Nuclear Safeguards: The First Steps

by David Fischer

From a suspicious "spider's web", a trusted security net was born.

The late David Fischer's "Nuclear Safeguards: Evolution and Future" — written eight years ago for the Verification Yearbook 2000 — provides an insightful overview of international safeguards. In it, the author focuses on steps to strengthen the global nuclear verification regime. The following article is excerpted from that 2000 essay.

Nuclear safeguards were first publicly proposed in a November 1945 joint declaration by US President Harry Truman, UK Prime Minister Clement Attlee and Canadian Prime Minister William Mackenzie King. The three allies said that they would be willing 'to proceed with the exchange of fundamental scientific literature about atomic energy', but only when 'it is possible to devise acceptable, reciprocal and enforceable safeguards acceptable to all nations' against its destructive use.

By the end of 1959, the USA had concluded agreements with 42 countries to cooperate on the peaceful application of atomic energy. These agreements required the use of safeguards — initially by the USA, but later, in many cases, by the International Atomic Energy Agency (IAEA).

Safeguards were institutionalised regionally in 1957 with the creation of the European Atomic Energy Community (Euratom), and internationally with the establishment of the IAEA. In Latin America, Argentina and Brazil have also set up a bilateral safeguards system, administered by the Argentina-Brazil Agency for Accounting and Control of Nuclear Material (ABACC) and the IAEA cooperate closely in applying safeguards; each retaining, however, the ability to verify independently compliance with their joint safeguards agreement. In addition, since 1967, nuclear weapon-free zones have been set up by treaty in several regions.

These safeguards aim to verify that nuclear material and technology are only used for purposes permitted by their charters. All of the charters (with the exception of Euratom's) prohibit the diversion of safeguarded nuclear material to nuclear weapons or to other nuclear explosive devices, or go further and ban all non-peaceful uses of nuclear energy. The treaties call on the IAEA to verify compliance with these restrictions.

The IAEA and Euratom

The main international safeguards applied today are those of the IAEA — an autonomous, intergovernmental body controlled by a General Conference of Member States and a 35-nation Board of Governors. The IAEA reports on its work to the UN General Assembly and the Security Council.

Like the IAEA, Euratom — which is the nuclear branch of the European Union (EU) — owes the development of its safeguards regime largely to US policy requirements.

In the early 1950s, the leading Western European States shared the general belief that nuclear power would be the energy of the future, that it would free them from dependence on Arab oil, and that it would be the driving force behind a united Europe. To launch a nuclear power programme, though, Western Europe would have to draw heavily on American nuclear fuel and technology, which would only be available under certain restrictions. Consequently, they equipped Euratom with safeguards that met American demands.

In 1958, the framers of US nuclear policy were divided. Some wanted the country's nuclear exports to Western

Metallic seals like the one in the picture are commonly used by safeguards inspectors. The seals provide important evidence of any unauthorized attempt to gain access to the secured material.

Photo: D.Calma/IAEA

Europe to fall under the safeguards of the IAEA (largely an American creation), while others backed Euratom safeguards as a means of strengthening the unity of Western Europe and its bonds with the USA. The latter carried the day.

In the late 1960s, it became urgent to decide what safeguards should apply in non-nuclear weapon States parties to the Nuclear Non-Proliferation Treaty (NPT), which had been opened for signature in 1968 and which required full-scope safeguards for such States. Anxious about the nuclear potential of West Germany, the Soviet Union successfully resisted Western European attempts to retain Euratom's safeguards monopoly.

The IAEA, Euratom, and Euratom's non-nuclear weapon States agreed in 1973 to amalgamate the safeguards that the two agencies would apply in these countries. This opened the way for Euratom's non-nuclear weapon member States to ratify the NPT in 1975. In so doing, they also renounced the right to acquire nuclear weapons and accepted joint verification of this decision by Euratom and the IAEA. The integration of the two safeguards operations was taken further in 1992 by an agreement between the Secretariats of the two organisations 'on a new partnership approach'. This move has already reduced by nearly 25% the number of inspections that the IAEA carries out in these States.

As the EU expands, so too does the coverage of the IAEA-Euratom agreement. Euratom's safeguards are comprehensive in the case of the EU's non-nuclear weapon States, but only apply to the civilian nuclear activities of its two nuclear weapon states: France and the UK.

Growth of IAEA safeguards

The Agency's safeguards initially encountered mistrust and resistance, especially from its developing country members, but also from the Soviet bloc and some West European States intent on protecting Euratom. In the mid-1960s, the coverage of IAEA safeguards began to expand as a result of the US decision to transfer to the IAEA responsibility for safeguarding its nuclear exports to non-European Economic Community (EEC) countries and of the 1963 Soviet decision to give IAEA safeguards full Eastern bloc support. This change of policy probably reflected the *détente* in East-West relations that followed the resolution of the 1962 Cuban missile crisis, the fact that China turned into the Soviet Union's harshest critic after the latter had helped it to make 'the bomb', and, above all, Soviet concerns about the Federal Republic of Germany's emerging nuclear programme. By 1968, the IAEA was able to draw up safeguards covering almost every type of nuclear plant.

