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An Overview of the Evolution, Operation and Status of Nuclear Safeguards

Andreas Persbo (with Ben Mayo & Matthew Peterson)

1. The IAEA Safeguards System: an Historic-Systematic Account

Sixty years ago, the world witnessed with horror the force of the split atom unleashed on a civilian population. Consequently, the very first resolution adopted by the UN General Assembly (UNGA) in 1946 established a commission to deal with the discovery of atomic energy and related matters. It was tasked with developing proposals for the control of atomic energy, to the extent necessary to ensure its use only for peaceful purposes, and for effective safeguards[1] by way of inspection and other means to protect complying states against the hazards of violations and evasions.[2]

In 1946, the United States presented an ambitious proposal to the commission. Based on the assumption that no system of safeguards could provide an effective guarantee against production of atomic weapons by a nation bent on aggression, the plan called for the creation of an International Atomic Development Authority, to which all phases of the development and use of atomic energy should be entrusted. The authority would have the principal responsibility to verify that no unlawful activities were conducted on the soil of subscribing states. The plan principally envisaged verification through inspection with adequate freedom of access to states. The inspectors were to be recruited for their proven competence and, as far as possible, on an international basis.[3] The plan eventually failed because of Soviet mistrust of Western intentions.[4]

Seven years later, US President Dwight Eisenhower delivered his 'atoms for peace' proposal to the UNGA on 8 December 1953.[5] Several programmes emerged from his initiative, including one for an 'International Atomic Energy Agency' (IAEA) which was eventually established in 1957.

1.1 The International Atomic Energy Agency

The IAEA has two primary objectives. First, to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. Second, to ensure that assistance provided by it, or at its request or under its supervision or control, is not used to further any military purpose.[6] The two objectives are contradictory, since the spread of peaceful nuclear energy equates to the spread of knowledge about the fundamentals of nuclear weapons technology. The safeguards system only encompasses materials that can be used in nuclear weapons and divides these materials into 'special fissionable materials', which can be used in a programme to develop an atomic bomb with relative ease, and 'source materials', which need to be processed to be usable (see annex 1).[7]

The IAEA Statute forms the basis of the safeguards system. The drafters anticipated that Agency safeguards would be required as a consequence of bilateral or multilateral agreements. However, prior to the entry into force of the 1968 Nuclear Non-Proliferation Treaty (NPT), safeguards were applied almost exclusively as a condition insisted upon by nuclear material suppliers. The IAEA was therefore authorised to establish and administer safeguards, to ensure that nuclear materials, services, equipment, facilities and information under its supervision are not used in such a way as to further any military purpose. At the request of a state, safeguards could also be applied to any of that state's activities in the field of atomic energy.[8] Emphasising the IAEA's supportive and non-intrusive nature, the statute stipulates that the Agency's activities shall be carried out with due observance of the sovereign rights of states.[9] Among other things, the statute gives the Agency the right to examine specialised equipment and facilities, to require the maintenance and production of operating records, and to call for and receive progress reports. To facilitate verification, the statute also gives the IAEA the right to send inspectors, whom it designates, after consultations with the state concerned. However, inspectors must be escorted by representatives of the state if the state so requests.[10]

Despite the notable emphasis on safeguards by the negotiators of the IAEA statute, there were no serious proposals for applying IAEA safeguards in the three nuclear weapon states that existed at the time, or in Eastern Europe. The open question, and the most debated, was how to apply safeguards

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in Japan, Western Europe and certain developing countries, which at that time had embarked on massive nuclear power programmes. The IAEA's role seemed to be curtailed in its infancy as Europe preferred to safeguard its nuclear industry regionally.

1.1.1 IAEA Relations with EURATOM

The European Atomic Energy Community (EURATOM) was established in 1958.[11] Soon after its creation it signed a memorandum of understanding and an agreement for cooperation with the USA. Immediately, concerns were voiced that EURATOM should not be given the right of self-inspection since it might encourage other regions to develop local solutions and evade international inspections.[12] Despite these concerns, EURATOM developed its own comprehensive safeguards system while the IAEA had none. The creation of EURATOM had several serious implications for the subsequent verification regime instituted by the IAEA. First, it excluded the application of IAEA safeguards in Western Europe, a situation which remained unchanged until 1978. Second, as a countermeasure, states in Eastern Europe and the Soviet Union ruled out the presence of international inspectors on their territories. Third, it denied the Soviet Union the opportunity to verify activities in the country it most mistrusted: the Federal Republic of Germany.[13]

The European Commission (EC) has been responsible for safeguards activities since 1967, when EURATOM was subsumed into the commission. Once all European non-nuclear weapon states (and EURATOM) had signed NPT-mandated safeguards agreements with the IAEA, inspections mainly fell under the principal authority of the IAEA. Since 1992, IAEA and EURATOM inspectors have worked in joint teams. The number of inspections in European Union states has decreased since 1992, but this is primarily because a number of large nuclear power plants have closed rather than a result of the partnership approach.[14]

1.2 The Agency's Safeguards System

In 1959 the first objects were put under IAEA safeguards: a Japanese research reactor and its fuel.[15] It quickly became clear that to apply safeguards on an ad hoc basis would be both time consuming and controversial, so the IAEA began to develop general guidelines for verification.[16] In 1961, despite opposition from India and the Soviet Union, the IAEA approved a set of complex principles and procedures for verification of research reactors.[17] These were followed by guidelines for Agency inspectors, which in practice restricted the degree of their access to routes and locations designated by the state.[18] It was clear that many governments resented the idea that foreign inspectors, perhaps from hostile states, would be allowed to inspect the elements of national technology which were deemed most sensitive in both economic and national security terms.[19]

The situation changed somewhat in 1963 when the Soviet Union changed direction, announcing that it had always supported the concept of nuclear safeguards. A complete review of the safeguards system ensued and it was decided to extend it to cover large reactor facilities.[20] A revised system followed in 1965, which included additional provisions for reprocessing plants and safeguarded nuclear material in conversion and fabrication plants. The improved safeguards system was completed in 1968.[21] It incorporates two principal elements: first, the state is to declare its holdings to the IAEA; second, the IAEA is to verify that the declaration is correct.

1.2.1 Safeguarded Facilities

Safeguards are applied in connection with an Agency project,[22] bilateral or multilateral agreement, or after a unilateral submission[23] and are, subject to the terms of the agreement, applied to one or several of a state's reactors.[24] Other facilities that may be safeguarded are 'principal nuclear facilities', i.e. reprocessing plants, isotope separation plants, materials production facilities or other types of facilities (including storage facilities) classified as 'principal nuclear facilities' by the IAEA Board of Governors.[25]

1.2.2 Reporting Obligations

Under the Agency's safeguards system, record-keeping of nuclear materials is subject to agreement between the IAEA and the state. A system of records must be created for each facility,[26] comprising accounting records of all safeguarded nuclear material and operating records for principal nuclear facilities.[27] Under this safeguards system, the state is required to submit the following types of report:

- Design Review;[28]
- Routine Reports;[29]
- Reports on Progress in Construction;[30]
- Special Reports.[31]

Design reviews have the sole purpose of satisfying the Agency that a facility will permit effective application of safeguards, and should be undertaken as early as possible in the development of a facility. The state is only required to submit basic characteristics of the facility relevant to the planning of safeguards activities. The Agency is required to complete the review promptly and notify the state of its conclusions without delay.

