

INTEGRATED SAFEGUARDS - PROGRESS AND ISSUES

John Carlson

Paper presented at INMM 2004 symposium Orlando FL, USA – July 2004

Australian Safeguards and Non-Proliferation Office,
RG Casey Bldg, John McEwen Crescent, Barton, ACT 0221, Australia

Abstract

As the program to strengthen safeguards gathers pace, the concept of integrated safeguards is assuming increasing importance. With the Additional Protocol (AP) entering into widespread application, strengthened safeguards—the combination of a comprehensive safeguards agreement and the AP—are becoming firmly established as the Nuclear Non-Proliferation Treaty (NPT) safeguards norm. Integrated safeguards takes this process further. Rather than being determined mechanistically, by number of facilities and quantities of material, safeguards effort can be rationalised so as to focus on areas of greatest proliferation significance.

At the time of writing (early April 2004), Additional Protocols have already been ratified or signed by three-quarters of states with comprehensive safeguards agreements that have significant nuclear activities. When the EU members ratify their APs—expected shortly—over 70% of all nuclear facilities under comprehensive safeguards will be in states with APs in force. Most AP states can be expected to qualify for integrated safeguards (IS)—IS should be in widespread application within the next 2-3 years.

To date most of the development of IS has been in the conceptual framework, and in facility-level approaches that take advantage of redundancies between “traditional” and strengthened safeguards to reduce routine safeguards effort. The outcome is a substantial improvement in cost-effectiveness, but currently it still resembles the “one-size-fits-all” approach of traditional safeguards. The next major phase is the development of genuinely state-level safeguards approaches, based on the characteristics of each state.

This paper discusses some of the major issues involved, including:

- developing an appropriate methodology for tailoring safeguards effort to individual states;
- whether the current “threshold” assumption, that states of proliferation concern are unlikely to qualify for IS, is soundly-based—and what to do if this is not the case;
- ensuring that IS are sufficiently robust to deal effectively with changing circumstances;
- implications for the International Atomic Energy Agency (IAEA).

1. INTRODUCTION

Integrated safeguards (IS) comprise the optimum combination of safeguards measures available under both the standard NPT safeguards agreement—INFCIRC/153—and the Additional Protocol (AP) which achieves maximum effectiveness and efficiency within available resources. For a state to qualify for IS requires that an AP is in force and that the IAEA has been able to reach an initial conclusion on the

absence of undeclared nuclear activities. Thus, progress to IS requires in the first instance conclusion of an AP.

Viewed in terms of total NPT membership, the rate of uptake of APs remains disappointing—to date, less than half the Parties to the NPT have ratified or signed an AP. This delay in accepting the AP has adverse consequences for strengthening the safeguards system—e.g. in terms of access to confirm absence of significant nuclear activities, or availability of import/export information—and every effort must be made to improve the situation. Nonetheless, in terms of safeguards implementation in states known to have significant nuclear activities¹, the situation is more positive—APs have now been ratified or signed by three-quarters of such states. Most of these can be expected to qualify for IS.

Already over 90% of all nuclear facilities subject to comprehensive safeguards are in states that have at least signed an AP. When the EU members ratify their APs—expected shortly, perhaps before this paper is published—over 70% of nuclear facilities under comprehensive safeguards will be in states with APs in force. IS should be in widespread application within the next 2-3 years.

2. CHALLENGES IN THE DEVELOPMENT OF INTEGRATED SAFEGUARDS

The development of IS faces two major challenges:

1. How to adjust safeguards intensity for state circumstances, to ensure the realisation of efficiency gains—through reducing routine inspection effort—without compromising effectiveness—the validity of the assurance delivered by the safeguards system.
2. Closely related to the first point is—how to effectively address the issue of undeclared nuclear activities. This issue—of critical importance to the credibility of the safeguards system—has been highlighted by the illicit spread of centrifuge enrichment technology.

While detection of undeclared activities might seem primarily an issue for states outside IS—states that do not conclude an AP or do not qualify for IS—such a perception would be incorrect. As will be discussed, IS must be developed with sufficient robustness to deal with the possibilities of: (a) a state qualifying for IS that has undeclared activities that at that time have escaped detection; or (b) a change in a state’s commitment to non-proliferation some time after qualifying. Safeguards are built on the maxim “trust but verify”—under IS trust increases, but effective verification is still necessary—it is a question of finding the right balance.

