

BACK TO BASICS – RE-THINKING SAFEGUARDS PRINCIPLES

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Abstract

The technical objective of comprehensive safeguards—timely detection of diversion, and deterrence by the risk of early detection—is well established. The safeguards approaches for meeting this objective, however, have evolved substantially since INFCIRC/153 was introduced. The greatest area of change is the development of strengthened safeguards to counter possible undeclared nuclear activities. This is very much an ongoing effort: and the effectiveness and efficiency benefits of strengthened and integrated safeguards will not be fully realised until the Additional Protocol is adopted by every comprehensive safeguards state.

Two principles are fundamental to the broad political consensus underlying safeguards—effectiveness and non-discrimination. Traditionally both these principles have been pursued through uniformity in safeguards implementation. Uniformity however has resulted in major inefficiencies. Some states maintain they are subject to excessive safeguards attention, to the detriment of effort in areas of greater proliferation concern; and that integrated safeguards concepts currently under development remain too formulistic.

The argument against uniformity has also arisen in a different way—looking at particular problems, some national experts have favoured moving away from generic safeguards approaches to situation-specific solutions.

A vital aspect of strengthened safeguards is broadening the range of information taken into account in safeguards. Greater use of information and other qualitative factors not only increases safeguards effectiveness, but also opens the way to incorporating expert judgment in safeguards decisions. This presents the opportunity to base safeguards effort on state-specific factors—differentiation is not discriminatory if based on transparent, well-documented, objective methodology.

These developments raise a number of fundamental issues, including: what is the minimum level of safeguards intensity required to maintain credible conclusions; how to match safeguards effort to proliferation risk; and how to maintain generic safeguards approaches that permit appropriate flexibility? The key to optimising effectiveness and efficiency is to avoid rigid models and precepts, making greater use of judgment in implementing safeguards and drawing conclusions.

1. INTRODUCTION

The present nuclear safeguards system was originally designed over three decades ago, in an environment substantially different from today's. The Nuclear Non-Proliferation Treaty (NPT) was opened for signature in 1968, and the associated model comprehensive safeguards agreement (INFCIRC/153) was finalised in 1971. At that time the number of states with significant nuclear facilities was smaller than today, and the technological hurdles in developing clandestine nuclear weapons programs were significantly greater.

Since then, scientific and technological changes have increased the availability of nuclear technology and knowledge to those wishing to use these for peaceful or non-peaceful purposes. Techniques to produce fissile material have become more refined and widespread. Nuclear knowledge is now more available, some of it readily accessible on the internet.

The quantity of nuclear material is also increasing. New material is constantly becoming subject to safeguards, but very little material ever leaves safeguards.

The system of safeguards has endeavoured to keep pace with these changes. The most recent change is the introduction of strengthened safeguards measures to assist the IAEA in determining that NPT non-nuclear-weapon states (NNWS) do not possess undeclared nuclear material or activities. This has culminated with the establishment of the Additional Protocol (AP) to give the IAEA, *inter alia*, greater access and information, and the introduction of Integrated Safeguards in states where the Agency has found no indication of undeclared nuclear activities or material.

The AP is now becoming established as the minimum level of commitment required by states that wish to be transparent about their nuclear programs. It is also likely that in the not-too-distant future most nuclear supplier states will set an AP as a pre-requisite for supply of nuclear technology, materials and dual-use goods.

The greater availability of nuclear technology, the increasing quantity of nuclear material requiring safeguards, and heightened proliferation concerns all point to an ongoing need to re-examine how to achieve safeguards objectives in the most effective way. This includes an evaluation of what we want safeguards to deliver now and in the future, and how this can be best achieved with the most effective use of skilled but limited resources.

2. “CLASSICAL” SAFEGUARDS SYSTEM

The classical safeguards system has a number of characteristics, some inherent and some that have developed over years of practice. The principal characteristic is that the criteria for safeguards at each facility are uniform for each facility-type, regardless of the state in which the facility is located and any state-specific factors. The underlying reasons for uniformity appear to be: to ensure standardization of performance; to facilitate performance evaluation; and to avoid charges of discrimination.