Generally, reports should encompass information relating to the production, processing and use of safeguarded nuclear material, both inside and outside principal nuclear facilities. Therefore, the IAEA and the safeguarded state are to agree on a system of reports with respect to each facility and also to safeguarded nuclear material outside the facilities. Reports need only include information relevant for safeguards.

Routine reports comprise accounting reports and operating reports. Accounting reports should show the receipt, transfer out, inventory and use of all safeguarded nuclear material. Operating reports give information on the use of a facility since the last report. As far as possible, they should also include a programme of future work at the facility. Construction reports may be required, to inform the Agency when particular stages in the construction of a principal nuclear facility have been, or are about to be, reached.

Special reports are to be submitted to the IAEA without delay if an unusual incident occurs involving any safeguarded nuclear material or principal nuclear facility. They are also required if the state has reason to believe that safeguarded nuclear material, in quantities exceeding that accepted by the Agency, is lost or unaccounted for. States are also required to report transfers which do not require advance notification but which will result in a significant change in the quantity of safeguarded nuclear material. Such reports should indicate the amount and nature of the material concerned and its intended use.

1.2.3 Inspection Rights

The basic IAEA safeguards system envisages three types of inspections:

- Routine Inspections;[32]
- Initial Inspections of principal nuclear facilities;[33]

• Special Inspections.[34]

The scope of routine inspections is subject to agreement but may include: audit of records and reports; verification of the amount of safeguarded nuclear material by physical inspection, measurement and sampling; examination of principal nuclear facilities; and checking of the operations carried out at principal nuclear facilities, and research and development facilities containing safeguarded nuclear material. If the Agency has right of access to the facility at all times (see annex 2), it may perform inspections without notice. However such inspections are only allowed to the extent necessary for the effective application of safeguards; the actual procedures are subject to agreement between the IAEA and the state.

If the safeguards agreement calls for design review, the IAEA may be allowed to conduct initial inspections to verify that the construction of a principal nuclear facility is in accordance with the submitted design. This should be done as soon as possible after the facility starts to operate, or when it comes under Agency safeguards.

Special inspections can be initiated if study of a report indicates that such inspection is desirable, or if any unforeseen circumstance requires immediate action. Special inspections may also be carried out if a substantial amount of safeguarded material is to be transferred outside the jurisdiction of the state.

1.3 The Comprehensive 'Full Scope' Safeguards System

The entry into force of the 1968 Nuclear Non-Proliferation Treaty (NPT) heralded a change in nuclear safeguards.[35] The treaty states that:

> 'Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system'.

With the introduction of the NPT, each subscribing non-nuclear weapon state[36] is obligated to bring into force safeguards agreements with the IAEA no later than eighteen months after the start of negotiations (which may not start later than the date when the state deposited its instrument of ratification).[37] The review resulted in an agreement on what is commonly called the Comprehensive Safeguards Agreement (CSA).[38]

1.3.1 State System of Accounting and Control

Under the CSA, each party is required to set up and maintain a state system for accounting and control (SSAC) of all nuclear material subject to safeguards. The system lies at the very heart of the verification regime, since it is an important source of information for the IAEA. It also enables a state to exercise more stringent controls over nuclear materials in its own territory. The system is based on a structure of material balance areas (MBAs)[39] and establishes both accountancy routines (such as effective inventories) and national procedures for evaluating eventual discrepancies.[40] Accountancy is highlighted as the procedure of fundamental importance, while containment and surveillance are complementary measures.[41] Containment and surveillance techniques are applied in order to maintain continuity of knowledge gained through IAEA verification. A variety of techniques are used, primarily video surveillance and sealing. These measures serve to back up material accountancy by providing means by which access to nuclear material can be monitored and any undeclared movement of material detected.

1.3.2 Safeguarded Facilities

Under the old system the IAEA could only safeguard facilities (or parts of facilities) subject to a voluntary arrangement or a bilateral agreement, or facilities forming part of an IAEA project. Full-scope safeguards aim to cover certain critical aspects of a state's nuclear industry. The system focuses on a few types of facilities, which were considered important from a safeguards perspective. MBAs can be established for the facility as a whole or for the following parts of the facility individually:[42]

- Reactors;
- Critical facilities;
- Conversion plants;
- Reprocessing plants;
- Isotope separation plants;
- Separate storage facilities;
- Any location where more than one effective kilogram[43] of nuclear material is customarily used.

It was later realised that this focus on enumerated facilities left a substantial lacuna in the verification coverage, and that the Agency needed information on additional facilities to draw a conclusion about the completeness of a state's declaration (see 1.3 below).

1.3.3 Reporting Obligations

An important component of the full-scope safeguards system is the reporting system, which forms the starting point of subsequent inspections. The SSAC compiles reports, which are then sent to the IAEA for evaluation.[44]

The following types of reports are stipulated in a CSA:

- Initial report within 30 days of the agreement's entry into force;[45]
- Accounting reports for each material balance area;[46]
- Semi-annual statements of book inventory in each material balance area;[47]
- Special reports;[48]
- Design Information.[49]

The state's initial report contains information on all nuclear material which is to be subject to safeguards. The Agency may then conduct an ad hoc inspection to verify the correctness of the initial report. Subsequent reports can be of two types, either 'accounting reports' or 'special reports'. In particular, the state is required to report inventory changes as soon as possible. To keep the IAEA informed, the state must also submit semi-annual statements of its book inventory of nuclear materials. 'Special reports' can be submitted if the states suspect unauthorised removal of nuclear materials or if any unusual incident or circumstance occurs.

1.3.4 Inspection Rights

The nuclear safeguards system relies on two types of inspections. Routine inspections constitute the monitoring element of the regime,[50] while ad hoc[51] and special[52] inspections form part of specific verification processes (see 2 below). These inspections are stipulated in a CSA.