3. TAILORING SAFEGUARDS EFFORT TO STATE-SPECIFIC CIRCUMSTANCES

A feature of the traditional safeguards system is uniformity—inspection activities at similar facilities in different states are similar, with limited differentiation between states. This has resulted in substantial safeguards effort being concentrated in a few states, driven primarily by quantities of nuclear material and numbers of facilities. IS are intended to redress this situation. A key principle of IS is that safeguards implementation is to be based on a specific state level approach—an approach developed to reflect factors pertinent to the state concerned.

Safeguards implementation under IS, generally speaking, is less rigorous than under traditional safeguards—some timeliness goals are extended, in some cases lower detection probabilities apply, and—

most importantly—not all facilities are inspected: IS provides for some inspections to be performed on a sample of facilities (e.g. interim inspections are to be performed at only 20% of light water reactors). Beyond these savings, however, it is also intended that the safeguards effort in the state will not simply be an aggregation of the standard facility approaches, and that adjustments will be made for state-specific factors.

How will a state level approach be determined? Provision to take account of state-specific factors is already made in INFCIRC/153, paragraph 81—albeit currently applied only to a limited extent—fuel cycle characteristics, international interdependence, verification of flows, effectiveness of the SSAC (state safeguards system), etc. These are developed further in the IS Conceptual Framework, which refers to:

1. The nature and scope of the state's nuclear fuel cycle and related activities including:
 - a. the structure of the nuclear fuel cycle, from uranium mines to nuclear waste;
 - b. the number and types of nuclear facilities and LOFs (locations outside facilities) and associated activities conducted on nuclear sites;
 - c. the safeguards relevant characteristics of the facilities and LOFs;
 - d. the inventory and flow of nuclear material within and between facilities;
 - e. fuel cycle-related research and development;
 - f. the manufacture and export of sensitive nuclear-related equipment and materials; and
 - g. the correlation of all the above information.
2. The possibility for use of advanced safeguards technology in the state;
3. The possibility for effective use of unannounced inspections in the state; and
4. Increasing co-operation between the IAEA and the state/regional safeguards system.

It remains to be seen how the state level approach will work in practice—IS have not yet been applied in states with large fuel cycles. For some time development and refinement of state level approaches is expected to be an iterative process.

A potential problem in the current IS scheme may be lack of sufficient flexibility—e.g. instead of the fixed value currently provided for selection of facilities for inspection (e.g. in certain cases 20%), it would be preferable to apply a range (say 10% - 30%), and to make it clear this range is only indicative. Further, in many cases there appears to be no flexibility—e.g. a PIV (physical inventory verification) is to be performed at every LWR in a refuelling year.

Allowing for greater flexibility is one thing—establishing an appropriate basis for applying flexibility is another. Factors of the kind outlined above—“technical” factors related very directly to the fuel cycle—may be too narrow to allow significant differentiation between states. Without broadening the factors that can be taken into account, there is the risk that ultimately IS will suffer from the same problem as traditional safeguards, that the drivers of safeguards effort will still largely be quantities of nuclear material/numbers of facilities.

Governments evaluate each other on a very broad range of information, including: the way a state conducts its foreign relations; its military capability and posture; its alliances; its strategic interests and

circumstances (e.g. whether located in a region of tension); its observance of treaty commitments; its past practice in these areas; its public pronouncements; and so on. Many of these considerations are regarded as political—yet many of them give rise to objective indicators (e.g. military procurement), and are capable of objective analysis.

Is it possible to develop an objective, sufficiently rigorous—and politically acceptable—process for considering some of these factors in decisions on safeguards intensity? The idea of doing so should not be dismissed out of hand—some broadening of the information used in safeguards will be necessary if safeguards are to meet the major objectives of greater efficiency and greater effectiveness.

4. QUALIFYING FOR INTEGRATED SAFEGUARDS

Under the IS concept, either a state qualifies for IS—in which case the optimisation of safeguards measures applies—or it does not—in which case INFCIRC/153 measures and AP measures apply cumulatively.

For a state to qualify for IS, the IAEA must have reached satisfactory conclusions under both traditional safeguards—that there has been no diversion—and the AP—that there are no indications of undeclared nuclear activities or material. In the case of a state about which there are proliferation concerns, it is assumed there will be significant questions and inconsistencies that cannot be satisfactorily resolved—so the state will not qualify for IS.

Is this a valid assumption—will there always be significant unresolved questions and inconsistencies? This very much depends on the capacity of the information review and evaluation process to identify questions capable of being tested by the Agency (e.g. through complementary access to specific locations)—mere suspicion will not suffice.

Safeguards planning must take into account the possibility that at the time a state is being evaluated for IS no specific unresolved questions will be identified. There could well be political pressure to qualify a state for IS even where there are concerns about the prudence of doing so. This leads to the topic discussed in the next section, how to ensure IS are sufficiently robust to deal with a situation of this kind.

