

**IAEA Regional Seminar on the Protocol Additional
to Nuclear Safeguards Agreements
Lima, Peru
4 - 7 December 2001**

**SESSION 11: IMPLEMENTING THE ADDITIONAL PROTOCOL:
THE STATE PERSPECTIVE**

J. Carlson
Australian Safeguards and Non-Proliferation Office

Abstract

Australia is the first State in which integrated safeguards are being applied. As such, Australia's experience will be of interest to other States as they consult with the IAEA on the modalities for the introduction of integrated safeguards in their jurisdictions. In January 2001, the IAEA approved an integrated safeguards approach for Australia on a State-as-a-whole level. This approach relies *inter alia* on unannounced inspections and on complementary access to provide the necessary level of assurance as to the absence of undeclared activities. The purpose of the paper is to outline Australia's experience with strengthened safeguards and Australia's views on the implementation of integrated safeguards.

1. INTRODUCTION

Australia brings a special perspective to this subject:

- for many years we have given a high priority to the development and promotion of strengthened safeguards;
- we played a key role in the negotiation of the model Additional Protocol (INFCIRC/540), agreed by the IAEA's Board of Governors in 1997;
- we were the first both to sign and to ratify an Additional Protocol, also in 1997;
- consequently we experienced three years' application of strengthened safeguards measures, including the Agency's first exercises of complementary access, managed access under INFCIRC/540, and complementary access to a uranium mine;
- we are the first State in which integrated safeguards are being implemented (from January this year).

Although Australia has only a small nuclear program, we believe our strong political support for strengthened safeguards, reinforced by the high priority we gave to ratification of the Additional Protocol,

has been a positive example in encouraging other States to do likewise. The experience gained by the Agency in implementing new safeguards measures, and the assistance we have given in the development of these measures, has made an invaluable contribution to the Agency's capabilities for bringing strengthened and integrated safeguards into general application.

2. THE NEED FOR STRENGTHENED SAFEGUARDS

The classical safeguards system has a strong emphasis on nuclear materials accountancy, and is primarily concerned with verifying nuclear activities as declared by the State - what has been termed the *correctness* of States' declarations. The classical system has provided the international community with a high level of assurance that all the nuclear material *declared* to the IAEA remains in the civil nuclear fuel cycle. Following the 1991 Gulf War, however, it has been recognised that the classical system does not adequately address the possibility of *undeclared* nuclear activities - the issue of the *completeness* of States' declarations.

The experience with Iraq showed that if a proliferator is able to establish nuclear material upgrading capabilities - enrichment or reprocessing - clandestinely, it is more attractive for it to proceed with a wholly clandestine program than risk detection by diverting safeguarded nuclear material. Of course, access to safeguarded material and facilities will make the proliferator's task easier, so safeguards on declared nuclear material and activities must be maintained at an appropriate level. The point is, however, that we cannot assume declared and undeclared activities will necessarily intersect, so classical safeguards by themselves can no longer be considered adequate.

For safeguards to continue their key confidence-building role, it is essential to adequately address the issue of detection of undeclared nuclear activities. At the same time, there is pressure for safeguards to become more efficient, to enable the Agency to manage an expanding workload within budget constraints.

3. THE DEVELOPMENT OF STRENGTHENED SAFEGUARDS

From the outset of the program to develop strengthened safeguards, it was recognised that under a strengthened safeguards system the IAEA would need:

- greater rights of access, both at declared nuclear sites and to other places in the State;
- greater capabilities to acquire and analyse information; and
- deployment of new technologies, particularly environmental analysis (which had proven to be highly effective in unravelling Iraq's clandestine nuclear program).

Certain safeguards strengthening measures (termed "Part 1" measures) could be carried out under existing safeguards agreements, and the Board of Governors endorsed the implementation of these in 1995. These measures, which have now been in routine application for some time, include:

- environmental sampling at nuclear sites;
- the systematic evaluation of all the information available to the IAEA about States' nuclear and nuclear-related activities;
- greater use of *unannounced* inspections as part of the routine inspection regime; and

- use of advanced technologies, such as remote monitoring.