Ad hoc inspections are primarily conducted to verify the information in the initial materials inventory report, but also to identify any changes which have occurred since the submission of the first report. The IAEA is required to give at least one week's notice before inspectors arrive.[53] Ad hoc inspections are also deployed upon export of nuclear materials

to verify that no material is diverted during transport. In this case, twenty-four hours' notice is sufficient.[54]

The primary purpose of routine inspections is to verify that reports are consistent with records and to verify the location, identity, quantity and composition of safeguarded materials. The number, intensity and duration of routine inspections are kept to the minimum consistent with the effective implementation of safeguards. Facilities having stock or an annual throughput of less than five effective kilograms of nuclear material per year (see annex 3) should not be inspected more than once a year. The maximum number of inspections depends on the type of facility and the stock or annual throughput of nuclear materials, as expressed in effective kilograms. The comprehensive safeguards agreement also outlines the length of notice to which the state to be inspected is entitled. Twenty-four hours' notice is given if the materials at the location contain plutonium or uranium enriched to more than five per cent. One week's notice is given in all other circumstances. The inspected state also has the right to receive advance notice of the place and time of the inspectors' arrival and to have the inspectors accompanied by representatives of the state during their inspection.[55] A number of the routine inspections can be unannounced, but the IAEA must specify general periods when inspections are foreseen.[56] Unannounced inspections[57] were rarely used prior to the advent of the strengthened safeguards system (see 1.4 below).

Special inspections can be initiated if the Agency concludes that information made available by the country, including subsequent explanations and information obtained from routine inspections, is not adequate for the IAEA to reach a conclusion on compliance. The special inspections provision has only been invoked once, to support the IAEA's effort to verify the extent of North Korea's nuclear programme in the early 1990s. During a special inspection, the IAEA can request access to any location at any time, including locations outside designated buildings. Any special inspection, however, has to be preceded by consultation with the state. Access to all buildings except designated buildings is subject to consent by the inspected state. If consent is not given, all the IAEA can do is to call upon the state to take the required action without delay.[58] Even if agreement can be reached, access must only be given only 'as promptly as possible'.[59] Clearly, the ability of the IAEA to conduct special inspections depends on the attitude of the state. If the state is cooperative, routine inspections are generally sufficient, while if the state refuses to cooperate, the possibility of conducting special inspections exists only in theory.

1.4 The Strengthened Safeguards System

By the beginning of the 1980s, almost all industrialised countries and many developing nations had joined the NPT and most of them, with the exception of the nuclear weapon states, had put their nuclear materials under IAEA safeguards.[60] After the first Gulf War in 1991, it was revealed that Iraq had developed a parallel nuclear programme over the previous decade. Since the safeguards system was based on state declarations and material accountancy in designated facilities, Iraq's comprehensive safeguards agreement had provided less than sufficient information to detect diversion.

Beginning in the early 1990s, the Agency started to review the safeguards system. The first question it sought to address was what additional measures could be taken under its existing authority. Box 1 shows the measures agreed.

Box 1. Measures under Comprehensive Safeguards Agreements

- State provision of design information on new facilities or on changes in existing facilities handling safeguarded nuclear material, as soon as the state authorities decide to construct, authorise construction of or modify a facility. The IAEA maintains its right to verify the design information over the facility's life cycle, including decommissioning.
- Enhanced IAEA evaluation of information from a state's declarations, Agency verification activities and a wide range of open and other sources (e.g. scientific literature, news articles, satellite imagery and third parties).
- Voluntary reporting by states on inventories, imports and exports of nuclear material and exports of specified equipment and non-nuclear material.
- Agency use, to a greater extent than previously, of unannounced inspections within the routine inspection regime.
- Agency collection of environmental samples in facilities and at locations where, under safeguards agreements, IAEA inspectors have access during inspections and design information visits; such samples to be analysed at the IAEA Clean Laboratory and/or at qualified laboratories in member states.

Parallel to this review, the IAEA embarked on the ambitious '93+2 programme', to establish what additional authority was required by the Agency to fulfil its mission. The result was the adoption in 1997 of the so-called Additional Protocol (AP). It is important to note that this protocol is signed as an additional agreement to the CSA and is not a stand-alone document. The protocol allows for the measures shown in Box 2.

Box 2. Measures under an Additional Protocol

- State provision of information about, and IAEA inspector access to, all parts of a state's nuclear fuel cycle, from uranium mines to nuclear waste, and any other location where nuclear material intended for non-nuclear use is present.
- Agency collection of environmental samples at locations beyond those provided under safeguards agreements.
- State provision of information on, and Agency short-notice access to, all buildings on a nuclear site.
- State acceptance of IAEA designations of inspectors and issuance of multiple entry visas (valid for at least one year) to inspectors.
- State provision of information about, and Agency verification mechanisms for, a state's research and development activities related to its nuclear fuel cycle.
- Agency right to make use of internationally established communications systems, including satellite systems and other forms of telecommunication.
- State provision of information on the manufacture and export of sensitive nuclear-related technologies, and IAEA verification mechanisms for manufacturing and import locations in the state.
- Wide area environmental sampling, after IAEA Board of Governors approval of procedural arrangements for such sampling and consultations with the state concerned.

1.5 The Integrated Safeguards System

The increased financial and personnel burden (see 3.3 below) is a potential obstacle to the implementation of strengthened safeguards. Integrated safeguards, which are being implemented in states with a CSA and Additional Protocol in force, seek to ease this problem by enhancing the efficiency of safeguards (overall and in relation to particular states), enabling the Agency to focus its efforts where they are needed most. The conceptual framework for integrated safeguards was completed in March 2002 and the development of practical approaches to implementation, including in participating countries, continues. Integrated safeguards involve two distinct approaches. The first aims to decrease reliance on traditional routine inspections through increased use of remote sensing devices and automated systems, as well as by refining verification modalities and techniques. The second seeks to 'customise' verification for individual states by identifying redundancies and consolidating and rationalising measures, thereby reducing the verification burden for both the state and the IAEA. This includes minimising, wherever possible, the effort expended on verifying previously verified material.[63]

1.6 A Note on Nuclear Weapon States Safeguards

Nuclear weapon states (as established by the NPT) are not required to put their facilities under safeguards.[64] Nevertheless, all nuclear weapon states have agreements of some sort in force with the Agency. These agreements are variants of the CSA and the AP.[65] All agreements allow for materials to be removed from safeguards (that is, transferred from a state's civilian stockpile to its military stockpile) subject to notification to the Agency.

1.7 A Note on the Recruitment of IAEA Inspectors

IAEA Safeguards Inspectors are recruited from the IAEA's Member States. They are hired on the basis of professional qualifications, and secondarily by nationality, to ensure staff representation from all continents and from developing countries. Article VIII of the IAEA Statute states:

> The paramount consideration in the recruitment… of the staff… shall be to secure employees of the highest standards of efficiency, technical competence, and integrity. Subject to this consideration, due regard shall be paid to the contributions of members to the Agency and to the importance of recruiting the staff on as wide a geographical basis as possible.

Inspectors are required to have degrees in relevant scientific subjects and several years of experience in the nuclear field, particularly the fuel cycle. They are hired on an initial three year contract, which may be extended by two years. Inspectors rarely receive more than two extensions. The IAEA does not operate strict geographical quota for recruitment, but it does prioritise applicants from underrepresented states. Furthermore, other things being equal, applicants from developing states are given priority. The most recent available data for the regional breakdown of IAEA inspectors (2001) is as follows: 22 per cent from North America; 22 per cent EU; 17 per cent Far East and Pacific; 16 per cent from Eastern Europe, including newly independent states; ten per cent from Africa; six per cent from the Middle East and South Asia; and six per cent from South America. Overall, 38 per cent of inspectors are from developing countries.

