of logistical measures, and the application of new verification techniques. Member States also provided access to information, including satellite imagery. The inspections had the collective weight, and sanctions power, of the Council behind them.

The special operation in Iraq had international legal authority far beyond that found in IAEA comprehensive safeguards agreements. Even so, the IAEA's Iraq Action Team faced a demanding task, not free of Iraqi resistance. The most publicized event:

the four-day detention of Agency inspectors in September 1991 in a Baghdad parking lot, after they had uncovered key documents.

Today — six years, more than 1000 inspections at over 200 different sites, and hundreds of interviews later — the clandestine Iraqi nuclear-weapons programme has been uncovered and its components destroyed, removed or rendered harmless. To ensure it is not reconstituted, a system of long-term monitoring and verification carried out by the Agency's Nuclear Monitoring Group is now in place, working with support of the UN Special Commission. Yet the relevant nuclear know-how remains in the country. (See adjacent box.)

**B**aghdad's challenge sparked critical evaluations of what went wrong and what to do about it. The review process would take more than five years, and ultimately lay the foundation for a strengthened safeguards system. (See box, page 7.)

*Photo: Prof. Maurizio Zifferero, Leader of the IAEA Iraq Action Team until shortly before illness claimed his life in June 1997.*

# LESSONS FROM A BIG TEST

**T**he problems that the IAEA and the NPT regime faced in Iraq were not unique to nuclear non-proliferation. Any other arms control or disarmament treaty, for instance the Chemical Weapons Convention, the Biological Weapons Convention, and the Comprehensive Test Ban Treaty, could run into similar problems.

The Iraqi case showed that a determined and authoritarian State with very large financial resources and a skilled and dedicated nuclear establishment could defy its obligations under the NPT and evade detection for many years. This evasion may have been helped by the fact that, during the Iran-Iraq war, Western governments tended to tilt towards Iraq, which also received support from the Soviet Union. Whether the clandestine programme would have remained undetected, once the large electromagnetic isotope separation plants went into full production, is an open question. So, too, is the question of the uniqueness of Iraq's circumstances — its internal political

structure, its technical and financial resources and its regional and international political environment. What is not open to question is that, even if the physical aspects of the Iraqi programme have been completely eliminated, it nevertheless left Iraqi scientists and engineers with an invaluable store of practical knowledge about the production and processing of fissile material and the construction of a nuclear warhead.

The world is unlikely to ever have a completely effective non-proliferation regime or safeguards that are completely fool-proof. That is, of course, no reason for taking safeguards out of the hands of the IAEA as some suggested after the Gulf War; rather it underlines the continuing need to strengthen the regime and to enhance the efficacy of the IAEA's operation.

...There was, however, no escaping the fact that the first breach of an IAEA safeguards agreement had been by the use of unsuspected and unwatched clandestine plants, and not by diverting declared materials and cheating the IAEA's material

accountancy. The IAEA was seen by many as having failed its (presumably) first diversion detection test; it had patently been unable to detect a large and longstanding undeclared programme. Without the Gulf War, the IAEA might not have discovered the programme until the Iraqi government openly demonstrated that it had acquired the bomb. While this judgement would have been unduly harsh — the Director General, his staff, the Action Team, and the Board of Governors acted swiftly and decisively and dealt effectively with a new and unforeseen challenge — there was no doubt that a fundamental review and redirection of the existing IAEA safeguards system was essential. It is to the credit of the IAEA that this review was promptly undertaken and first applied in the case of the DPRK.

— *Excerpts from David Fischer's new book on the IAEA's history. See the back cover of the Supplement to this edition for more information about it.*

The Iraqi case had radically changed the political environment and raised the stakes. It altered how States perceived their own national security vis-a-vis IAEA safeguards. As a result, they were more willing to extend greater latitude to the Agency in interpreting its rights and obligations, though not at first. Some States strictly

saw the IAEA's job as verifying States' declarations, not to conduct "fishing expeditions" to seek out undeclared material. There was also considerable political sensitivity about the IAEA's use of information acquired other than from the State itself, in particular information acquired through "national technical means".