It is to be hoped states that do not qualify for IS will be a small minority. It is likely a state level approach will be needed, not only for states under IS, but also for states that fail to qualify. Rather than a simple accumulation of AP measures and INFCIRC/153 measures at routine intensity, safeguards intensity may need to be increased for particular segments of the relevant acquisition paths—but might be reduced in less relevant segments. Paragraph 81 of INFCIRC/153 can be applied in either direction—not only to reduce, but also to increase safeguards intensity. Thus, safeguards implementation outside the IS framework will also involve development of an “optimum combination” of measures—a combination specifically designed to address the concerns relating to the particular state.

5. ENSURING INTEGRATED SAFEGUARDS ARE EFFECTIVE

“Absence of evidence is not evidence of absence”—states may qualify for IS simply because indicators of undeclared activities have not come to light. Even for states that currently are exemplary members of the non-proliferation regime, it must be recognised that over time political commitment can change. Thus, it is essential for IS to be sufficiently robust to provide the assurance needed by the international community.

This requires action at a number of levels:

- The state level approach—tailoring an approach to the circumstances of the particular state. As discussed earlier, it is essential that IS move away from the uniformity of traditional safeguards, and that safeguards intensity is based on expert judgment taking proper account of all relevant circumstances. This will mean significant differentiation between states—and the possibility of significant adjustment from time to time for a particular state—i.e. the safeguards approach for each state should be subject to regular review and adjustment as questions arise (or as assurance increases).
- Ongoing development of safeguards procedures—particularly greater use of unpredictability in inspection timing and selection of facilities for inspection (e.g. through unannounced inspections). As a further development of unpredictability, the concept of infrequent intensive verification may be of particular value. As an efficiency measure, this concept would involve trading-off additional reductions in routine inspection effort against acceptance of occasional unpredictable intensive inspections. As an effectiveness measure, the concept could be used to re-validate the reductions in routine inspections introduced under IS.
- Development of new detection methods for undeclared activities—particularly identification and detection of indicators for centrifuge enrichment activities. This is an area where close collaboration between states having relevant technical expertise and the IAEA is especially important.
- Building on information collection and analysis skills—and broadening the range of information taken into account in judgments on appropriate safeguards intensity—discussed above. Also important is information-sharing—a greater preparedness of states to make information available to the IAEA (e.g. intelligence information, and information on dual-use exports).

6. IMPLICATIONS FOR THE IAEA

Safeguards implementation under IS will be very different to traditional safeguards. The latter placed emphasis on uniformity, a set routine for inspectors, and a quantitative system for evaluation. Under IS, in addition to adaptability in developing state level approaches, the broadening of available verification measures will require greater adaptability at the implementation level—more options will be available to inspectors, there will be less emphasis on routine inspection activities, and much more emphasis on observation skills. Verification activities directed at the possibility of undeclared activities will involve new ways of thinking.

Major change will also be involved in safeguards evaluation—quantitative methods are not possible where qualitative judgments are being made. Evaluation will need to develop along quality management lines—was the state level approach appropriate to meet the safeguards objectives; was the approach implemented as planned; if not, were appropriate alternatives taken, and what are the implications for the safeguards conclusions?

A particular challenge will be caused by the need to differentiate between states—this has to be done in a way that is accepted as being objective and non-discriminatory.

7. CONCLUSIONS

After years of careful preparation for IS—development of the conceptual framework and facility-level approaches, building up the necessary capabilities in information collection and analysis, inspectors' observational skills, etc.—the IAEA is now on the threshold of the wide-spread introduction of IS. This is a very positive development—the great majority of safeguarded nuclear material and facilities can be expected to be under IS within the next 2-3 years.

The extra workload during the evaluation/qualification phase, however, will place considerable stress on the Agency. States must be prepared to assist where they can, and to show patience and understanding during what will be a demanding period for Agency inspectors and management. In the general euphoria of progressing IS, it must not be overlooked that effectiveness—capability for timely detection—remains the primary objective for safeguards—and it cannot be assumed that simply because states qualify for IS the Agency's capability for detection of undeclared activities—and for that matter diversion—becomes less important.

This is an exciting and challenging period for safeguards practitioners—one that will define the safeguards system and the state of the non-proliferation regime for years to come.

-
1. The IAEA definition of a State with “significant nuclear activities” is a State having any amount of nuclear material in a facility or location outside facilities (LOF) or nuclear material in excess of the exemption limits in INFCIRC/153 paragraph 37.