Once inspectors are contracted to the Agency – and this applies to other verification bodies, such as the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC) – they may not accept instructions from their government or breach the organisation's confidentiality rules. Confidentiality concerns surrounded the operations of UNMOVIC's predecessor, the United Nations Special Commission (UNSCOM). UNSCOM personnel were, in contrast, seconded to the UN by their respective states.

2. The IAEA Safeguards System: a Process-Oriented View

The present system draws on the entire legal construct dating from the IAEA's inception to today, giving it an 'organic character'. The system still rests on the basic premise that the state voluntarily enters into an agreement with the IAEA. The difference is that the variety of agreements available today allows a considerably stronger verification system than the set of agreements available thirty years ago.

2.1 Elements of the Verification Process

Nuclear safeguards involve a significant monitoring component, because of their emphasis on state declarations and routine inspections. The Agency's monitoring system has been described in detail above. It should be remembered that routine monitoring does not in itself imply a charge of non-compliance.

When suspicions of non-compliance arise, the verification process can roughly be divided into three separate phases: fact finding, review and assessment.[66] A compliance process usually follows the verification process. It can roughly be divided into two separate phases: dispute settlement and corrective and/or enforcement measures.

The monitoring, verification and enforcement components reinforce each other. There are also certain areas of overlap in all processes. Monitoring triggers and reinforces the fact finding process; the review and assessment processes are often conducted simultaneously. A state taking corrective action through a dispute settlement process often achieves a verified return to complicance, removing the need for further enforcement actions. Monitoring both serves as a deterrent and helps to establish whether a state has returned to compliance.

2.2 Fact Finding

Several critical aspects of the IAEA's monitoring system have been described in section 1 and need not be repeated here. As implied above, monitoring forms part of verification as it is a means of gathering information. While monitoring may constitute the first step in the verification process, it is also a means of ensuring compliance since it acts as a deterrent. Monitoring is not an essential component of the verification process (verification may be conducted solely through so-called challenge inspections), however routine monitoring has proved its capacity to generate useful information for making baseline and subsequent compliance assessments. The information collected through routine monitoring may be sufficient to reach a conclusion on compliance. Importantly, however, routine monitoring itself does not imply a charge of non-compliance. Challenge inspections – on the other hand – are often instigated after one state party has accused another of non-compliance with the agreement.

There are a few mechanisms that fall outside the Agency's monitoring system. These are the use of so-called national technical means of verification (national intelligence) and open source data, briefly mentioned in section 1.4 above.

The general approach adopted by the IAEA in respect to these additional means is to compare states' declarations with supplementary information available to the Agency, and to look into any apparent inconsistencies.[67] There are, however, limitations to the usefulness of this kind of information.

2.2.1 National Technical Means

There is no reference in the statute or in the model CSA or AP to national technical means of verification. The inclusion of intelligence data into nuclear verification was not formally endorsed by the IAEA until February 1992. National intelligence was initially given only for Iraq, but since 1992 governments (especially the US) have begun to provide the Agency with intelligence on other countries, including Iran, South Africa and North Korea. However, Agency officials state categorically that they do not provide any formal feedback to, or engage in data exchanges with, national intelligence agencies.[68] The use of national intelligence in multilateral verification has always been a politically sensitive issue. Moreover, questions about the veracity, interpretation, and use or misuse of national intelligence information provided by the British and US government about Iraq, has for many observers served as an indication of the need for a multilateral verification process free from nationally supplied data.[69]

2.2.2 Open Source Data

The IAEA also accumulates information on individual states through data generally available to the public from external sources. Satellite imagery can provide accurate, reliable and independent information but is heavily dependent on good location data and favourable weather conditions. It cannot provide information about plans and intentions. Scientific journals, research papers and conference proceedings can also be useful in identifying research areas, organisations or individuals actively engaged in nuclear research in particular countries. Information from the media is also used, albeit with considerable caution. NGOs or commercial companies can also provide data that is otherwise difficult to access. [70]

2.3 Review and Assessment

When the facts have been established, they are tested against the rules of the relevant agreement. This constitutes the review phase of the verification process. Tied into the review phase is the assessment, in which the IAEA decides or estimates the degree of compliance, based on the conclusions of the review. While the review phase is a largely a technical analysis, the assessment phase is a legal and political qualification of pre-established facts.

There are several relevant agreements dealing with nuclear safeguards (such as those on nuclear weapon-free zones), but the most important one is the NPT, in which non-nuclear weapon states undertake not to receive, transfer, assume control over, manufacture or acquire nuclear weapons or nuclear explosive devices either directly or indirectly.[71] As noted, nuclear safeguards have not traditionally employed a holistic approach to verification of this obligation. Nuclear safeguards simply aim to prevent diversion of nuclear materials to weapons or other nuclear explosive devices.[72] The 'product' of the IAEA's verification activities is a statement of the amount of material unaccounted for over a specific period.[73] A safeguards evaluation based on the broader information and complementary access[74] activities provided under an AP enables the IAEA to draw conclusions about both the non-diversion of declared nuclear material and the absence of undeclared nuclear material and activities in the state.[75] If it cannot draw such conclusions, it will issue a finding to that effect. This does not necessarily indicate that the missing materials have gone to a nuclear weapons programme or that there are undeclared facilities on the state's territory.

The assessment is conducted by the IAEA's executive body, the Board of Governors. The Board has 35 member states, elected by the IAEA General Conference; the outgoing Board of Governors designates 15 members advanced in the technology of atomic energy, while the General Conference designates 20 based on equitable geographical representation. The Board ultimately decides on the degree of compliance by a state and also considers any question arising out of the interpretation of the safeguards agreement or agreements.[76] Decisions are preferably made by consensus, but if consensus is unattainable the Board can decide by majority vote.[77] The IAEA Statute regrettably does not prohibit a board member from being involved in deciding on its own compliance.