The approach of uniformity has meant full advantage has not been taken of the provisions in INFCIRC/153 which allow for flexibility in safeguards implementation. Paragraph 81 of INFCIRC/153 provides for a number of criteria to be taken into account in determining the number, intensity, duration, timing and mode of routine inspections, including:

- (a) the form of nuclear material—bulk or items; chemical composition and enrichment; and accessibility;
- (b) the effectiveness of the state’s accounting and control system (SSAC);
- (c) characteristics of the state’s nuclear fuel cycle;
- (d) international interdependence; and
- (e) technical developments in the field of safeguards, including the use of statistical techniques and random sampling.

Interestingly, the drafting of paragraph 81 indicates these criteria are mandatory, not merely discretionary. In practice, while some of these have been taken into account to some extent, others—particularly (b), (c) and (d)—have been neglected. Now, with the development of integrated safeguards, greater attention is being given to the application of considerations of this kind—but the potential to do so has always been available under INFCIRC/153.

Uniformity has major disadvantages:

- excessive safeguards effort is expended in states generally accepted as presenting low proliferation risk—not all that long ago 70% of inspection effort was allocated in Canada, Germany and Japan, and it is understood these three states still account for some 40% of effort;
- it is difficult to increase safeguards intensity in states where there may be proliferation concerns. In some cases the IAEA has been able to gain the state’s acceptance of additional safeguards activities, but the basis for this is fragile—states are always free to withdraw voluntary cooperation.

The problem is that a lowest common denominator will always be too high for some states but too low for others. A better way to proceed—and budgetary pressures as well as concerns about effectiveness are driving this—is to establish criteria against which safeguards intensity can be adjusted upwards or downwards to match the characteristics of the state concerned. Apart from other advantages, the existence of transparent, objective criteria will remove arguments about differential treatment.

3. ADDITIONAL PROTOCOL AND INTEGRATED SAFEGUARDS

When a state concludes an AP, initially safeguards activities proceed in an “additive” manner, i.e. the IAEA carries out the routine inspections pursuant to INFCIRC/153 as well as the new measures—such as complementary access—pursuant to the AP. Recognising however that this will result in a substantial degree of redundancy—certain acquisition paths will be covered by both INFCIRC/153 and AP safeguards measures—the concept of integrated safeguards has been developed. Integrated safeguards are described as the optimum combination of safeguards measures available under both comprehensive safeguards agreements (INFCIRC/153) and APs which achieves maximum effectiveness and efficiency within available resources. Progress to integrated safeguards is possible when the IAEA has reached an initial conclusion on the absence of undeclared nuclear material and activities in the state concerned.

The concept of integrated safeguards establishes a basis for introducing flexibility into the application of safeguards:

- at the facility level, a reduced level of routine safeguards inspection is specified—at this stage, for LWRs (light water reactors), RRCAs (research reactors and critical assemblies), and DNLEU (depleted, natural and low enriched uranium) fuel fabrication plants. The facility-level IS (integrated safeguards) approaches also provide for different options for meeting safeguards objectives, e.g. where unannounced inspections are not practicable short-notice inspections can be used in combination with surveillance;
- routine safeguards inspections are supplemented by complementary access (CA). CA is of two types—that undertaken on a selective basis to assure the absence of undeclared nuclear material and activities at specified locations, and that undertaken in order to resolve *questions and inconsistencies* arising from the IAEA’s information review and evaluation. Potentially CA, used in combination with routine inspection effort, provides a substantial degree of flexibility in safeguards intensity, although the modalities for this require further development;
- also central to integrated safeguards is the application of state-level IS approaches—here too considerable further development is required.

