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Information Analysis and International Safeguards

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Abstract

After the first Gulf War, it was recognized that one of the key weaknesses of the international safeguards system was that there was no systematic attempt by the International Atomic Energy Agency (IAEA) to analyze all available information about States' nuclear programs to determine whether these programs were consistent with nonproliferation obligations. The IAEA, as part of its effort to redesign the international safeguards system, is looking closely at the issue of information review and evaluation. The application of information analysis (IA) techniques to the international nuclear safeguards system has the potential to revolutionize the form and practice of safeguards. Assessing the possibilities of IA for the IAEA, and in particular those embodied in concepts of information-driven safeguards, requires an understanding of IA, the limits on its effectiveness and the requirements placed on such analyses in a variety of safeguards contexts. The Australian Safeguards and Nonproliferation Office (ASNO) and the United States Department of Energy (DOE) agreed in July 2002 to undertake a joint study of "information-driven safeguards" under a long-standing cooperative arrangement. It was decided that a broad range of ideas should be considered, and that the study would not be intended to be and would not be an elaboration of either US or Australian governmental positions. This paper reports some findings of Phase 1 of this collaborative effort and offers some initial thinking on the part of the authors on the outstanding issues to be addressed in Phase 2. An effort to explore through case studies alternative strategies for utilizing IA by the IAEA that provide the same or increased confidence in safeguards conclusions while allowing safeguards resource allocation to be determined not only by the types and quantities of nuclear material and facilities in a State but also by other objective factors.

Introduction

After the first Gulf War, it was recognized that one of the key weaknesses of the international safeguards system was that there was no systematic attempt by the International Atomic Energy Agency (IAEA) to analyze all available information about States' nuclear programs to determine whether these programs were consistent with nonproliferation obligations. The IAEA, as part of its effort to redesign the international safeguards system, is looking closely at the issue of information review and evaluation. The application of information analysis (IA) techniques to the international nuclear safeguards system has the potential to revolutionize the form and practice of safeguards. The possible roles for IA in safeguards, which have been articulated by the IAEA or by others, include:

- providing new safeguards measures with detection capabilities for undeclared activities and facilities or an ability to infer the existence of an active nuclear weapon program in a State;
- providing a means to enhance or optimize other safeguards measures in a State, including reducing traditional safeguards efforts on declared facilities and materials,

targeting complementary accesses and other safeguards measures such as satellite imagery in a State, etc.;
- providing a means to improve safeguards planning and resource allocations, including setting safeguards performance objectives for each State as part a "graded" safeguards concept, e.g., changing timeliness goals under integrated safeguards, and allocating Agency inspection efforts across all States.

Will these roles be feasible and practical? Will IA be able to affect key decisions in resource allocation? Assessing the possibilities of IA for the IAEA, and in particular those embodied in concepts of information-driven safeguards, requires an understanding of IA, the limits on its effectiveness and the requirements placed on such analyses in a variety of safeguards contexts. The Australian Safeguards and Nonproliferation Office (ASNO) and the United States Department of Energy (DOE) agreed in July 2002 to undertake a joint study of “information-driven safeguards” under a long-standing cooperative arrangement. It was decided that a broad range of ideas should be considered, and that the study would not be intended to be and would not be an elaboration of either US or Australian governmental positions.

Phase 1 was an effort to explore strategies for utilizing information analysis in international safeguards, with the objective of ensuring and, to the extent possible, enhancing, the effectiveness of safeguards. It considered the prospect of achieving efficiencies via approaches to resource allocation within a State and across States that take into account considerations beyond the types and quantities of nuclear material and facilities in a given State.

In particular, this phase of the study identified and analyzed a variety of factors for consideration in safeguards for resource allocation, some of which appear more promising than others. Combination strategies, which look for example at a State’s capabilities and evidence of proliferation as well as other factors appear most useful and practicable. The actual combinations of safeguards activities utilized should be based on State-specific detection issues.

Work is now beginning on Phase 2 of the study, which will test the concepts developed in the first phase. Plans have been made to further evaluate the strategies through the application of case studies with a view to ascertaining whether an information-driven resource allocation methodology could be developed and effectively applied.