2.4 A Note on Dispute Settlement

Dispute settlement mechanisms are present both in the IAEA statute and in the Comprehensive Safeguards Agreement. The mechanisms are centred on the use of bilateral consultations, negotiations within the Board, and if necessary, settlement by arbitral tribunal. A question or dispute relating to the interpretation or application of the IAEA statute shall be referred to the International Court of Justice (ICJ). If authorised by the UNGA, the IAEA Board of Governors or its General Conference are separately empowered to request an advisory opinion from the ICJ on any legal question arising within the scope of the Agency's activities.[78]

2.5 A Note on Corrective Measures and Enforcement Mechanisms

It is the IAEA and its Board of Governors that ultimately decide on necessary actions in accordance with its mandate. This principle has been upheld on several occasions by the parties to the NPT. Presently, the IAEA is mandated to take the following measures.[79]

- Call upon the non-compliant state to remedy the non-compliance;
- Report the non-compliance to IAEA members, the United Nations Security Council (UNSC) and the UN General Assembly (UNGA);
- Directly curtail or suspend nuclear assistance;
- Call for the return of materials and equipment made available to the state;
- Suspend from the exercise of the privileges and rights of membership of the IAEA.[80]

3. Weaknesses in the IAEA Safeguards System

3.1 Structural Weaknesses

In the beginning the fundamental weakness was that the IAEA could only inspect or monitor materials and facilities declared to it by state parties, allowing would-be proliferators to develop substantial undeclared nuclear capabilities undetected, either co-located with declared facilities or completely separately.[81]

Under today's safeguards system, one limitation is that nuclear safeguards permit states to assemble many of the elements of a future nuclear weapons programme, such as a uranium enrichment capability, as long as they declare them to be for peaceful purposes and subject them to safeguards.[82] The state can later exercise its right to withdraw from the NPT, and then legally develop nuclear weapons.

Another weakness of the safeguards system stems from the premise that the intensity of verification of any state party should be determined by the size of its nuclear industry, rather than by the likelihood of its non-compliance. This has led to the expenditure of considerable resources on verifying states with large, well-developed nuclear industries, like Canada, that are not of proliferation concern, while distracting attention from those that are, such as Iran. [83]

3.2 Lack of Geographical Coverage

The IAEA verification budget currently stands at some US$102m, allowing the Agency to employ around 500 inspectors. Even though each non-nuclear weapon state party to the NPT is required by the treaty to conclude a CSA with the IAEA, as of 19 July 2005, a large number – 37 out of 189 states parties – did not have such agreements in force.[84] Moreover, only 69 out of 189 states have brought their Additional Protocols into force. Safeguards are therefore unevenly applied around the world, which in itself is an unsatisfactory situation. Moreover, 86 out of the 152 states that do have a CSA in force, also have a so-called small quantities protocol (see 5.1.2) attached to their agreement, reducing the amount of information that the IAEA receives as a whole and suspending all of the Agency's inspection rights in those states. Figure 1 shows the number of states with no CSA, with a CSA, and with both a CSA and an AP.

Figure 1. Number of States with Safeguards Agreements in Force

Source: IAEA, Latest Status of Safeguards Agreements & Additional Protocols, http://www.iaea.org/OurWork/SV/Safeguards/sv.html

3.3 Lack of Resources

Each IAEA member's base rate contribution to the Agency's general budget is derived using the scale approved by the UN General Assembly to determine contributions to the UN Regular Budget. A coefficient is applied to the UN scale to compensate for differences in membership between the IAEA and the UN, except to the member with the highest UN assessment and the 13 members with the lowest.

Appropriations assessments to the IAEA's safeguards budget depend on whether states are 'shielded' or 'unshielded'.[85] IAEA members with shielded status do not pay for increases of the safeguards component of the Regular Budget beyond zero real growth. Unshielded members are proportionally assessed for an additional contribution to compensate for the relief granted to the shielded states. In the 2005 assessment there were 105 shielded members and 32 unshielded members.

In the past decade the verification burden on the IAEA has increased substantially, increasing pressure on resources and finances. New verification burdens have included:

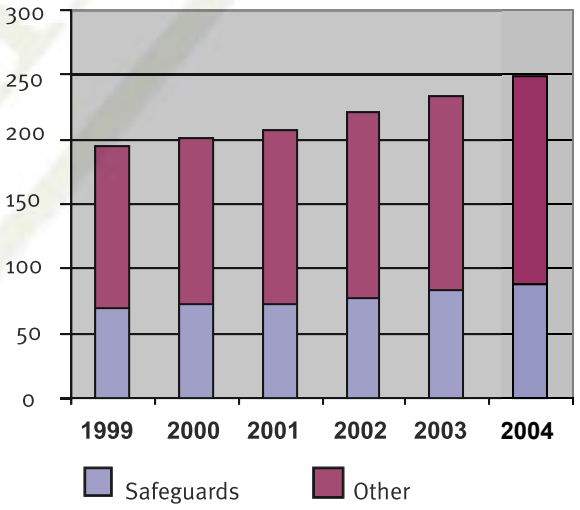
- The placing under IAEA supervision of considerable quantities of fissile material and numbers of nuclear facilities in the Soviet successor states, many of them verification-intensive due to their former military nature;[86]
- Intensive verification activities in Iraq, Iran and Libya;
- Involvement in monitoring efforts to return to the US poorly protected fissionable material in unstable countries, such as the states of the former Yugoslavia and former Soviet Union;
- The implementation of strengthened safeguards, including Additional Protocols. (While integrated safeguards are intended to cut the costs of strengthened safeguards, and still promise eventually to do so, their introduction necessitates an initial investment of time and resources.)

For more than a decade the IAEA operated under zero real growth restrictions imposed by the Western states. In 2003, the Agency at last had the first significant boost to its budget since the 1980s when the Board of Governors agreed a $US15 million increase. The bulk of the increase went to verification. The IAEA budget for 2004 is US$268.5 million. These increases enable the Agency to fund safeguards activities without having to resort to supplemental funding (up to US$19 million in recent years). They will also provide an improved financial basis for strengthened nuclear safeguards (see Figure 2). The increase, moreover, has helped to decouple verification spending from spending on technical cooperation to developing countries.[87]

Figure 2. Agency's Safeguards Budget 1998-2003

US$m – adjusted to 2003's US Consumer Price Index.

Sources IAEA Annual Reports, 1999-2004



The amount of nuclear material under safeguards has grown steadily over the years (see Figure 3). This trend shows no signs of slowing down, and if, as some experts predict, nuclear power is going to experience a renaissance over the next few decades, the safeguards regime is bound to be subject to great financial pressure in the future.

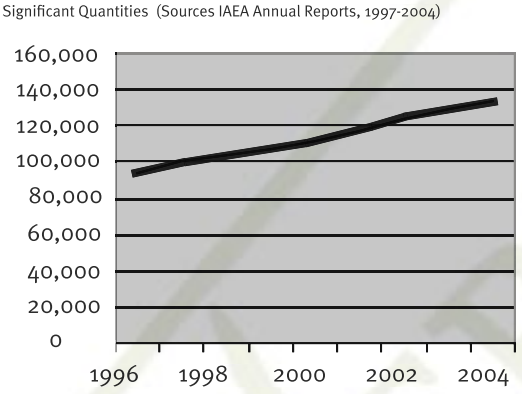
3.4 A Note on Verification in Failing or Non-compliant States

The 'classical safeguards system' (INFCIRC/153) could be applied with minimal infringement on national sovereignty and minimal participation of national authorities. The strengthened safeguards system is more reliant on effective

participation of national authorities and may also impose more on national sovereignty. The dilemma for the IAEA is that the more obligations it imposes upon states, the more it has to rely on them for proper execution. There is a wealth of literature about weak states, failed states and unrecognised territories (such as Abkhazia, Georgia). Heavy concentrations of states that could be characterised as weak or failed are located in subsaharan Africa and within the former communist block. For the safeguards system to work as envisaged, a state would need the following:[88]

- A professional administrative structure, a dependable legal system and a 'monopoly on violence'[89] within its territory;
- Unchallenged status and recognition of central government authority, effective control over the national territory, unified direction and accountability of military and police forces;
- Knowledge of nuclear activities in industrial enterprises, trade and business pursuits, and scientific establishments; and
- Political awareness and expert competence at the government level of what is and what is not permitted under international legal norms of non-proliferation.