When the NPT came into force in 1970 it became urgent to construct a safeguards system covering the entire nuclear fuel cycles of the non-nuclear weapon States that would soon join the Treaty. The Agency's Board approved the new system in 1971. By the beginning of the 1980s, almost all industrialised countries and many developing nations had joined the NPT, and, with the exception of the nuclear-weapon States, most of them had placed all of their nuclear material under IAEA safeguards, as required by Article III of the NPT.

In 1991, it was discovered that Iraq was conducting an extensive nuclear weapons programme, undetected by IAEA safeguards, even though it had foresworn nuclear weapons when it ratified the NPT in October 1969. This led to a fundamental review of the existing (1971) system. Henceforth, the IAEA should be able to monitor both the nuclear and nuclear-related activities of a State, and not just (as heretofore) the individual nuclear plants declared to the Agency.

Despite the Iraqi setback, the early 1990s marked a high point in the evolution of the NPT and international acceptance of IAEA safeguards mainly because of the unexpected end of the Cold War. At the 1995 quinquennial NPT conference the parties agreed to an indefinite extension of the Treaty. By this point all except three of the countries that had significant nuclear programmes (India, Israel and Pakistan) had acceded to the NPT or to one of the regional accords banning nuclear weapons.

By the end of the 1990s, however, threats emerged to the non-proliferation regime. North Korea had been in violation of its IAEA safeguards agreement. In 1998, the UN Special Commission (UNSCOM) and IAEA inspectors were banned from Iraq, and, earlier the same year, India and Pakistan damaged the emerging norm against nuclear testing enshrined in the 1996 Comprehensive Nuclear Test Ban

Treaty (CTBT). In 1999, the US Senate rejected ratification of the CTBT, which the international community has been striving for since the 1950s. In addition, moves towards nuclear disarmament, envisaged in Article VI of the NPT, ground to a halt. In early 2000, the Russian Duma failed to ratify the second Strategic Arms Reduction Talks Treaty, despite encouragement from the government. And pressure mounted in the US for a nationwide anti-ballistic missile defence system, endangering a cornerstone of nuclear disarmament, the 1972 Anti-Ballistic Missile Treaty.

Many nations have helped to promote IAEA safeguards, but their effectiveness has largely depended on American initiatives and support. This dependence has become of critical significance at a time when some US political leaders appear to be turning away from collective security as a mainstay of foreign policy and towards US technical supremacy in a world in which it has become the supreme power.

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Three Phases of IAEA Safeguards

Phase 1: IAEA safeguards face an uphill struggle until the mid-1960s. In January 1959, the Agency's Board of Governors approved the first agreement for the application of safeguards, covering a small Japanese reactor and its fuel. However, several members of the Board vigorously opposed the agreement. Although the Soviet Union was engaged in a Cold War propaganda contest with the West, it genuinely doubted the wisdom of a global diffusion of nuclear technology. It likened IAEA safeguards to a 'spider's web', designed to ensnare developing countries and to stifle their scientific and technical progress. Some of the leading EEC countries saw IAEA safeguards as a potential threat to Euratom. India and its 'Third World' supporters believed that nuclear power was the energy of the future and were mistrustful of international controls on their infant nuclear programmes. They would accept IAEA safeguards only when it became clear that this was the price they would have to pay for obtaining access to US civilian nuclear technology.