A sign of what could be achieved came in 1991 and 1992, when IAEA Director General Blix secured three measures he deemed essential if the IAEA were to be able to prevent another State from trying to follow Iraq's example. As David Fischer, author of a new book about the IAEA, recounts: First, the Agency's



Board of Governors reaffirmed the IAEA's right to carry out a special inspection in a State that had accepted comprehensive safeguards, if needed to confirm that all nuclear material that should be under safeguards had been reported to the IAEA.

Second, the Board of Governors agreed to provide the IAEA with greater access to information. As Dr. Blix put it, the IAEA could not scour the territories of numerous non-nuclear-weapon States party to the NPT "in a blind search" for undeclared nuclear plants or material. The right to carry out special inspections would not be of much practical value unless the IAEA knew where to look. The Board concurred in a series of proposals to ensure that the Agency would have more extensive information about the nuclear activities and plans of States concerned.

Third, the Board of Governors agreed that the backing of the Security Council would be essential if a nation blocked effective verification of its safeguards agreement with the IAEA. That came on 31 January 1992, when the Council's President issued a declaration on behalf of its members, represented at the meeting by their Heads of State or government. The Council considered that the proliferation of all weapons of mass destruction constituted a threat to international peace and security and its members would take appropriate measures in the case of any violation reported by the IAEA.

**S**o initially reinforced, the system was unexpectedly tested again, in the Democratic People's

Republic of Korea (DPRK) in early 1992. Like Iraq, the country was party to the NPT and had concluded a comprehensive safeguards agreement with the Agency. Questions arose almost from the start, when the Agency found discrepancies concerning declared amounts of plutonium. When the Director General formally demanded a special inspection, the DPRK rejected it. The IAEA Board found the DPRK in breach of its safeguards agreement and reported it to the Security Council, which backed the Agency. Events cascaded from there, including rounds of high-level political talks between the DPRK and the United States. In October 1994, the two countries signed an Agreed Framework that included provisions to freeze key elements of the DPRK's nuclear programme and to have the IAEA verify it.

The situation largely prevails. The Agency's ongoing verification includes having inspectors continuously stationed in the DPRK, and ensuring that nuclear installations subject to the freeze are actually frozen. Other issues originally identified by the IAEA remain unresolved. The DPRK still has not complied fully with its safeguards agreement, and the Agency has not yet gained access to information needed for a comprehensive picture of the nuclear programme. Questions remain about the completeness of the initial declaration of nuclear activities. As past events have shown, how the issues are ultimately resolved may well depend upon factors outside the Agency's control.

**T**he DPRK case seriously challenged the integrity of the system, and still does. But as author David Fischer points out, the first new verification approaches paid off:

- The IAEA detected a mismatch between the plutonium that the DPRK presented to it as products or in waste using sophisticated analytical techniques. This led the IAEA to conclude that the DPRK had understated the amount of plutonium it had separated.

- The IAEA Board of Governors formally reaffirmed the IAEA's right, in the context of comprehensive safeguards agreements, to carry out special inspections at undeclared locations. The DPRK's rejection of such inspections deepened suspicions of its programme.

- The IAEA was provided with satellite images of sufficiently high quality to convince its Board of the probable existence of undeclared nuclear waste stores. This also established a useful precedent for IAEA access to national intelligence.

- The Board demonstrated that it was able to take prompt and decisive action, confirming within four days the Director General's demand for a special inspection and thrice finding that the DPRK had breached its safeguards agreement, reporting violations to the Security Council.

- For the first time (except in the abnormal circumstances of Iraq) the Board made use of the IAEA's direct line to the Security Council to draw the Council's attention to a deliberate and significant violation of a safeguards agreement.



# TOWARDS A STRONGER SAFEGUARDS REGIME

New safeguards measures adopted this year have opened a groundbreaking new track. They are the outgrowth of governmental and IAEA efforts since 1991 to give the safeguards system more teeth — a much greater chance to discover possible secret nuclear activities. The IAEA Board of Governors in May 1997 adopted a model protocol to comprehensive safeguards agreements that grants the inspectorate broader rights of access to sites and information. States accepting the protocol will provide additional information on nuclear and related activities. Moreover, the IAEA will have greater access to activities and locations to detect clandestine nuclear programmes.