Figure 3. Significant Quantities of Safeguarded Materials 1996-2004



The difficulty of verification in allegedly non-compliant states is illustrated by a two and a half year long verification process in Iran. It will remain a problem while safeguards are applied in a non-discriminatory manner. The strengthened safeguards system will rectify some shortcomings, but not all. The system does not adequately consider states' intentions, nor does it allow verification of secondary R&D, engineering and construction activities relating to weaponisation of nuclear materials. It also does not properly address other state activities, such as the development and construction of delivery systems (for example long range ballistic missiles).

4. 'New Challenges' to the Safeguards System

The verification regime is constantly being reviewed and assessed by the IAEA and its member states. There are many outstanding issues such as verification in weak, failed or unrecognised states and issues relating to the use of the nuclear fuel cycle. However, two issues can be highlighted in the context of this paper. The lengthy verification process in Iran, coupled with discoveries of undeclared nuclear activities in Egypt, South Korea and Taiwan, has led some states to call for a review of the overall operation of the safeguards system. Meanwhile, Saudi Arabia's signature of a CSA with a Small Quantities Protocol (SQP) attached has triggered discussion on how to verify the legitimate use of small quantities of nuclear materials.

4.1 The Call for Optimal Verification: a Review of the Additional Protocol

To date the IAEA has carried out verification activities in Iran with professionalism and persistence. It has applied its enhanced verification techniques and technology to the case. This has permitted the Agency to reveal, for instance, that centrifuge equipment was contaminated with uranium enriched to a much higher level than admitted by Iran, forcing the country to reveal that the equipment had been imported (presumably through the A.Q. Kahn network) rather than made in Iran. Iran is provisionally applying the Additional Protocol on its territory, enabling the Agency to gain experience in applying the measures provided for in an AP to a state that is already widely suspected of non-compliance.[90] However, the process has taken a long time, and Iranian concerns about the intrusiveness of inspections have delayed access to military sites where nuclear materials or facilities are suspected. The round of inspections in Iran has, among other things, highlighted the need to review the rules on complementary and managed access.

4.2 The Call for Comprehensive Coverage: the Small Quantities Protocol

A Small Quantities Protocol (SQP) can only be concluded if a state is in possession of quantities of nuclear materials otherwise exempt from safeguards and if it does not operate any nuclear facilities. The SQP suspends all provisions relating to the state's records system and its reporting obligations and also puts in abeyance the International Atomic Energy Agency's right to inspections. The protocol does stipulate that the state shall report on exports and imports of material containing uranium and thorium. This information may be consolidated and submitted in an annual report to the Agency. The state is still required to submit design information on existing nuclear facilities (if any) and on new facilities 'as early as possible' before nuclear material is introduced into the facility.

The SQP remains binding only as long as the state is not in possession of nuclear material exceeding quantities otherwise exempt from safeguards and as long as no material is introduced into nuclear facilities. The state is still under a general obligation to provide relevant information to the IAEA. If it fails to do so, the Director-General may report this to the Board of Governors, which may call on the state to take the required action without delay. If the Board of Governors then finds that the Agency is unable to verify that nuclear materials subject to safeguards have not been diverted to a nuclear weapons programme, it may initiate an enforcement process.[91] SQP agreements are considered by the IAEA to be a weakness in the verification regime (since they reduce the amount of information provided to the Agency) and ways to amend the protocol are being considered. The process is complicated by the IAEA having little or no contact with SQP states, some of which do not even have a permanent representative in Vienna.[92]

5. Concluding Remarks

Even the most sophisticated of verification processes would be unable to collate reliable facts on the intentions of states. Indeed, the present nuclear verification regime does not concern itself with collection of such data. Even a conclusion

that nuclear materials are unaccounted for, or that undeclared activities may be present on the territory of one state, is not in itself an assessment of whether the state concerned is developing a nuclear weapons programme. With regard to the current focus on materials and facilities, the chance of detecting clandestine nuclear activities depends on the degree of access to information and access to sites that is given to the IAEA. No verification regime can detect every instance of non-compliance. A complex system might raise the degree of assurance, but such a system would be more expensive and intrusive, and still not reduce the uncertainty to zero.[93] The true litmus test is simply if a verification regime is able to detect and verify significant breaches of a state obligation while respecting the need for industrial or military secrecy. If it fails to do so, the system needs to be reviewed. Financial challenges are also important; a verification regime often needs to achieve a high level of assurance about compliance on a minimum budget.

Andreas Persbo is a nuclear arms control and disarmament researcher at the Verification Research Training and Information Centre (VERTIC) in London.

List of Authorities

Treaties

1957 Statute of the International Atomic Energy Agency

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UN General Assembly Resolutions

UNGA Resolution 1 (I), 1 February 1946

Speeches

Bernard Baruch to the United Nations Atomic Energy Commission, 14 June 1946

Literature

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Bertrand Russell, 'Has Man a Future?', Simon & Schuster, New York (1962)

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IAEA Information Circulars

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INFCIRC/26, 30 March 1961

INFCIRC/26/Add.1, 9 April 1964

INFCIRC/66/Rev.2, 16 September 1968

INFCIRC/153/(Corrected)

IAEA General Conference

GC(V)/INF/39, June 1961

Webpages

IAEA, 'Safeguards with regard to conclusion of Safeguards Agreements and Additional Protocols', http://www.iaea.org/OurWork/SV/Safeguards/sir_table.pdf (accessed 18 August 2005)

IAEA, 'The Safeguards System of the International Atomic Energy Agency ("the Agency"), http://www.iaea.org/OurWork/SV/Safeguards/safeg_system.pdf (as of 18 August 2005)

Annex 1. Safeguarded materials and Significant Quantities

Special Fissionable Materials:

- Plutonium-239;
- Uranium- 233;
- Uranium enriched in the isotopes 235 or 233;
- Any material containing one or more of the foregoing;
- Such other fissionable material as the Board of Governors shall from time to time determine.

Source Materials:

- Uranium containing the mixture of isotopes occurring in nature;
- Uranium depleted in the isotope 235;
- Any of the foregoing in the form of metal, alloy, chemical compound, or concentrate;
- Any other material containing one or more of the foregoing in such concentration as the Board of Governors shall from time to time determine; and
- Such other material as the Board of Governors shall from time to time determine.

