# FUTURE DIRECTIONS OF NUCLEAR VERIFICATION

BY DR. HANS BLIX

There is at present a general optimism about further arms control and verification. The main reason for optimism is the reduction in global and regional tensions — the end of the Cold War and the end of crusading ideology. Of course some tension areas remain: the Korean peninsula, the Indian subcontinent and the Middle East. If national security is in many areas of the world seen as a lessening problem, then the incentive to move to nuclear weapons is diminished. If, further, there is a general movement away from nuclear weapons, as is slowly the case in nuclear-weapon States, this movement, too, will reduce the incentive.

In the areas where we presently see the greatest risk of further proliferation, the front line efforts to impede it will, in my view, need to be in the areas of foreign policy, security policy and economic policy, aiming particularly at building trust and detente. But international verification is also a vital element: it can act as a confidence-building measure which contributes to trust.

There is a widening recognition that international verification may be necessary in support of new and expanded arms control rules. Such recognition is not to be taken for granted. Other models were tried and some of these still have a role to play, e.g. national controls on supply; bilateral inspection arrangements and regional arrangements. The growing acceptance of international verification no doubt results in part from the demonstrated utility of IAEA safeguards over the years. It was clearly relevant to the decision of the Security Council to use the Agency as the mechanism for implementing the nuclear component of its measures to eliminate Iraq's weapons of mass destruction. While differing in details, the new arms-control measures being put into place — the Chemical Weapons Convention and the Comprehensive Nuclear Test Ban Treaty — share the premise that a system of international verification is required.

## VERIFICATION OF NON-PROLIFERATION COMMITMENTS

The IAEA's work in verifying non-proliferation commitments will clearly remain a central part of its future work. Despite uncertainties about the future growth of the nuclear power industry worldwide, the number of facilities being safeguarded and the types and quantity of material safeguarded continue to grow. At the same time the evident shortcomings in the system are being addressed, particularly to strengthen the capacity to detect undeclared activity.

Another factor may need to be mentioned. For the States which continue to rely on nuclear weapons or on nuclear umbrellas, the process of reduction of nuclear weapons will be accompanied by the demand for increased assurance that such weapons are not being acquired by others. In short, the fewer nuclear weapons there are, the more important it will be that no one is cheating. Thus effective non-proliferation verification is an essential prerequisite for the reduction and eventual elimination of nuclear weapons — and therefore likely to become more important in years to come.

## PRACTICALITIES OF STRENGTHENING SAFEGUARDS

Immediate priorities in the field of nuclear verification are set out in the measures adopted in recent years and in the Additional Protocol (which was adopted by the IAEA Board of Governors in May 1997). The sooner the Protocol is widely adopted by States, the sooner the benefits of increased effectiveness and

*Dr. Blix served as IAEA Director General from December 1981 to December 1997. This article is based on his address to the IAEA Symposium on International Safeguards in October 1997.*

efficiency will be realized. We must therefore maintain the momentum that has been built up and use every occasion to promote early adherence. We must also maintain our momentum in implementation, which is no small task. While there will be a need for consultations accompanying the introduction of new measures, the safeguards community will know of the experience already acquired during the trials and in practice, for example in the area of environmental sampling. Occasions such as this IAEA Symposium on International Safeguards enable the experts and practitioners to share that experience — thereby simplifying the IAEA Secretariat's job. There is also scope for States to work bilaterally and regionally building on past experience — for example, the collaboration with the States of the former Soviet Union in establishing nuclear accounting systems.

Further, the Agency's verification work has benefited over the years from the research and development in Member States of safeguards technologies and systems. This will remain essential. Even with the measures now adopted there will be a continuing requirement for improved effectiveness and efficiency which can only come by further developmental work — for which the Agency does not have resources! New approaches will be required for new fuel cycle technologies; while a good start has been made, we have a long way to go to make maximum use of remote monitoring and automatic data transmission; and we are only starting to explore the potential of satellite imagery.