The protocol is the direct outcome of a two-part process for achieving a strengthened and more cost-effective safeguards system. Part-1, approved by the IAEA Board in 1995 and being implemented now, includes:

- Environmental sampling at locations to which the IAEA has access for design information verification or inspections. It is considered a powerful tool for detecting the presence of undeclared activities at or near declared nuclear sites.

- "No-notice" inspections at the strategic points of all nuclear facilities.

- The Agency's right of access to records of activities carried out before a safeguards agreement enters into force, to help ensure that all material

has been declared. The Board in 1995 confirmed the right.

- Use of advanced technologies that can operate unattended to transmit information to IAEA headquarters.

Part-2 measures incorporated in the protocol include:

- An "expanded declaration" to provide information on activities related to the nuclear fuel cycle. This will help give the IAEA a better understanding of a State's nuclear programme, its future directions, and the kinds of nuclear activities the programme's infrastructure could support.

- Access to any place on a nuclear facility site, to any decommissioned facility, and to any other location where nuclear material is present; to nuclear-related manufacturing and other locations identified by the State in its expanded declaration; and to other locations identified by the IAEA.

- The use of environmental sampling and other measures at these locations.

It will take some years before the strengthened system is fully and generally operative. The IAEA has initiated the process of acceptance by governments, and some already are taking steps to adhere to the protocol.

In Vienna, the Agency's immediate challenge is to integrate and adequately fund its conventional and new safeguards operations, with an eye to greater overall efficiency and effectiveness. IAEA Deputy Director General for Safeguards, Bruno Pellaud, sees it



as a transition to a "two lane, or two speed" safeguards system — with one lane for States having only a safeguards agreement in force, and the other lane covering States that have added the protocol to their safeguards agreements and accepted the new, Part-2 verification measures.

This new Strengthened Safeguards System, he says, will make the work of the IAEA difficult and complex. But he is convinced that with the combined efforts of Member States, the Agency's Board, and its Secretariat, the challenge will be met.

Valuable experience has been gained through trials of some measures — including remote monitoring, environmental sampling, and closer cooperation with State nuclear-control authorities — as well as through an import/export reporting scheme approved by the IAEA Board in 1992. The scheme today encompasses 52 States, including most nuclear suppliers.

—Based on papers and statements by Dr. Hans Blix, Bruno Pellaud, and Richard Hooper, Director of the IAEA Safeguards Division of Concepts & Planning and project leader of the "93+2" safeguards development programme.

*Photo: Inspections in Iraq. IAEA inspector Demetrius Perricos (centre) now carries responsibilities that include safeguards in the DPRK.*



**A**s warmer winds calmed the global security environment in the 1990s, a third major test arose. In March 1993, South Africa announced to a startled world that it had dismantled its nuclear-weapons programme — before it acceded to the NPT as a non-nuclear-weapon State in July 1991 and signed an IAEA comprehensive safeguards agreement not much later. The news prompted the IAEA to augment its safeguards team in South Africa with, among other specialists, nuclear-weapon experts. The team's assignment was extended to include assessing the status of the former weapons programme and ascertaining that all its related nuclear material had been recovered and placed under safeguards.

The job to verify the correctness, and for the first time the completeness of a State's declared nuclear programme, was tough. South Africa's extensive nuclear fuel cycle required considerable resources to inspect and it required help from South African authorities for access to facilities and operating records. Over the months that followed, the team thoroughly examined detailed records, visited sites, and verified the inventories of nuclear materials in South Africa. As a result, it was able to document the timing and scope of the former nuclear-weapons programme. The work enabled the IAEA to conclude that there were no indications to suggest that South Africa's initial declaration of nuclear material to the Agency was incomplete or that the nuclear-weapons programme

had not been completely terminated and dismantled.

The case broadened the IAEA's verification experience, and demonstrated key factors at play. For its part, South Africa offered every opportunity for access to any location the IAEA inspectorate deemed necessary to fulfill its tasks. This enabled the Agency to effectively apply new verification techniques and make valuable use of external information. As importantly, the case helped show what is possible when a government credibly pursues a policy of nuclear transparency.