For certain other measures (termed “Part 2” measures), it was considered that additional legal authority was necessary, or at least desirable, and it was decided to establish a new legal instrument for this purpose. This culminated in the Board agreeing, in May 1997, to the text of the model Additional Protocol (INFCIRC/540), which serves as the model for each State to conclude an individual protocol complementary to its safeguards agreement with the Agency.

4. IMPLEMENTATION OF THE ADDITIONAL PROTOCOL – AUSTRALIA’S EXPERIENCE

As has been noted, the Additional Protocol has been in effect in Australia since the end of 1997. The provisions of the Additional Protocol will be covered in greater detail in other presentations at this Symposium. The following is an outline of major provisions and how they might affect individual States.

4.1. Additional information

The Protocol involves additional reporting, both initially in the Expanded Declaration (Article 2), and subsequently through regular updates required by Article 3. Principal aspects can be summarised as follows:

- detailed information on activities (past and present) at nuclear sites;
- capacity and annual production of uranium mines and uranium and thorium concentration plants;
- holdings, imports and exports of uranium and thorium which have not reached the composition and purity suitable for nuclear processing (except material which has been processed into non-nuclear end-use form);
- holdings and uses of nuclear material exempted from safeguards (again, not including material which has been processed into non-nuclear end-use form);
- nuclear fuel cycle-related R&D, not involving nuclear material, authorised etc. by the State - and every reasonable effort to provide information for such activities when not authorised by the State;
- manufacture or processing of specified nuclear items, nuclear-related materials (e.g. heavy water and graphite), flasks for irradiated fuel, hot cells; etc.;
- import and export of specified equipment and non-nuclear material.

While these items go beyond the scope of basic (INFCIRC/153-type) safeguards agreements - which are limited not only to *nuclear material*, but to nuclear material which has reached “the starting point of safeguards”¹ - clearly they are very relevant to establishing the possible existence of undeclared nuclear material. They are also very relevant to broader non-proliferation commitments, and would already be subject to regulation or supervision in many, if not most, States.

1. The “starting point of safeguards” relates to nuclear material which has reached a purity and composition suitable for fuel fabrication or enrichment. The term is misleading, since nuclear material before this stage is also relevant to safeguards - an aspect now rectified by the Additional Protocol.

In Australia's case, existing legislation - the Safeguards Act - had been drafted more widely than required solely to give effect to the basic safeguards agreement with the IAEA, and covered not just nuclear material but also nuclear-related materials, equipment and technology. This approach was taken to give the fullest effect to NPT commitments, as well as to reflect commitments under various bilateral agreements. The Safeguards Act therefore already provided for the regulation of materials such as graphite, heavy water and zirconium, and nuclear equipment and technology (including sensitive information), as well as uranium production. This was very helpful when it came to ratifying the Additional Protocol.

The process of preparing the Expanded Declaration was simpler for Australia than might be the case for some other States, as Australia had already spent a number of years clarifying and extending our knowledge of our nuclear history in preparation for the Additional Protocol. We had submitted a trial expanded declaration to the Agency before ratification of the Protocol, as part of our assistance to the Agency in developing Protocol procedures. Even so, this was not an entirely straightforward exercise, as Australia's nuclear site, ANSTO's Research Establishment at Lucas Heights (near Sydney), has been involved in a wide range of nuclear activities since the 1950s, and much of the early history has been lost. Australia and the Agency went through an iterative process of examining information and obtaining clarifications. This provided the Agency with useful experience of some of the practical difficulties involved in reconstructing the history of a nuclear site and early programs, which should be helpful for similar exercises in other States.

As already mentioned, in Australia most of the items to which the Additional Protocol applies were already covered by legislation - either the Safeguards Act or, in the case of imports and exports, the Customs Act. This is also expected to be the case for most other States, so that preparing initial and updated reports is unlikely to cause significant problems.

The only possible exception would appear to be nuclear-related R&D which does not involve nuclear material and which is not authorised, etc., by the State. Here, the State is required to make every reasonable effort to provide relevant information. The term "every reasonable effort" is not defined, but was intended by the drafters of INFCIRC/540 to recognise that there could be circumstances where the State might not know about relevant R&D carried out by the private sector or universities. On the other hand, the State is expected to make some effort, it cannot say that it did not know simply because it had no process for finding out.