## ASSESSING RESULTS

In addition to the practicalities of acceptance and implementation of the new measures, considerable thought must still be given to the methods of assessing the results of this work and presenting those results to governments and the public. We have struggled with these questions in the past, but there are now new considerations which will make the task even more difficult. Whereas in the past much of the assessment was based on quantitative results, the new measures involve a more qualitative analysis. Moreover, the Additional Protocol stipulates that measures should not be carried out mechanistically or systematically. Again, judgement is called for in finding the right balance.

A further consideration in assessing and presenting the results of verification is that while the tools of verification can be powerful, they do have some limitations which must be acknowledged:

- It is clear that normally verification measures cannot catch the intentions of States. Although some actions by States may suggest intentions to do something specific, verification mostly functions like a radar beam which tells us that something or nothing is happening here and now;
- It is also apparent that the chance of detecting secret nuclear installations and activities depends on the degree of access to information and access to sites that is given to the inspectorate. However, even with extreme access rights and availability of satellite and intelligence-based information — as we have been able to employ in Iraq — the detection capability is never 100%. It is a matter for governments to judge how high the degree of assurance should be. A fine meshed system might raise the degree of assurance, but such systems would be more expensive and intrusive and they may also be susceptible to false alarms. They will never reduce the uncertainty to zero.

It goes without saying that the assurance that can be gained from the non-finding of any indications of diversion or of undeclared activities is directly related to the extent and quality of the verification undertaken… The IAEA's annual reporting on safeguards implementation in the world expressly indicates that there is always a degree of uncertainty — in particular about the possibility of the existence of undeclared material. Even in the case of South Africa, where the co-operation extended by the authorities was most extensive — offering the inspectors to visit any place any time and opening military sites — the conclusions reported by the IAEA Secretariat to the Board of Governors reflect caution.

## NEW TASKS IN NUCLEAR VERIFICATION

The experience of Agency safeguards over recent years has included: establishing safeguards in major new countries of the former Soviet Union, some of which had nuclear weapons on their territory; observing the status of South Africa's former weapon programme; the operations in Iraq and the Democratic People's Republic of Korea (DPRK); the roles

acquired in connection with new nuclear-weapon-free-zones (NWFZs) in Africa and South East Asia; and the strengthening of the safeguards system itself. These experiences have broadened the horizons of the Secretariat and of Member States, provided us with new tools and given grounds for confidence that other new tasks could be tackled beyond the traditional non-proliferation role.

■ ***The Trilateral Initiative.*** One such possible task is related to the Trilateral Initiative. Trilateral discussions started in September 1996 in a meeting I had with the then US Secretary for Energy, Mrs. O'Leary, and Minister Mikhailov of Russia. The objective is an agreement between the US and Russia and the IAEA on verification by the IAEA of nuclear material which is transferred out of the defense sectors in the US and Russia, notably that from dismantled nuclear weapons. So far only discussions have taken place and several questions will need to be answered before a regime can be defined: Which are the techniques to be used by the IAEA to verify that declared material does not go back to new bombs? How are we to avoid that the inspectors learn something about bomb construction? Are the techniques of verification to be as thorough as those which are applied to highly enriched uranium (HEU) and plutonium in a non-nuclear-weapon State? Some measure of error would not be so grave in a nuclear-weapon State as in a non-nuclear-weapon State given that large numbers of weapons remain in the hands of the inspected party anyway. Error in a non-nuclear-weapon State is a different matter. Here it might make the difference between a weapons capacity and non-weapons capacity. Further questions relate to cost. How much would this kind of verification be worth? And who is to pay for the verification? And, finally, what are the appropriate legal instruments for such a regime?