This paper reports some findings of Phase 1 and offers some initial thinking on the part of the authors on the outstanding issues in the context of testing these findings in an effort to explore alternative strategies for utilizing IA by the IAEA that provide the same or increased confidence in safeguards conclusions while allowing safeguards resource allocation to be determined not only by the types and quantities of nuclear material and facilities in a State but also by other objective factors.

Concept Development (Phase 1)

Assessing the possibilities of IA for the IAEA, and in particular those embodied in concepts of information-driven safeguards, involved an analysis of IA, the limits on its effectiveness and the requirements placed on such analyses in a variety of safeguards contexts. In the US-Australian

study, the process of IA is described in terms of "best practices." Possible roles were then discussed, along with the promise as well as the inherent limits of IA. Finally, there was an analysis of the ways in which IA can be used to assist the IAEA in allocating resources, as well as the issues involved with that effort.

The study identified two general approaches in which IA can potentially be used to support a more efficient allocation of Agency safeguards resources. The first involves the use of available information and/or analytical tools to improve the efficiency of current safeguards resource allocation practices. This would represent an incremental change to the current approach but may produce significant benefits. Such uses can, in principle, be rapidly implemented and do not raise some of the larger conceptual issues surrounding the use of IA.

Beyond this incremental improvement, there are a series of possible alternative resource allocation strategies. They would represent a significant change in safeguards practice, with ostensibly an increased use of or reliance upon IA. The paper addressed the following elements, which are potential building blocks for the alternatives we considered:

- political (explicit determination of effort allocation by direct decision of a formally constituted policy-making organ);
- motivation based (likelihood of proliferation);
- capability based (technical means of proliferation); and
- evidence driven (positive indicators of proliferation).

These elements were separated for analytic reasons. They would likely be combined and are considered as elements in broader strategies in any final information-driven safeguards strategies. The following are illustrative examples of potential combination strategies utilizing the above elements. The political element was not included below, because preliminary discussions led us to believe it was unlikely to be considered legitimate for such fundamental resource decisions explicitly to be taken on political grounds by political bodies with political agendas.

Motivation and Evidence Driven Strategy

This strategy offers an approach to resource allocation based on an assessment of motivations using such factors as transparency, accessibility and entry into force of the Additional Protocol to assess a State's non-proliferation *bona fides*. This approach would not be insensitive to evidence of proliferation-related activities on the part of the State. If the IA process produces indicators of proliferation-related activities, additional resources would be allocated to ensure appropriate safeguards coverage of the State. The assessment of motivations itself would likely be updated with evidence of proliferation actions if it became available.

However, even if the issue of motivation was well-defined (all desired variables known), it would not be clear that IA would be able to provide values for these variables. Even good IA is difficult and is likely to be perceived in politicized ways. This approach does not blend well with the old or new capabilities and measures available to the Agency (e.g. satellite imagery, protocol declarations). As the Agency is a technically based organization, this would not be readily integratable with its existing mission.

Motivation/Capability/Evidence Driven Strategy
In this strategy, motivation and evidence would be combined with an assessment of a State's capabilities as the primary basis for safeguards resource allocation. By doing so, the problem of uni-dimensional motivations such as security or status can be better addressed. However the issues pertaining to motivations and evidence noted above would remain.

In principle, performing an assessment of a State's capabilities would allow for more targeted resource allocations. With regard to the use of IA in this context, capabilities are a more tractable technical problem with which the Agency is institutionally capable of dealing. In addition, this approach blends more naturally with Agency's new safeguards measures.

Capability and Evidence Driven Strategy
Rather than relying to some extent on an assessment of motivations, initial State-specific approaches could be designed based on an understanding of a State's technical capabilities and then modified with evidence of proliferation actions. Obviously, this alternative raises the issues outlined in the previous motivations/capabilities/evidence strategy except those associated with assessing motivations.

The key issues with the capabilities approach have to do with the limits of capabilities as a means of characterizing proliferation risks and the evolving Agency experience in using IA. The former will remain an issue but the latter may be more readily addressed over time as the agency gains more experience with using IA.