The procedures followed in Australia to identify relevant R&D include:

- Australia's national safeguards authority, ASNO, has arrangements with the national Patents Office to report patent applications of interest;
- with the assistance of the national nuclear science organisation ANSTO, ASNO regularly scans academic journals and thesis topics;
- ASNO has regular discussions with private sector companies and laboratories.

Similar administrative arrangements and processes should be possible for other States.

4.2. Complementary Access

A vital measure introduced by the Additional Protocol is complementary access - that is, access by IAEA inspectors to places not covered by routine safeguards inspections. In broad summary, the Additional Protocol provides for complementary access:

- (a) to establish the absence of undeclared nuclear activities, at:
- nuclear sites;
 - certain locations where nuclear material is stored or processed (such as uranium mines and concentration plants, and holdings of uranium and thorium and exempted nuclear material);
- (b) to resolve a question relating to the correctness and completeness of information, or to resolve an inconsistency relating to that information, at:
- certain other nuclear-related locations (such as those involving R&D without nuclear material, production of nuclear-related materials and components, etc.);
 - other places in the State.

In case of a question or inconsistency (i.e. locations encompassed by (b) above), the Agency is to provide the State with the opportunity to resolve the matter before requesting access, unless delay would be prejudicial. The Protocol provides that if the State is unable to provide access it shall make every reasonable effort to satisfy IAEA requirements through other means.

There should be no difficulty for the State to provide access at nuclear sites, as these will be subject to regulation by the State. Likewise, it can be expected that nuclear-related locations, such as uranium mines and concentration plants, and R&D projects using nuclear material, should present no difficulty. Difficulties could arise however with respect to private sector production of nuclear-related materials and components, and nuclear-related R&D, not involving nuclear material, by the private sector or universities. Here, if necessary, States may have to introduce legislation to cover access (and provision of information) relating to such activities.

In Australia's case, the Government was not in a position to guarantee access at privately owned locations if nuclear or other regulated materials or technology were not involved. A key step in ratifying the Additional Protocol, therefore, was to amend the Safeguards Act, to ensure the IAEA could be given access for Protocol purposes at *any* location in Australia.

Advance notice The Additional Protocol requires that advance notice of at least 24 hours be given for complementary access. There is only one exception - where access on a nuclear site is sought in conjunction with a safeguards inspection, notice can be reduced to two hours, or less in exceptional circumstances.

Managed access This is not a new concept - managed access is allowed for in INFCIRC/153, though not referred to by that term. The Additional Protocol specifically provides for the right of the State to establish managed access arrangements to protect proliferation sensitive information, to meet safety or physical protection requirements, or to protect commercial confidentiality.

4.3. Australia's experience with complementary access

In the three and a half years that the Additional Protocol has been implemented in Australia, the Agency has exercised complementary access on 12 occasions - ten times at our nuclear site, Lucas Heights, and twice elsewhere in Australia. One of the complementary accesses at Lucas Heights was on a managed access basis. All but two of the complementary accesses were requested during a routine safeguards inspection. For eight of the complementary accesses at Lucas Heights, inspectors gave two hours notice, and were

given access within this period. For the managed access, and a complementary access which was not conducted in conjunction with an inspection, the Agency had foreshadowed its request well in advance to allow sufficient time for appropriate arrangements to be established.

One of the cases of complementary access away from Lucas Heights involved a location in South Australia, some 1100 km from Lucas Heights. Notice was given during a routine inspection at Lucas Heights, for access 24 hours later. The other complementary access was to the Ranger uranium mine in the Northern Territory, a remote location difficult to reach, particularly by public transport. Notice was given during a routine inspection at Lucas Heights, for access five days later. Even with five days notice there were some practical difficulties in arranging transport.

The managed access involved components remaining from Australia's former centrifuge enrichment program, which had been decommissioned in the 1980s. The access arrangements were negotiated on an *ad hoc* basis. Clearly it is preferable to establish such arrangements well in advance, and the Protocol encourages this. Accordingly, Australia and the Agency have agreed on the managed access arrangements to apply to the private sector laser enrichment R&D project at Lucas Heights.