■ ***A Cut-Off Agreement.*** Regrettably the negotiations of a treaty prohibiting the production of highly enriched uranium or plutonium for weapons purposes have not yet begun. In my view such a treaty would be very desirable and should not be too difficult from the security point of view for any State. In fact it appears that the declared nuclear-weapon States are not producing more nuclear material for weapons purposes. If we can attain an arrangement whereby HEU and plutonium from dismantled weapons — to start with in the US and Russia — are stored or used for peaceful purposes under IAEA verification and, in addition, a verified cut-off, we would obtain assurance that the global aggregate of fissile material available for weapons use is shrinking.

It has always been assumed that the verification of a cut-off would be a task for the IAEA. It would be a large job — and it would cost a good deal of money — but the techniques as they relate to reprocessing and enrichment already exist. Indeed, they are applied in several non-nuclear-weapon States already, e.g. Japan, Argentina, and Brazil.

■ ***Extending the Use of NWFZs.*** I have referred to some existing nuclear-weapon-free zones which rely on IAEA safeguards verification of the type required by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). However, what is considered an adequate verification regime in most zones may not be enough for regions of high tension. A resolution was adopted on 3 October 1997 by the IAEA General Conference of on the subject of "Application of IAEA Safeguards in the Middle East". This resolution, moved by Arab States, seeks to induce Israel to accept comprehensive NPT-type safeguards. If accepted by Israel, it would, of course, require Israel to dismantle whatever nuclear weapons capacity it has. With many and far-reaching reservations, Israel has voted in favour of this resolution. Two passages in the text are of special interest here. One is a preambular paragraph by which the General Conference declares that it is "Mindful of the usefulness of the Agency's safeguards system as a *reliable means of verification* of the peaceful uses of nuclear energy," (italics added). The other passage is an operative paragraph in which the Conference recommends a "mutually and effectively verifiable NWFZ" and invites the parties in the region to international non-proliferation regimes, including the NPT, "as a means of *complementing* participation in a zone free of all weapons of mass destruction ..." (italics added).

What emerges is that, despite the general respect paid to the "reliability" of the Agency's NPT-type safeguards, the parties view a treaty establishing a

zone free of weapons of mass destruction as the primary instrument and NPT obligations as only "complementing" those in a zone treaty. It is quite clear that the States in the Middle East would require verification measures which would go much beyond even the now strengthened NPT-type IAEA safeguards. In all likelihood the inspection would be both bilateral and international, with a right for the parties and not only the Secretariat of the IAEA, to bring about challenge inspections, and that on grounds that would be much less demanding than those which INFCIRC/153 require. In this regard let me quote from the Agency's fortieth anniversary publication, *Personal Reflections.* Gideon Frank, the Director General of the Israel Atomic Energy Commission, in his article in that book observes:

"The uniquely complex and challenging conditions prevailing in the Middle East require a specific verification mode. We believe that when political conditions eventually ripen for arms control and disarmament to take hold in our region, the appropriate verification mode would have to be a NWFZ based on a mutual regular and challenge verification regime that ought to be more stringent than the NPT."

Further, he argues that mutual verification is generally more effective than international verification. To quote again:

"Under mutual verification the inspector goes to the field with the full backing of his or her country's institutional power. Put simply, if the country's intelligence service suspects anything, this information could be made available to help the inspector define what is wrong and where to go".

■ ***The Sub-National Dimension: Trafficking.*** Parallel with the attention to international verification of undertakings made by States, non-proliferation and disarmament measures will also need more efforts to ensure that sub-national terrorist or other groups do not acquire weapons-grade material. Illicit trafficking has been given a good deal of publicity in the last few years. While the primary action to prevent such trafficking rests on governments, the IAEA has been asked in the last few years to assist Member States to strengthen their legislation and administrative measures to keep all nuclear material under control. The Agency is also maintaining a database in which all known cases of nuclear trafficking are registered, together with information obtained from the relevant governments.

## OTHER MODELS OF VERIFICATION

IAEA safeguards were in many respects the testing ground for international verification systems, but they are no longer alone in the field. While drawing on Agency experience, the new models have developed approaches suited for their own specific purposes. Agency verification can in turn learn from the experience of the new systems, and some even speak of the synergies that may be developed.