Integrated safeguards—avoiding rigidity

There are two potentially troublesome aspects of the current IS concept:

- it is an “all or nothing” model: either a state qualifies for IS—in which case the optimisation of safeguards measures applies—or it does not—in which case all INFCIRC/153 measures and all AP measures apply cumulatively;
- it also looks very much like a “one size fits all” model—how adjustments will be made for state-specific characteristics is not yet clear. This is discussed further below.

The current IS concept represents a pragmatic approach at this early stage, when the IS concept is being elaborated and is in limited application—right now there are only two states where IS are being applied, Australia and Norway. However if, as hoped, in due course every comprehensive safeguards state concludes an AP, such a simplistic approach will need to be reconsidered:

- first, there will be political pressure from those states that *never* qualify for IS. For that matter, the basis for denying IS qualification for a state of concern might not be sustainable in every case. The IS concept assumes that in such cases there will always be significant questions and inconsistencies that can be used for denying IS. But whether there are significant questions and inconsistencies depends on the capacity of information review and evaluation to identify them—safeguards planning must take into account the possibility of an absence of outstanding questions and inconsistencies;
- second, the logic of the additive approach is questionable. If the rationale of IS is that implementation of both INFCIRC/153 and the AP leads to redundancies in respect of particular acquisition paths, this must also be the case in states of concern—the same redundancies will still exist for these states, the question is, what level of safeguards intensity is considered necessary for the particular states. In some situations the judgment may be made that implementation of routine safeguards measures in full is required; in other situations the most rigorous approach might be considered necessary only for some parts of the state’s nuclear program.

These problems exist because of the current approach to IS. They can be resolved by two conceptual changes:

- that in principle IS—the optimisation of INFCIRC/153 and AP measures—should be applicable to every comprehensive safeguards state that has an AP in place;
- that the actual outcome of this optimisation will vary from state to state, based on state-specific considerations. In some cases optimisation will require a rigorous approach, in other cases a less intense approach.

4. FLEXIBILITY IN SAFEGUARDS IMPLEMENTATION

An important feature of the IS concept is that differentiation between states is possible, indeed, is to be expected. Differentiation is not discrimination, provided the same safeguards objectives are applied, and states having similar characteristics are treated in a similar way in meeting those objectives. As discussed in this paper, however, the definition of “characteristics” for this purpose requires further elaboration.

Realising the potential under IS for flexibility in safeguards implementation, in particular tailoring safeguards intensity to state-specific characteristics, remains a challenge. At this stage some observers are concerned that in practice state-level approaches may amount to little more than the aggregation of the facility-level approaches applicable in the particular state—thereby replicating

one of the problems of classical safeguards implementation. The IAEA is adamant this will not be the case—but this is an area that requires considerable further development.

What is meant by “flexibility”?

The authors use the term “flexibility” by way of contrast to the criteria-driven approach that has come to characterise classical safeguards. There is now general recognition that the mechanistic, prescriptive approach followed in classical safeguards leads to inefficiencies in prioritizing allocation of safeguards resources. A key objective of IS should be to apply the optimal combination of safeguards measures at appropriate intensity, based on a state-level approach, taking account of state-specific considerations. This approach should result in a degree of freedom to select measures to meet safeguards objectives. Hence there is a need to exercise judgment, both at the state level and at the facility level—this is what, for want of a better term, we call “flexibility”.

It should be clearly understood that flexibility does not imply an arbitrary approach—for decisions in implementing safeguards to lead to credible outcomes, it is essential to apply a methodology, the results of which can be validated by a quality management system. These areas—a methodology for flexibility and a quality management system—have yet to be established.

Opportunities for flexibility

Although the IS approaches so far developed by the IAEA are based on a reduced level of routine inspection activity, they also contain some rigidities. Take the example of LWRs, for which the basic IS approach may be briefly summarised as:

- for every LWR refuelled in the calendar year, a PIV (physical inventory verification) is to be conducted at the time of refuelling;
- for LWRs with refuelling intervals greater than one year, 50% are to have a “PIV-equivalent” inspection in a year refuelling does not take place;
- in addition, unannounced inspections are to be conducted at 20% of LWRs each year.