4.4. Participation of national inspectors

This is a matter of importance to a number of States, and is relevant both to safeguards inspections (including unannounced inspections, discussed below) and complementary access. Both safeguards agreements and the Additional Protocol recognise the right of the State to have representatives accompany Agency inspectors, provided the inspectors are not thereby delayed or impeded.

Under Australian law (the Safeguards Act), IAEA inspectors have no authority to enter property unless they have the permission of the occupier or they are accompanied by a national (ASNO) inspector. A national inspector can, if necessary, obtain a warrant from a magistrate to enter property, and can call on police assistance. Although difficulties are unlikely to arise, it is Australian policy that Agency inspectors should be accompanied by national inspectors, to ensure full cooperation is extended to the IAEA, and to ensure that the Government is immediately aware if there are any difficulties.

Given Australia's large, relatively uninhabited land mass, access to remote sites will present some logistical challenges, for example transport arrangements might take several days to resolve. However, ASNO expects that requests for complementary access to distant parts of Australia would be infrequent.

4.5. Unannounced inspections

These are not unique to either strengthened or integrated safeguards - INFCIRC/153 provides for a proportion of routine inspections to be unannounced. However, the value of unannounced inspections - i.e. inspections whose timing is *unpredictable* to the State or the facility operator - has been particularly recognised in the context of strengthened and integrated safeguards.

It should be appreciated that unannounced inspections do not necessarily - or usually - mean *immediate* access. A distinction is made between the initiation of the inspection - arrival of inspectors at the facility - and the time in which the inspectors require access to the area to be inspected.

In determining the required access time, the IAEA needs to take account of practical matters - availability of operators' personnel essential to the conduct of the inspection, any requirement for national inspectors to be present (as discussed above), and so on. There should be a careful balance between the objectives of the inspection and these practical considerations. If the scenario the inspection is intended to

address would remain detectable over a period - e.g. modifications to plant that would take days to reverse, environmental traces that could be detected weeks or even months after the event - this can be factored into the required access period. Indeed, in many situations it may be possible to provide some advance notice of the inspection. To the extent consistent with the requirement for detection capability, in ASNO's view the principal aim should be *unpredictability* rather than surprise in an *immediate* sense.

In Australia's case, the Agency has agreed to provide 3 hours notice of required access pursuant to an unannounced inspection. Notice would normally be given at 7.00 am for an inspection to commence at 10.00 am that day. This is consistent with the travelling time required for national inspectors to reach Australia's nuclear site, Lucas Heights, from ASNO's office in Canberra (a distance of 275 km), and reflects the Agency's judgment that any undeclared activity at Lucas Heights could not be concealed within that time. If for any reason national inspectors are delayed in reaching the site, the inspection can commence in any event after 3 hours.

It should be noted that unannounced inspections place new requirements on facility operators and national safeguards authorities. Apart from the need for the national authority to be on standby for an inspection, for unannounced inspections to work efficiently the operator's accountancy records must be maintained on a real-time or near-real-time basis (NRTA - "near-real-time accountancy"). The national authority will need to ensure that accurate NRTA records are maintained.

4.6. Verification measures for uranium mines Under classical safeguards uranium production was considered to be "before the starting point of safeguards". Verifying production at a uranium mine on any rigorous basis would require continuous inspector presence. Since any diverted ore or source material would have to pass through many downstream processes, each of which offers some opportunity for detection, before attaining a form suitable for nuclear explosive use, it was not considered cost-effective to extend safeguards to uranium mines.

During the development of strengthened safeguards, it was considered that the possibility of verification of uranium production was worthwhile as a complement to conventional safeguards, and INFCIRC/540 provides for broad reporting requirements and complementary access at mines. Although accountancy-type measures are not practicable, appropriate verification measures could identify questions or inconsistencies indicating the need for wider investigation in the State concerned. At one extreme is the discovery of totally undeclared production, i.e. an undeclared mine, or a mine incorrectly declared to be closed down. Perhaps a more plausible scenario is the under-stating of production. Australia is assisting the Agency in developing verification approaches and techniques that could identify such a situation, including use of satellite imagery and environmental sampling to date production - the results of this Australian Safeguards Support Program task are discussed in a separate poster presentation (paper IAEA-SM-367/A/6/01/P) at this Symposium.