Let me first turn to the Comprehensive Test Ban Treaty (CTBT) whose provisional technical secretariat is growing in Vienna, although the Treaty is not yet in force. The object of verification is here the undertaking of all parties not to test any nuclear weapon or other nuclear explosive device.

It has been rightly observed that such a commitment exists already under the NPT for all non-nuclear-weapon States party to that Treaty. They have committed themselves not to divert any nuclear material for weapons or explosives purposes. A fortiori they are committed to refrain from testing. The CTBT is thus of particular interest as regards the five declared nuclear-weapon States and the three threshold States not party to the NPT, Israel, India and Pakistan.

The verification approach under the CTBT is radically different from that of safeguards under the NPT. Under INFCIRC/153 there is verification through periodic visits of inspectors to declared nuclear installations and continuous surveillance in between. What would inspectors watch periodically under a test ban? Abandoned test sites? There is, indeed, no provision for routine visits by inspectors. Instead an International Monitoring System to detect any tests is being established relying on seismological monitoring; radionuclide monitoring; hydro-acoustic monitoring; and infrasound monitoring.

All this monitoring is organized through an extensive network of stations around the world. They send data continuously to the Treaty Secretariat in Vienna and the data are

compiled and made available to institutions in States party to the Treaty.

Unlike the IAEA Secretariat which verifies States' compliance with the NPT, the CTBT Secretariat does not analyze the material obtained through monitoring with a view to discovering any anomalies to be followed up. The emphasis is rather on relaying the data to Member States and leaving it to them to analyze the data. If the States find things that need to be clarified they can either turn directly to the State on whose territory the relevant event appears to have occurred or to the Director General or the Executive Council of the CTBTO. If States are not satisfied with the clarifications obtained they — but not the Director General — can ask for on-site inspection to be decided by the Executive Council. Thirty affirmative votes would be needed — out of 51 — to mount such an inspection.

The request for an on-site inspection may be based on the data compiled by the monitoring system of the Organization or on relevant technical information obtained through "national technical means of verification in a manner consistent with generally recognized principles of international law". As satellite observation is deemed compatible with such principles, data from such observation is considered an acceptable basis, while espionage reports, in all likelihood, are not.

For perspective, it is also instructive to observe how States are going about the business of verifying the Chemical Weapons Convention which entered into force just this year. The Secretariat of this Convention is established at the Hague. Many provisions demonstrate that the verification provisions were negotiated at a later date than INFCIRC/153. States have had some time to get used to international inspections through IAEA safeguards.

The CWC verification system is more akin to INFCIRC/153 than is the CTBT verification. Here we have, again, a permanent inspectorate that pays periodic visits to the parties. A special feature is the challenge inspections. Any State Party may request the Technical Secretariat to undertake a challenge inspection to clarify any questions concerning possible non-compliance with the Convention. Unlike the IAEA Secretariat, which can request a special inspection, the Secretariat of the CWC cannot, itself, initiate a challenge inspection. On the other hand, a party requesting a challenge inspection will only need one-third of the Council to support it. Thus two-thirds would be needed to block a challenge inspection.

"Managed access" is a method introduced for inspection of sensitive installations, to prevent the disclosure of sensitive information. Managed access permits removal of sensitive papers and the shrouding of sensitive equipment unrelated to the subject of the inspection. Under the Additional Protocol to IAEA safeguards agreements there are, similarly, arrangements available to protect legitimate interests of confidentiality.

## KEEPING A WATCH ON PROGRESS

In the nuclear field, those charged with the responsibility of contributing to the verification of arms-control measures are required to report to the world community through a number of mechanisms — the Security Council, United Nations General Assembly, the Agency's Board and the governing body of the CTBT. Also, every five years the nonproliferation regime is subject to the close scrutiny of the NPT review conference — the next is due in the year 2000. Both States and the international community at large will no doubt be drawing up a scorecard. What items should be on it?