Starting with the selection of a proportion of LWRs—50% for PIV-equivalent inspections, 20% for unannounced inspections—the observation can be made that these appear to be arbitrary figures: there is no greater rationale for selecting 50% than, say, 30% or 70%. Likewise, the selection of 20% for unannounced inspections might just as readily have been, say, 10% or 50%. These figures were chosen as representing a reasonable balance between the desire for rigor and the need to rationalise resource demands—but the point is, other figures *could* be chosen, and perhaps a range, rather than a fixed figure, should be employed. On this basis, unannounced inspections of LWRs in a particular state would be chosen from a range of say, 10% to 50%, the actual level to be determined by the IAEA based on considerations such as those discussed in this paper.

The same arguments apply in the case of PIVs—for LWRs undergoing refuelling, why does the selection for inspections have to be 100%? PIVs too could be based on selection from a range, the actual number conducted to be based on judgment taking account of appropriate considerations.

The conduct of complementary access (CA) is another area where flexibility, based on expert judgment, should apply. The IAEA has developed guidelines for CA, which include indicative targets for the numbers of CA to be conducted under the various provisions of the AP. It is reasonable to have purely indicative numbers for planning purposes, but care must be taken to avoid these becoming prescriptive. Judgment should be important in determining the numbers of CA for assuring the absence of undeclared material and activities, and also in determining the significance of *questions and inconsistencies*, hence determining the effort which should be expended through CA to resolve these.

There are many more areas where judgment should, and does, come into safeguards implementation. One example is in the resolution of anomalies—deciding whether an anomaly exists, and if so whether it is significant. These decisions have important implications for safeguards effectiveness, but of course also a direct impact on resource usage. Across all areas of safeguards implementation there needs to be a careful balance—effectiveness must be the predominant consideration, but judgment should be exercised in deciding the practical limits to safeguards effort.

The basis for exercising flexibility/expert judgment

What are the bases that could be used for differentiating between states in safeguards implementation? Which factors are relevant to safeguards, and which factors are acceptable to the international community?

Part of the answer is already provided in INFCIRC/153—the various criteria listed in paragraph 81, which, as we have discussed, have not yet been used to good effect. How might these be built on, or added to?

An essential element in strengthened/integrated safeguards pursuant to the AP is the use of information review and evaluation. Under classical safeguards, which are focused on declared nuclear material and facilities, there was only a limited place for information review and evaluation. While the IAEA was always to be alert to the possibility of undeclared nuclear activities—and the special inspection provisions exist to address this possibility—a methodology was not in place for information analysis directed against such activities. Now, analysis of information from a range of sources—through AP provisions, from inspection activities, from other IAEA activities and programs, from open sources, and provided by states—is assuming increasing importance in the planning of safeguards activities and in the drawing of safeguards conclusions.

To date, information review and evaluation has focused on matters that are directly nuclear-related—nuclear programs, nuclear R&D, nuclear-related manufacturing and procurement activities, and so on. Here, the question is, whether the areas of interest for the IAEA—and which are used in safeguards decisions and evaluations—should be widened.

At present the IAEA's information review and evaluation efforts remain relatively narrowly focused. It needs to be kept in mind that nuclear proliferation does not occur in a vacuum—there will be many indicators of an interest in pursuing nuclear weapons. History shows there are several reasons why states may wish to acquire nuclear weapons or the capability to produce them. These include national security, prestige, domestic and political pressures, foreign military threats and regional tensions. The state's actions can also give an indication of its desire to pursue nuclear weapons. Fuel cycle activities particularly conducive to the production of weapons grade fissile material, building military capabilities in proliferation-related areas (including chemical weapons, biological weapons and ballistic missiles) and proliferation-sensitive procurement, all provide indications that a state may have nuclear weapons aspirations.