5. INTEGRATED SAFEGUARDS

Integrated safeguards do not represent a new system of safeguards. The verification activities relevant to integrated safeguards - information analysis, complementary access, unannounced inspections, environmental sampling - have been outlined above, in the discussion of strengthened safeguards.

Rather, integrated safeguards are a rationalisation of classical and strengthened safeguards measures - the optimum combination of all safeguards measures available to the IAEA under comprehensive safeguards agreements and Additional Protocols which achieves the maximum effectiveness and efficiency within available resources. Thus integrated safeguards are to do with efficiency - the efficiencies possible under integrated safeguards are essential to fulfilling the IAEA's commitment that to the extent possible the

strengthening of safeguards will be budget neutral over time.

Under classical safeguards, the level of verification effort takes into account the possibility that undeclared nuclear activities may exist undetected. For example, the timeliness goal for detection of diversion of spent fuel incorporates the assumption that an undeclared reprocessing plant may exist ready to use in processing diverted material immediately after diversion. The basis of integrated safeguards is that classical and strengthened safeguards are self-reinforcing and to some extent redundant – as strengthened safeguards establish credible assurance of the absence of undeclared nuclear activities, particularly enrichment and reprocessing, a corresponding reduction should be possible in the intensity of classical safeguards effort. Thus, if there is credible assurance that a State has no undeclared reprocessing plant, the time required for conversion of diverted spent fuel will be extended by the very considerable time required to establish such a facility, and this can be reflected in a reduced inspection frequency for spent fuel, from three months to, say, 12 months.

The IAEA has determined that the introduction of integrated safeguards can be considered if there are positive results from the implementation of both classical and strengthened safeguards activities. For each State, therefore, progress to integrated safeguards is a *two-stage process*, the first stage of which is to meet the requirements of strengthened safeguards.

In Australia's case, the series of complementary accesses, combined with the results of environmental sampling and information analysis, assisted the IAEA in concluding there is no indication of undeclared nuclear material or activities in Australia and that the expanded declaration was correct and – most importantly – complete. Australia's cooperation with the Agency in the implementation of strengthened safeguards was also a key factor. Once the IAEA had arrived at a credible level of assurance that there are no undeclared nuclear activities in Australia, it became possible to proceed with the introduction of integrated safeguards.

5.1. Whole-of-State approach

The evaluation of the State as a whole has a central place in developing integrated safeguards approaches. The classical safeguards system has been characterised by a uniform approach to safeguards implementation, exacerbated by the facility-by-facility approach. This has had unfortunate consequences for inspection resources, with effort being expended in a mechanistic way based on the category and amount of nuclear material in each facility rather than on any more broadly based evaluation of the proliferation risk arising from the use/misuse of the material/facility in context. Although INFCIRC/153 provides for flexibility, taking account of factors such as the characteristics of the State's nuclear fuel cycle, its international interdependence, and the effectiveness of the national safeguards system, in practice opportunities for flexibility have not been used to advantage.

Integrated safeguards however provide the opportunity for greater cost-efficiency, to take account of State-specific circumstances. Rather than treat each facility type identically regardless of the State in which it is located, the facility can be considered in its broader context. For example, the proliferation potential of an inventory of high enriched uranium (HEU) at a research reactor will depend on factors such as: whether that is the only HEU in the State concerned; whether further processing (reprocessing and enrichment) would be required to upgrade the HEU for weapons use; if so, whether the State is known to have the necessary processing capability; and so on. It is likely no two States will have identical circumstances, and therefore the implementation of safeguards will vary from one State to another. This will have to be done, however, in a transparent way, using objective criteria, to avoid any suggestion of discrimination. The methodologies for this are being developed by the IAEA with the assistance of Member States. This subject is discussed further in another paper presented at this Symposium, IAEA-SM-367/12/02, "Integrated Safeguards: How Much Flexibility is Possible, and Acceptable?"

6. THE INTEGRATED SAFEGUARDS REGIME FOR AUSTRALIA

Under classical safeguards, the IAEA's inspection activity was determined primarily by Australia's holdings of research reactor fuel. Australia has large holdings of irradiated HEU fuel - though these are being steadily reduced through transfers to the US and France. The classical safeguards criteria require this irradiated fuel to be inspected four times a year.