(Source: IAEA Statute, article XX)

Significant Quantities:

The approximate quantity of nuclear material in respect of which, taking into account any conversion process involved, the possibility of manufacturing a nuclear explosive device cannot be excluded:

• Plutonium	8 kilograms
• Uranium-235 (highly enriched uranium)	25 kilograms
• Uranium-235 (low enriched uranium)	75 kilograms

(Source: Against the Spread of Nuclear Weapons: IAEA Safeguards in the 1990s, IAEA, Vienna (1993), http://www.iaea.org/Publications/Booklets/Safeguards/)

Annex 2. Frequency of Inspections under INFCIRC/66/Rev.2

Whichever is the largest of:

- Facility inventory;
- Annual throughput; or
- Maximum potential annual production.

Kg of nuclear materials	Inspections per year
Up to 1	0
More than 1 & up to 5	1
More than 5 & up to 10	2
More than 10 & up to 15	3
More than 15 & up to 20	4
More than 20 & up to 25	5
More than 25 & up to 30	6
More than 30 & up to 35	7
More than 35 & up to 40	8
More than 40 & up to 45	9
More than 45 & up to 50	10
More than 50 & up to 55	11
More than 55 & up to 60	12
More than 60	Right of access at all times

(Source: IAEA INFCIRC/66/Rev.2, par. 57)

Annex 3. Effective kilogram (ekg)

- For plutonium: its weight in kilograms.
- For uranium enriched in 1 per cent or above 233, 235U: $ekg = w * \sqrt{e}$, where w is the weight in kilograms and e the enrichment level.
- For uranium enriched below 1 per cent 233, 235U but above 0,5 per cent: $ekg = w * 0.0001$, where w is the weight in kilograms.
- For uranium enriched below 0.5 per cent and for thorium: $ekg = w * 0.00005$, where w is the weight in kilograms.

(Source INFCIRC/153, art. 104)

Endnotes

[1] The words 'nuclear safeguards' are often used as a functional definition to describe, as the IAEA puts it 'an extensive set of technical measures by which the IAEA Secretariat independently verifies the correctness and the completeness of the declarations made by States about their nuclear material and activities'.

[2] UNGA Resolution 1 (I), 1 February 1946, www.un.org.

[3] Speech by Bernard Baruch to the United Nations Atomic Energy Commission, 14 June 1946, http://www.atomicarchive.com/Docs/Deterrence/BaruchPlan.shtml.

[4] Bertrand Russell, Has Man a Future?, Simon & Schuster, New York (1962).

[5] Speech by US President Dwight D. Eisenhower to the United Nations General Assembly, 8 December 1953, http://www.eisenhower.archives.gov/atoms.htm.

[6] 1957 Statute of the International Atomic Energy Agency [cit. IAEA Statute], article II.

[7] IAEA Statute, article XX.

[8] IAEA Statute, article III (A) (5).

[9] IAEA Statute, article III (D).

[10] IAEA Statute, article XII (1)-(6).

[11] 1957 Treaty Establishing the European Atomic Energy Community. Signed at Rome, on 25 March 1957 Came into force on 1 January 1958. Original members included the Netherlands, Italy, France, the Federal Republic of Germany, Land Berlin and Luxembourg. The treaty today forms part of EU law.

[12] Richard G Hewlett & Jack M Holl, Atoms for Peace and War 1953-1961: Eisenhower and the Atomic Energy Commission, University of California Press, Berkley (1989), p. 442.

[13] David Fischer, History of the International Atomic Energy Agency, IAEA, Vienna (1997), p. 245.

[14] David Fischer, 'History of the International Atomic Energy Agency', IAEA, Vienna (1997), at p. 288

[15] INFCIRC/3, 15 April 1959, www.iaea.org.

[16] Allan McKnight, Atomic Safeguards: A Study in International Verification, UNITAR, New York (1971).

[17] INFCIRC/26, 30 March 1961, www.iaea.org.

[18] GC(V)/INF/39, June 1961, www.iaea.org.

[19] David Fischer, History of the International Atomic Energy Agency, IAEA, Vienna (1997).

[20] INFCIRC/26/Add.1, 9 April 1964, www.iaea.org.

[21] INFCIRC/66/Rev.2, 16 September 1968, www.iaea.org. The authority to establish such a system was provided by Article III (A) (5) of the Statute. Agreements incorporating provisions from the earlier version of the safeguards system continued to be in force unless all parties to it requested the Agency to substitute its provisions.

[22] IAEA Projects are any projects for research on, or development or practical application of, atomic energy for peaceful purposes. States may request the assistance of the Agency in securing special fissionable and other materials, services, equipment, and facilities necessary for this purpose.

[23] INFCIRC/66/Rev/2, para. 82.

[24] INFCIRC/66/Rev/2, para. 7.

[25] INFCIRC/66/Rev/2, para. 78.

[26] INFCIRC/66/Rev/2, para. 33.

[27] INFCIRC/66/Rev/2, para. 35 and 36.

[28] See INFCIRC/66/Rev/2, para. 30-32.

[29] See INFCIRC/66/Rev/2, para. 39-40.

[30] INFCIRC/66/Rev/2, para. 41.

[31] INFCIRC/66/Rev/2, para. 42-43.

[32] INFCIRC/66/Rev/2, art. 49-50.

[33] INFCIRC/66/Rev/2, art. 51-52.

[34] INFCIRC/66/Rev/2, art. 53-54.

[35] 1968 Treaty on the Non-Proliferation of Nuclear Weapons [cit. NPT], opened for signature 1 July 1968, entered into force 5 March 1970. For more discussion on the NPT, see 2.3 below.

[36] A nuclear-weapon state (NWS) is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device before 1 January 1967. The other states parties are considered 'non-nuclear weapon states' (NNWS) under the treaty, even if they have since developed nuclear weapons or explosive devices. See NPT art. IX (3). This means that Israel, India and Pakistan – if they joined – would need to subscribe to NNWS rights and obligations. The NWS are China, France, Russia, the United Kingdom and the USA.

[37] NPT art. III (4).

[38] INFCIRC/153/(Corrected).

[39] A material balance area' is an area in or outside a facility such that (1) the quantity of nuclear material in each transfer into or out of each 'material balance area' can be determined; and (2) the physical inventory of nuclear material in each 'material balance area' can be determined when necessary, in accordance with specified procedures, to establish the material balance for Agency safeguards purposes. A 'Facility' is (1) a reactor, critical facility, conversion plant, fabrication plant, reprocessing plant, isotope separation plant or separate storage installation; or (2) any location where nuclear material in amounts greater than one effective kilogram is customarily used.

[40] INFCIRC/153/(Corrected), art. 31, 32 and 110.

[41] INFCIRC/153/(Corrected), art. 62.

[42] INFCIRC/153/(Corrected), art. 106.

[43] See annex III.