While some of these factors may be considered “political”, most are capable of objective analysis. Furthermore, they are the very considerations governments take into account in drawing conclusions about the behaviour of other states—since an important function of safeguards is international confidence-building, the safeguards system will be handicapped in this if it does not address the considerations that are on governments' minds. The worst example of this was the description by a senior IAEA official, shortly before the first Gulf War, of Iraq's safeguards performance as “exemplary”, when there was a substantial body of information, outside the formal safeguards system, of Iraq's efforts to develop uranium enrichment and nuclear weapons.

In collaboration with US colleagues, ASNO is currently developing the concept of “information-driven” safeguards approaches, exploring the range of factors which it would be appropriate for the IAEA’s information review and evaluation to take into account. Some of these factors include:

- capability—does the state have the technical means to proliferate? This would take account of industrial capabilities, general weapons-related capabilities, and expertise;
- motivation—does the state have a motivation to proliferate? This would take account of security needs, desire for “prestige”, and so on;
- evidence—are there specific indicators of interest in nuclear weapons (or other WMD)?

The most effective approach would probably be to take into account a combination of these factors. The “information-driven” concept will be unveiled when it has been developed further.

5. CONCLUSIONS

A uniform approach to safeguards implementation has been shown to be unsatisfactory in both directions—too much safeguards effort spent where it is not needed, and substantial difficulties in being able to devote more effort where it is needed.

With the introduction of integrated safeguards comes the opportunity to develop state-level safeguards approaches that take into account state-specific characteristics. At this stage it is not clear how this might work in practice, and care is needed to ensure that the potential benefits of integrated safeguards—in terms of both efficiency and effectiveness—are not hampered by the incorporation of new rigidities. This can be avoided by introducing flexibility to enable decisions on safeguards intensity to be based on expert judgment, and by widening the factors that can be taken into account in state evaluations.

While some of the considerations discussed in this paper may appear “subjective”, they can be analysed through objectively discernable indicators. For example, while as an abstract concept “motivation” appears to be a “political” issue, questions such as: is the state located in a region of tension?; does the state display a sense of being threatened, or for that matter has it issued threats to its neighbours?; are readily established questions of fact. Clearly a transparent methodology is needed for making these judgments, together with a quality management system to cross-check the validity of judgments made and their consequences in terms of safeguards decisions.

Here, there are two areas of concern:

- is the IAEA qualified to make informed judgments in “non-traditional” areas—and is there risk of the “wrong” judgments being made, i.e. insufficient safeguards intensity in particular states, jeopardising safeguards effectiveness?
- will states accept that it is appropriate for the IAEA to make such judgments?

Whether there is a risk of the IAEA leaning too far in the direction of reducing safeguards intensity is, again, a matter of having in place the appropriate methodology and quality system. An approach needs to be established for setting a minimum level of safeguards intensity that still meets safeguards objectives for the particular state—and an essential element has to be regular review in case of changing circumstances. The design of such a system needs some thought, but does not present insurmountable difficulties.

As to whether states will accept such a system, this depends on how well the system is explained, particularly to those states where it is proposed that safeguards effort be intensified. Here, the perceptions of the states themselves can be drawn upon. While many states would like to see their own safeguards requirements relaxed, few would be willing to see safeguards requirements relaxed for their regional rivals or their perceived adversaries. Thus it can be demonstrated to states that

intensification of safeguards effort meets their own national interest—a point which has been recognised by those states that have formed regional or bilateral safeguards arrangements, or nuclear-weapon-free zones, complementary to the IAEA's safeguards activities.

For IAEA safeguards to continue to fulfil their confidence-building role, they must be seen to be effectively addressing the international community's concerns. This requires calibration of safeguards effort to appropriately reflect state-specific situations. A process of determining safeguards effort that is both objective and more adaptive and informed will be important to the IAEA's ability to fulfil its mandate confidently over the longer term.