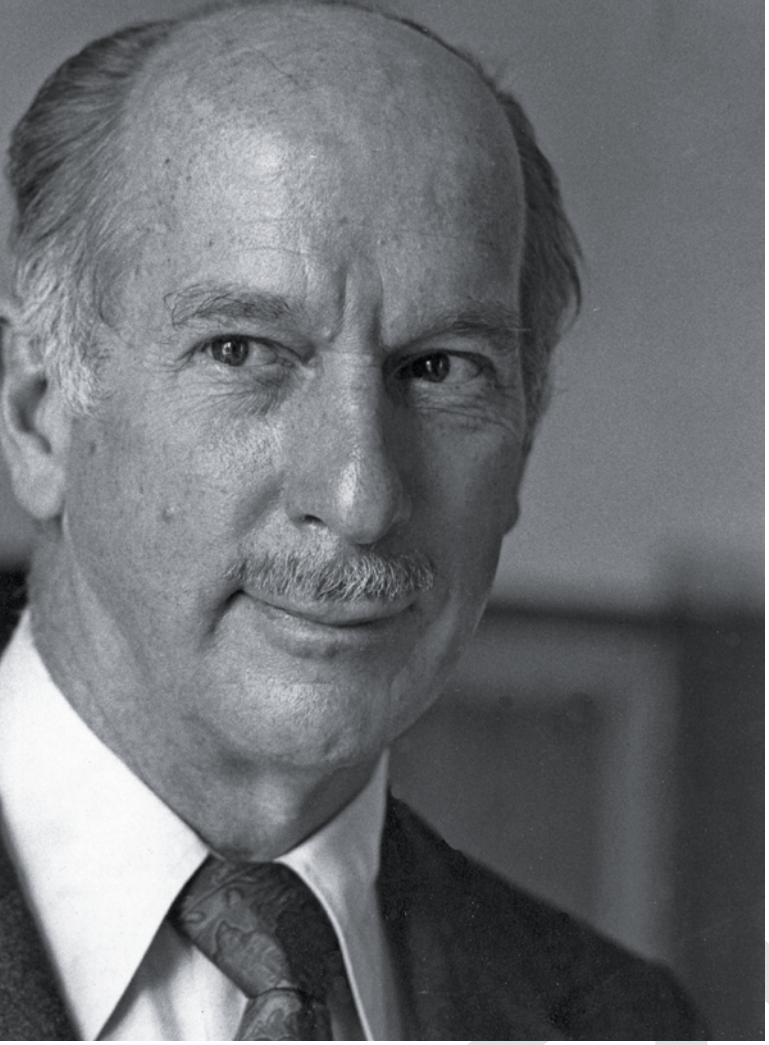
As proof of the need for an agreed and standardised system, proponents cited the lengthy discussions on safeguards for the small Japanese reactor. The Board of Governors approved the first IAEA safeguards system in 1961, but many Western European countries only went along reluctantly. The accompanying directive on the work of IAEA inspectors showed how far the Board had to go to get the document accepted. For instance, the IAEA would have to give at least one week's notice of each routine inspection. The government concerned would stipulate the port or airport through which inspectors must enter and leave the country and the routes that must be followed in that State. It also had the right to insist that the inspectors be accompanied everywhere by national officials.

In 1963, the Soviet Union unexpectedly expressed its full support for IAEA safeguards. As a result, the Agency's Board was soon able to approve a system that covered all types and sizes of nuclear plants (except enrichment facilities). Canada, the UK and the USA could now turn to the IAEA to monitor the use of the nuclear reactors that they were supplying to India, Japan and several other countries. These safeguards were designed to apply to individual supplies of plants and fuel, rather than to the entire fuel cycle of a non-nuclear weapon state. Nonetheless, they provided the NPT (under negotiation from 1965) with a tested verification system on which to build the comprehensive safeguards foreseen in Article III of the Treaty.

Phase 2: The NPT's entry into force and comprehensive IAEA safeguards. The NPT entered into force on 5 March 1970. According to the Soviet Union, the main objective of the Treaty was to enable other parties to keep an eye on their former enemy, the Federal Republic of Germany, which was building plants capable of producing nuclear weapon material: plutonium and enriched uranium. Some of the Federal Republic's neighbours shared Soviet apprehensions; some countries in East Asia felt the same about Japan.

But Germany, Japan and other non-nuclear weapon States with substantial nuclear energy activities were determined that the NPT should not impair their nuclear industries' right to engage in all non-military nuclear activities, including reprocessing spent fuel to recover plutonium and the enrichment of uranium. They also sought to ensure that safeguards should not be unduly intrusive, especially since the NPT would not require their nuclear-weapon State rivals (France, the UK and the US) to accept any safeguards whatsoever. In the eyes of the non-nuclear weapon States only the application of safeguards to the nuclear industries of their nuclear-weapon State competitors would 'level the playing field'.

The NPT would have little value if it were not accepted by the leading non-nuclear weapon States: the Federal Republic of Germany, Japan, and some other non-nuclear weapon State members of the EEC. It was therefore imperative to take



account of their concerns. Human inspections would have be kept to a minimum in order to reduce opportunities for industrial espionage, and safeguards would only be applied to nuclear material in nuclear plants which the government concerned had declared to the IAEA. In normal operations, the Agency's inspectors were to have access only to a limited number of previously agreed 'strategic points' in declared nuclear facilities in the country concerned. The last two limitations proved crucial.

It was also agreed that a comprehensive new safeguards system reflecting these concepts should be drawn up as soon as possible. A good reason for speed was that the NPT required its non-nuclear weapon State parties to negotiate and conclude full-scope safeguards agreements with the IAEA — a process to be completed within 18 months of their accession to the Treaty. It would also become illegal for any NPT party to supply nuclear material and technology to a non-nuclear weapon State not party to the NPT, unless the nuclear material itself or that resulting from the transaction was under IAEA safeguards. In practice, this meant that the US could no longer legally supply fuel for Belgian, Italian and West German reactors or for other plants in Euratom non-nuclear weapon States until all those nations had ratified the NPT and accepted full-scope IAEA safeguards.