[44] The evaluation is an assessment of the correctness and completeness of the state's declaration. It can also be said that the reports are being sent to the IAEA for an assessment of the states compliance. However, a report can be submitted incorrectly or incompletely in

good faith, so the word non-compliant should be used with care.

[45] INFCIRC/153/(Corrected), art. 29.

[46] INFCIRC/153/(Corrected), art. 63.

[47] INFCIRC/153/(Corrected), art. 66.

[48] INFCIRC/153/(Corrected), art. 68.

[49] INFCIRC/153/(Corrected), art. 42-44.

[50] INFCIRC/153/(Corrected), art. 71.

[51] INFCIRC/153/(Corrected), art. 72.

[52] INFCIRC/153/(Corrected), art. 73.

[53] INFCIRC/153/(Corrected), art. 83 (a).

[54] INFCIRC/153/(Corrected), art. 83 (a).

[55] INIFCIRC/153/(Corrected), art. 83 (c) and 89.

[56] INIFCIRC/153/(Corrected), art. 84.

[57] The use of unannounced inspections was foreseen under CSAs, but the IAEA and member states preferred scheduled routine inspections under the classical safeguards system. IAEA field trials have been carried out at low-enriched uranium fuel fabrication plants in the USA and Sweden to test practical aspects of unannounced inspections. Trials have also been carried out at large research reactors in Canada and South Africa. Use of unannounced inspections is expected to increase, particularly in connection with the application of remote monitoring and transmission of safeguards data.

[58] INIFCIRC/153/(Corrected), art. 18.

[59] INIFCIRC/153/(Corrected), art. 73, 83(b) and 87.

[60] David Fischer, 'Nuclear Safeguards: evolution and future', Verification Yearbook 2000, VERTIC, London (2000), at p. 45.

[61] Adapted from J. N. Cooley, 'Integrated Safeguards: genesis and evolution', Verification Yearbook 2003, VERTIC, London (2003), p. 32.

[62] Jill N. Cooley, 'Integrated Safeguards: genesis and evolution', Verification Yearbook 2003, VERTIC, London (2003), at p. 32.

[63] Trevor Findlay et al, WMD Verification and Compliance: The State of Play, Report No. 19, Weapons of Mass Destruction Commission, Stockholm (2004), at p. 10.

[64] This follows from art. III of the NPT.

[65] For the so-called voluntary offer safeguards agreement for NPT nuclear-weapon States, see INFCIRC/369 (China), INFCIRC/290 (France), INFCIRC/327 (Russian Federation), INFCIRC/263 (United Kingdom) and INFCIRC/288 (United States). All nuclear weapon states have signed an Additional Protocol to their CSA. The Russian Federation and the United States are yet to ratify.

[66] Guido Den Dekker, 'The Law of Arms Control: International Supervision and Enforcement', Martinus Nijhoff Publishers, The Hauge (2001), pp. 101.

[67] Mark H. Killinger, 'Improving IAEA safeguards through enhanced information analysis', The Nonproliferation Review, Volume 3, Number 1 (1995), at pp. 43. See also Annette Berriman, Russell Leslie and John Carlson, 'Information Analysis for IAEA Safeguards', paper presented at the INMM 2004 symposium, Orlando (2004).

[68] Tim McCarthy, 'Intelligence in arms control and disarmament', Verification Yearbook 2000, VERTIC, London (2000).

[69] Trevor Findlay, 'Multilateral verification in flux', Verification Yearbook 2003, VERTIC, London (2003).

[70] Annette Berriman, Russell Leslie and John Carlson, 'Information Analysis for IAEA Safeguards', paper presented at the INMM 2004 symposium, Orlando (2004). See also 'The Safeguards System of the International Atomic Energy Agency ("The Agency"), para. 41.

[71] NPT, art II. Other important safeguards agreements are bilateral agreements, where compliance is verified by the IAEA. For example a state may condition the supply of uranium on the recipients' acceptance of certain safeguards.

[72] NPT, art. III (1), compare with INFCIRC/153, art. 28.

[73] INFCIRC/153, art. 30.

[74] Complementary access is defined in the AP (sometimes loosely referred to as 'additional inspection authority'). Managed access techniques, where items are shielded from inspectors, have always been used but were formalised in the AP (INFCIRC/540)

[75] IAEA, 'The Safeguards System of the International Atomic Energy Agency ("the Agency"), http://www.iaea.org/OurWork/SV/Safeguards/safeg_system.pdf (as of 18 August 2005).

[76] INFCIRC/153, para. 21.

[77] IAEA Statue, art. VI (E).

[78] IAEA Statue, art. XVII and INFCIRC/153, para. 20-22.

[79] IAEA Statue, art. XII (C).

[80] The major privileges of IAEA membership are the rights to participate in technological exchange and receive IAEA assistance in the form of Agency projects.

[81] Trevor Findlay et al, WMD Verification and Compliance: the State of Play, Report No. 19, Weapons of Mass Destruction Commission, Stockholm (2004), at p. 10.

[82] ibid, p. 11.

[83] ibid, pp. 16.

[84] IAEA, 'Safeguards with regard to conclusion of Safeguards Agreements and Additional Protocols', http://www.iaea.org/OurWork/SV/Safeguards/sir_table.pdf (accessed 18 August 2005).

[85] This distinction will be phased out over the next decades.

[86] Verification in nuclear facilities in the Soviet successor states has been more intensive because these facilities have often stored large quantities of highly enriched, even weapons-grade, material.

[87] An unconditional safeguards budget allows the IAEA to fulfil its technical cooperation mandate more effectively, since voluntary contributions can be given on the condition that the IAEA take relevant measures. It is important to avoid situations where a contribution is given on the condition that the IAEA abstain from delivering technological support to certain projects or states.

[88] See Erwin Häckel, 'Implementing Safeguards in Weak and Failed States', in Häckel & Stein (eds), Tightening the Reins: towards a strengthened international nuclear safeguards regime, Springer-Verlag, Berlin (2000), at pp. 141

[89] Max Weber defines the state as a political organisation whose 'staff successfully upholds the claim to the monopoly on the legitimate use of physical force in the enforcement of its orders'.

[90] Trevor Findlay et al, WMD Verification and Compliance: the State of Play, Report No. 19, Weapons of Mass Destruction Commission, Stockholm (2004), at p. 16.

[91] Jack Boureston, Yana Feldman & Mary-Beth Nikitin, 'Difficulties in verifying small quantities: the tale of Saudi Arabia and the SQP', Trust & Verify No. 121, VERTIC, London (2005), at p. 5.

[92] VERTIC interview with IAEA official, August 2005.

[93] Hans Blix, 'Future directions of Nuclear Verification', IAEA Bulletin, Volume 39, No. 4 (1997).

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Administrative editor: Josephine Tucker (j.tucker@odi.org.uk)
Overseas Development Institute, 111 Westminster Bridge Road, London SE1 7JD Telephone: +44 (0)20 7922 0300 Fax: +44 (0)20 7922 0399 Email: forestry@odi.org.uk

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