Australia has five Material Balance Areas (MBAs) - four at Lucas Heights, the principal one covering the 10 MWt research reactor and the associated inventory of fresh and irradiated HEU fuel, the fifth MBA covering the rest of Australia. Generally Australia was subject to annual Physical Inventory Verifications (PIVs) for the four MBAs at Lucas Heights, plus quarterly interim inspections, making a total of four inspections a year (PIVs for the different MBAs were conducted concurrently with each other or with interim inspections in other MBAs) - although there was a period when the fresh fuel inventory exceeded 1 SQ (Significant Quantity), requiring monthly inspections.

Following the introduction of strengthened safeguards, this pattern of four inspections a year was maintained, with the addition of complementary accesses, which in most cases have been undertaken at the Lucas Heights site.

Under the integrated safeguards regime now being applied, the timeliness period for irradiated fuel has been changed from three months to 12 months, eliminating quarterly interim inspections. The four inspections each year have been replaced by one PIV (including comprehensive Design Information Verification activities), and an *average* of one unannounced inspection. The objectives of the unannounced inspection include, to verify the fresh and spent fuel inventory and if possible the core fuel, and to confirm facility design information, the declared operation of the reactor, and the absence of undeclared activities. The term "average" is important - to maintain deterrence, once the unannounced inspection has taken place, there should always be the possibility of a further unannounced inspection in the same year. Where possible, fuel transfers will be verified during the PIV or unannounced inspection(s), but the Agency has indicated that if necessary additional inspections may be undertaken for this purpose.

In addition to the inspections outlined above, there will be five or six complementary accesses each year, mainly at the Lucas Heights site, but also encompassing uranium mines and LOFs (locations other than facilities). In most circumstances it is expected that complementary accesses would be carried out when inspectors are in Australia for routine inspections.

In future the inventory of unirradiated HEU is not expected to exceed 1 SQ. If this does occur, the Agency has foreshadowed a return to monthly inspections, or the use of remote monitoring in conjunction with additional unannounced inspections. This is a case where the State-as-a-whole approach is important - a substantial, criteria-driven, increase in safeguards effort might not be warranted if (as in Australia's case) this was the only HEU inventory in the State and the excess over 1 SQ was small. The retention of rigid procedural criteria will limit the benefits of integrated safeguards, and should be replaced by flexibility guided by expert judgment.

In Australia the overall savings in inspection effort are expected to be about 45% (a reduction from 18 to 10 PDI - Person Days of Inspection) a year. In addition are significant savings in travel time and cost. However, savings depend on whether additional inspections are required to verify fuel transfers - this is an area where ASNO considers remote monitoring could be very useful, and is discussing this with the Agency.

7. CONCLUSIONS

The development of strengthened safeguards measures - and even more so the development of integrated safeguards - is very much a work in progress - inevitably the approaches developed will require refinement in the light of practical experience.

Major issues being addressed include, how to ensure the verification activities undertaken by the IAEA are sufficient to support a credible conclusion of the absence of undeclared nuclear activities. This involves both establishing the appropriate methodology and ensuring the methodology is implemented at an appropriate quality standard. An important group of issues concerns how to implement integrated safeguards in a flexible manner, based on State-specific factors, incorporating the expert judgment of the Agency, in a way that avoids discrimination, and delivers the required credibility.

The difficulties encountered in Iraq in the 1990s, where there was a very intrusive verification regime following the Gulf War, show that detection of undeclared nuclear activities is not an easy task. On the other hand, compared with individual States, the IAEA has considerable advantages to build on in pursuing this task. In addition to its expertise, the Agency will have comprehensive information bases, extensive access rights (the ability to “get under the roof”), and increasingly sophisticated verification methods.

Clearly the effective implementation of integrated safeguards presents a series of challenging tasks both for States and the Agency. The importance of doing this successfully cannot be overstated: the general application of strengthened safeguards measures is essential to providing the international community with assurance that NPT commitments are being met – and integrated safeguards are essential to achieving this in a cost-efficient manner. Australia will continue to be a strong supporter of the Agency in the evolution of the safeguards system - it is very much in the interest of all States to participate constructively in this effort.