The Agency's Board of Governors approved the new system in 1971. But it was not until 1975-1976 that the EEC non-nuclear weapon States and Japan ratified the NPT. These ratifications were made possible by the conclusion of agreements that dovetailed IAEA safeguards with those of Euratom and the Japanese verification system respectively. Almost all industrialised States and a wide range of developing countries, therefore, were able to ratify the NPT and to accept comprehensive safeguards before the end of the 1970s. But the leading absentees in 1980, and until the early 1990s, included two nuclear-weapon States, China and France, and several leading developing countries in regions then marked by intense political tension and regional rivalry: Argentina, Brazil, India, Israel, Pakistan, and South Africa.

Phase 3: the 1980s and 1990s. The end of the Cold War transformed relations between the leading nuclear States, redrew the political map of Eastern Europe and the former Soviet Union, and, as a result, laid the ground for major advances in nuclear disarmament. In addition, the transformation of internal politics and of relations between erstwhile enemies or rivals made it possible for Argentina and Brazil to renounce their nuclear weapon options and for South Africa to give up its nuclear weapons, leaving only India, Israel and Pakistan as significant nuclear absentees. These political developments also encouraged the creation of new nuclear weapon-free zones in Africa and, by force of example, in Southeast Asia, and helped strengthen and clarify the Treaty for the Prohibition of Nuclear Weapons in Latin America. By 1995, the NPT seemed to be coming close to universality and IAEA, safeguards appeared to be nearing the point at which they might cover all the nuclear activities of the non-nuclear weapon States.

The 1995 Conference on the Review and Extension of the NPT extended indefinitely the duration of the Treaty. Its full-scope safeguards agreements were also made permanent (except in the unlikely event that the State party concerned withdrew from the NPT). The Conference reaffirmed the commitment of the NPT States — in particular the nuclear-weapon nations — to work towards total nuclear disarmament, to conclude a CTBT no later than 1996, and to finalise a convention to ban fissile material for nuclear-weapon purposes.

The prospects for a world free of nuclear weapons, in which IAEA safeguards would verify compliance and maintain confidence, had never seemed brighter.

David Fischer (photo above) was a South African diplomat who helped draft the IAEA Statute in 1954-56. Over the period 1957-82, he was in charge of external relations for the IAEA, ending his service as Assistant Director General. Mr. Fischer passed away in March 2007, a loss deeply mourned by the IAEA and international community. The IAEA officially turned 50 this year on 29 July, the day its Statute entered into force a half century ago.

Safeguards on the Silver Screen

A six-minute video that gives viewers an inside look at safeguards in the 21st century. The video shows analysts working at the Safeguards Analytical Laboratory (SAL) in Seibersdorf, Austria, where more than 1000 samples of nuclear material are analyzed each year.

It was singled out recently for excellence in communications by the US International Film and Video Festival, which awarded the SAL video producers a certificate for creative excellence. The Festival was founded in 1967 and is one of the world's leading international events devoted exclusively to recognition of outstanding business, television, documentary, educational, entertainment, industrial and informational productions.

SAL analyzes samples of nuclear materials from IAEA safeguards inspections. The samples are taken at key measurement points of the nuclear fuel cycle and sent to SAL for destructive chemical and isotopic analysis. This complements physical inspections and measurements performed by IAEA inspectors in nuclear facilities. The goal is to verify that material under Agency safeguards is not diverted for non-peaceful purposes.

Additionally, SAL's Clean Laboratory receives samples and smears taken in nuclear facilities and analyzed to search for signatures of undeclared usage of the installations. Environmental samples of water, soil and vegetation are taken to search for traces of actinides indicating the presence and operation of an undeclared nuclear installation in the vicinity. Ultra-sensitive analytical techniques allow the identification and isotopic analysis of femtogram amounts of actinides and thereby the tracking of their origin.

Recently IAEA Director General Mohamed ElBaradei noted the need for more investment down the line. Addressing the IAEA Board, he said that significant additional resources are sorely needed for upgrading IAEA laboratories whose work is vital to carry out essential verification, safety and development functions.

The video can be viewed at www.iaea.org/NewsCenter/News/2007/sgvideo.html

A technician at the Safeguards Analytical Laboratory in Seibersdorf examining uranium particles under an optical microscope.

(Photo: D. Calma/IAEA)

Staff at the Safeguards Analytical Laboratory, where samples of nuclear materials from IAEA safeguards inspections are analysed.

(Photo: D. Calma/IAEA)