**B**ehind the headline cases were less highly publicized demands on the regime, including the safeguards component. The dissolution of the Soviet Union in the early 1990s meant that Russia and three newly independent States would have nuclear weapons on their territories — Belarus, Kazakhstan, and Ukraine, each of which since has opted to join the NPT and accept comprehensive IAEA safeguards agreements. It also brought the issue of stopping illicit nuclear trafficking to the global and IAEA agendas. (See box, page 10.)

Elsewhere, the Agency's role was being recast as more States formed nuclear-weapon-free zones that call for IAEA verification. New regional zones since 1985 include those in the South Pacific (Rarotonga Treaty), in South East Asia (Bangkok Treaty), and in Africa (Pelindaba Treaty). They join zones set up earlier in Latin America and the Caribbean (Tlatelolco Treaty), as well as those in regions having no human populations (Antarctica Treaty, Outer Space Treaty, and the Seabed Treaty).

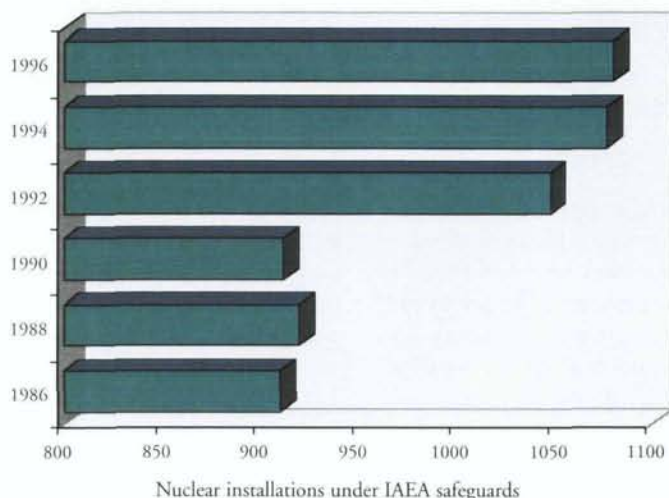
The zones now cover most of the Southern Hemisphere. Customizing the zonal approach, two major countries, Argentina and Brazil, codified renunciations of nuclear weapons. They opened their large nuclear programmes to joint inspections, formed a bilateral inspectorate, and in 1994 concluded a quadripartite agreement accepting comprehensive IAEA safeguards. Then in May 1995, the parties to the NPT, today numbering 185 countries, extended the Treaty indefinitely, and thereby the permanency of associated IAEA safeguards. As the 1990s draw to a close, ongoing progress in nuclear disarmament places other verification tasks on the table as warheads are dismantled. A net result is that more nuclear materials and installations have come under IAEA safeguards and verification over the past decade, as new agreements are activated with non-nuclear-weapon States, and the nuclear-weapon States seek to verify their arms cuts. (See graphs and box at right.)

**N**ot lost in this changing picture is the challenge of costs.

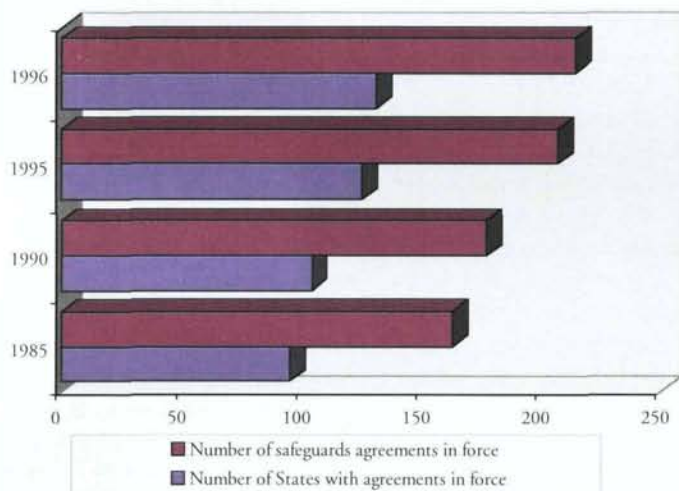
Spending for safeguards, and other IAEA programmes, has seen little growth in real terms over the past decade, and in several cases following the breakup of the Soviet Union, deep cuts were imposed that extrabudgetary contributions from some States only partly offset.