A first category will be the acceptance of obligations. Which States have made nonproliferation commitments and which have not? How many States that have made such commitments have concluded the relevant safeguards agreements with the IAEA? In the area of the Treaty of Tlatelolco, great efforts have been made in recent years to conclude such agreements to ensure there be no delay in bringing the Treaty fully into force once all States in the region have accepted it. However in other areas there remain quite a number of States that have yet to conclude the required safeguards agreement.

A further point relating to the legal framework is, now, the acceptance of the Additional Protocol — by non-nuclear-weapon States, nuclear-weapon States, and by the threshold States. This will be a litmus test of the commit-

ment of States to strengthened safeguards.

A second category will be the record of implementation. What amounts of material are being safeguarded, and in particular what quantities of plutonium and HEU are under inspection? How many States have offered inspectors multiple visas, how many have accepted the simplified inspector designation procedures, how many are reporting under the voluntary scheme of reporting on imports and exports? Other indicators of success will be the rate of introduction of efficiency measures such as remote monitoring; actions to establish base lines for environmental sampling; and progress in resolving long-standing implementation problems as identified in the Safeguards Implementation Report.

In addition it might be expected that the Agency will be called on to report its contributions in new verification areas and in particular its contribution to nuclear disarmament. For example, successive NPT reviews have expressed interest in the extended application of safeguards in the nuclear-weapon States.

Equally, progress in the Trilateral Initiative will be a matter of interest — and more generally we will need to monitor and report on progress in managing stockpiles of fissile materials usable in nuclear weapons. And if international expectations are to be met, we will see progress in the consideration of a cut-off agreement which would involve Agency contributions.

## COST-EFFECTIVE INVESTMENTS

The revelations of recent years of breaches to non-proliferation undertakings have been quickly acted on by the international community. The system of international safeguards has been changed and, once the provisions of the Additional Protocol are accepted by States, the assurance provided will be greatly enhanced.

Other elements of the non-proliferation regime, such as the Nuclear Suppliers Group, have also been upgraded. Also, it will be noted that the various elements of the non-proliferation regime have their respective roles and should complement each other — this they are doing. There are also areas of overlap and redundancy between the various elements — which is not surprising and indeed is desirable in such a sensitive area of international security and where no one mechanism is able to provide unequivocal assurance.

As we have seen in the case of Iraq, it was possible for a country to evade the safeguards system in force at that time. It was also able to acquire a vast assortment of equipment as well as raw materials for a weapon programme — despite the supplier controls then applying. Finally, it appears to have escaped detection by the various national intelligence capabilities.

While efforts are being made to remedy apparent shortcomings, it is equally clear that 100% assurance can never be achieved by any one of the measures I mentioned. It must be admitted that even when all systems are brought to bear, there is still a possibility that illegal activities could go undetected. And it is to be noted that while most scenarios assume State complicity in any such clandestine activity, the incidents of illegal trafficking in nuclear items remind us of the further possibility of proscribed activities by sub-national groups — even if it is far more likely that they would focus first on the more readily available options such as chemical agents — as was dramatically demonstrated not long back in the Tokyo underground railway.

It is no doubt these persisting elements of uncertainty that encourages thought of counter-proliferation by enhanced national detection capacity and defensive and/or offensive military capabilities directed at suspected proliferators. A further reason might be the increasingly serious attention being given to the so-called zero option — the nuclear-weapons-free world. As I have noted, movement in this direction will certainly increase the need for reliable verification. We probably have to assume that this goal is still distant — and we certainly have our hands full enough for some years to come. But it is important to know in what direction we want to go.

I will not pass judgement on the motives for, or the merits of, investment in the further layers of assurance being proposed — but I think it is also unlikely that such systems of counter-proliferation would be able to deliver 100% assurance. I would rather hazard that the relatively small costs of multilateral verification systems represent a very cost-effective investment. Further investments in such systems might give more dividends than some billion dollar alternatives. ❐