Steps to minimize costs are built into the IAEA's Strengthened Safeguards System. Measures taken or under consideration target the "optimization of resources", often linked to better use of

## SAFEGUARDED INSTALLATIONS



## SAFEGUARDS AGREEMENTS



modern communications, new verification technologies, and automated office systems. They include expanding the use of the IAEA's two regional safeguards offices in Toronto and Tokyo; concluding a partnership agreement for joint safeguards operations with the European Atomic Energy Community inspectorate; reducing the frequency of inspections at certain facilities; greater use of unattended measurement and surveillance

equipment with remote transmission of data; considering more regional safeguards offices to save travel costs and facilitate inspections; expanded training of inspectors; and joint use of equipment and analytical laboratories by the IAEA and State nuclear-control authorities.

The steps are expected to keep the strengthened programme cost-neutral over time, once higher start-up expenses are met. Right now,

**D**ismantling of nuclear warheads is releasing large quantities of plutonium and high-enriched uranium, adding to global stockpiles from civilian reprocessing of nuclear fuel and placing new demands on IAEA verification. By the end of 1996, the Agency was safeguarding materials including:

- 53.7 tonnes of separated plutonium. Just over sixteen tonnes, or about 2000 "significant quantities" (roughly the equivalent of some 2000 warheads) were safeguarded in non-nuclear-weapon States.
- 528.2 tonnes of plutonium in irradiated fuel.
- 4.5 tonnes of recycled plutonium in fuel elements in reactor cores.
- 20.8 tonnes of high-enriched uranium, amounting to 616 significant quantities. Just over ten tonnes, or about 300 significant quantities, were safeguarded in non-nuclear-weapon States.
- 48,620 tonnes of low-enriched uranium and 105,431 tonnes of source material (natural or depleted uranium and thorium).

Of all these materials, only separated plutonium and high-enriched uranium can be directly used in nuclear weapons. Still, all of the safeguarded material must be inspected and its uses verified.

In response to global concern about growing separated plutonium stocks, the IAEA began in 1993 to create a database on the amounts in civilian nuclear programmes and closely followed the work of its Member States which are in the process of identifying additional confidence-building measures relating to the safe handling, storage, and disposal of plutonium.



# ANTI NUCLEAR-TRAFFICKING

**A**troubling concern of the 1990s surrounds the spectre of stolen nuclear materials being traded or sold on the black market. Many reported cases of illicit trafficking in nuclear materials focused global attention on the problem in the early and mid-1990s, and led to concerted efforts to combat the smuggling. In April 1996, the Nuclear Safety and Security Summit in Moscow underlined the importance of preventing the problem, and agreed on a programme of joint action.

In some areas, States have turned to the IAEA for assistance. As early as 1992, the Agency began helping successor States of the Soviet Union to apply effective preventive measures. It also encouraged them, and other States, to ratify and apply the 1987 Convention on the Physical Protection of Nuclear Materials, and to apply the IAEA's guidelines on physical protection, to guard against the theft or diversion of nuclear

material in global transport and at nuclear facilities.

The IAEA's programme against illicit trafficking covers a number of components related to prevention, response, training, and the exchange of information. While national authorities carry the responsibility to combat illicit trafficking in their countries, effective action requires close cooperation among States and international organizations. Over recent years, States have asked the Agency to assist relevant national authorities and regional and global organizations in various ways. The programme includes the development and operation of a reliable database on incidents of illicit trafficking. Since October 1996, the Agency has provided authoritative summary information of confirmed cases to its Member States and certain international organizations working with the IAEA on the problem. Most confirmed cases so far, about 150 over the 1993-97 period, have involved low-enriched or natural uranium in

small quantities and radioactive sources. Some cases have involved high-enriched uranium or plutonium. Attempts have been made to illegally sell the materials. Also, cases involving weapons-grade material in small quantities deserve attention in the context of non-proliferation, since larger quantities of nuclear material having strategic value could be accumulated. In general, the unauthorized use or movement of radioactive material can endanger the lives of people handling it and can threaten public safety.

The IAEA plans to continue assisting countries in the development of national systems for the control of nuclear materials and providing technical support related to areas of physical protection. Also planned is continued interaction with Member States and international organizations, such as customs and other authorities mainly responsible for detection, prevention, and control.— *Based on reports by Svein Thorstensen and Anita Nilsson.*

future financial needs are hard to pin down, though it's clear more resources are needed. One major uncertainty: how many States, and when, will accept the new verification measures and allow the IAEA to start implementing them.

**A**fter years of negotiations stalled in Geneva, a Comprehensive Test Ban Treaty was approved and opened for signature by the UN

General Assembly in September 1996. The organization to verify the commitments of States party to the Treaty is being set up in Vienna. Though prospects for the Treaty's early entry into force are cloudy, it has near-universal backing to drive a deeper nail into the coffin of nuclear testing.

Up ahead may be an agreement to cut off the production of fissile material for nuclear weapons. If one is concluded, as

David Fischer points out, more materials could come under IAEA verification from the five declared military nuclear powers — China, France, Russia, United Kingdom, and United States — and the three remaining States that are operating unsafeguarded nuclear plants, India, Israel, and Pakistan. Pending future treaty provisions, the States may be required to place under IAEA safeguards all their reprocessing



and enrichment plants, and all the plutonium and high-enriched uranium produced by those plants that continue to operate, as well as any other plants using such material.

**D**uring the decade, States entrusted the IAEA inspectorate with new tasks for the international verification of arms control and nuclear disarmament. It already verifies about twelve tons of ex-military plutonium and highly enriched uranium in storage in the USA. Under a Trilateral Initiative with the USA and Russia, the dimensions of further verification arrangements are being closely examined for fissile materials released from weapons programmes.

No one should underestimate the new assignments, notes Bruno Pellaud, IAEA Deputy Director for Safeguards. In remarks at an International Policy Forum in the USA earlier this year, he reviewed major issues confronting the global community:

"The process of nuclear disarmament will pose challenges to domestic, regional, and international security, to economic growth and to environmental protection. Even the beginning steps being taken by the United States and Russia are not without problems: dismantling the tens of thousands of warheads is creating a surplus of plutonium and highly enriched uranium which is no longer needed for defense programmes, and that plutonium and highly enriched uranium demands protection and prudent disposal. Concerns remain that those materials might be stolen through force or guile, or



that relations between the United States and Russia might sour and today's surplus materials might be used to jump start a resurgent nuclear arms race.

"If the storage and disposition of those fissile materials is carried out in a prudent manner, Russia and the United States may agree to further arms reductions, other nuclear-weapon States may begin to reduce their arsenals independently or in lock-step, and the international community will be more effective in efforts to prevent any further proliferation of nuclear weapons.

"The international community, in particular the IAEA, will need to find ways to meet the challenge of a verification assignment that goes beyond the experience accumulated so far in the area of non-proliferation."

Concerning the IAEA's emerging role, he said that preliminary work has started, within the framework of the Trilateral Initiative, to set up a verification system that "may ultimately parallel the non-proliferation IAEA safeguards system". He emphasized that talks are still in early stages, with

many legal, technical, and financial details to be worked out on questions related to the nature, scope, and specific requirements of verification.

The overall objective is to provide credible assurances that fissile materials submitted for verification are not used again for nuclear explosive purposes.

—Lothar Wedekind, based on contributions, papers, and articles by Dr. Hans Blix, Bruno Pellaud, Dr. Mohamed ElBaradei, Ms. Jan Priest, Ms. Laura Rockwood, Richard Hooper, Dirk Schrieffer, Ms. Merle Opelz, Berhan Andemicael, David Fischer, David Sinden, Thomas Shea, Ms. Anita Nilsson, Garry Dillon, Demetrius Perricos, Adolph von Baeckmann, and Svein Thorstensen.

*Photo: A storage facility being built near Ozyorsk, Russia will house material from dismantled nuclear weapons. President Yeltsin has said the IAEA will be asked to verify that this material is not reused for weapons. Recently Director General Blix (left) and senior IAEA officers met with Russian officials and visited the construction site. (Credit: IAEA)*