Preliminary Findings (Phase 1)
Although it is a reasonable presumption that IA can and will play a positive role in modifying current safeguards resource allocation strategies, the issue of the utility of IA in a more fundamental restructuring of resource allocation strategies has not yet been fully determined. The ability to confidently draw safeguards conclusions that are information driven will depend on objective assessments of IA, its capabilities, and how it is to be used in pursuit of this objective.

Only if IA provides significant detection probabilities, can it increase confidence in safeguards conclusions. The ultimate level of information-based confidence that may be achieved is still uncertain. Only with strongly grounded information-based increases in confidence can one consider changes in resource allocation. Confidence in, and the credibility of, information-driven safeguards in this sense will also depend on Member State perceptions of the successes or failures of such techniques. In any event, IA must be subject to continual reassessment, evaluation and a high level of quality control.

Without prejudging the promise and limits of IA, this study identified and analyzed specific strategies for resources allocation, some of which appear more promising than others. In this vein, Phase 1 concluded:

- a politically driven approach is probably not feasible;
- a motivation-based approach is uncertain and difficult to assess even if one had objective factors; and

- capability and evidence driven approaches are more promising but need further examination to confirm this assessment is valid.

The study suggested it would be most useful and practical to utilize a combination of rationales. The actual combinations of safeguards activities utilized should be based on State-specific detection issues.

It also recognized that there is a need to further evaluate such strategies individually and in combination through the application of case studies with a view to ascertaining whether an information-driven resource allocation methodology could be developed.

Moving Ahead (Phase 2)

As noted, Phase 2 is intended to test the concepts developed in Phase 1. The work utilizes case studies. Each case study will involve assessing the State-specific information that is available to the Agency in the context of analytic strategies and drawing conclusions as to impacts on safeguards approaches, effectiveness, confidence levels and resources. As both the US and Australian teams independently begin the first case study, we are performing an initial information analysis using some combination of motivations, capabilities and evidence for each case. On this basis, we will then attempt to design a State-specific safeguards approach based on that analysis, and to examine the effectiveness, level of confidence provided and resource implications of that approach.

This process would serve a “graded” safeguards approach where the resources allocated to a given State would depend on State-specific information (e.g., perhaps by placing a State in a define category such as high/medium/low risk).

As noted, we are looking at motivations, capabilities and evidence. In our view, it is important to dispel sweeping assessments of motivations; instead we define targeted use of motivations, including capabilities and evidence suggestive of motivations. By capability, we refer to relevant nuclear, industrial and military capabilities. Concrete indications of proliferation actions are construed as evidence.

The category of evidence is not unambiguous in this context, but it can be understood. Capabilities and motivations are different matters entirely.

Neither capability nor motivation provide an unambiguous perspective on a State’s likelihood to go nuclear. Capabilities are clearly needed. They are a necessary but not a sufficient condition for developing (as opposed to acquiring, e.g., through theft) nuclear weapons. But States with extraordinary capability may not be seen to pose a proliferation risk. It is true that perceptions of risk can change over time, but a focus on capability alone means the Agency continues along its old path. This would likely produce resource allocations similar to those under traditional safeguards. The States with advanced nuclear fuel cycles would be those most heavily inspected.

Motivations, on the other hand, would appear to provide in principle a clearer indicator of the probability of nuclear-weapon proliferation. If a State has compelling reasons for weapons, is it not logical that they would be likely to acquire them?

It may well be, but there are other considerations that come into play—other options for addressing the issues that might motivate proliferation, concern about reactions, whether bilateral, regional or international, and so on. There is also the issue of whether a motivated State has the capabilities required for weapons, although there is little doubt nearly all States could, if motivated, acquire these weapons.

Beyond such concerns, we do not well understand motivation, and there is no sound body of theory on which to base assessments. It does appear insecurity is an abiding motivation but both secure and insecure States have sought weapons, and most insecure States have not resorted to proliferation. Prestige is also a possible motivation, but its quest may or may not lead a State to nuclear weapons.

If we look at both capabilities and motivation together, the overall picture does not become clearer. For example, on the basis of both capabilities and intentions, a case can be made that Australia is a proliferation risk. It has tremendous uranium reserves, is working on enrichment although it does not possess a commensurate domestic nuclear energy program and is concerned about regional threats, especially the perceived threats emanating from Indonesia (and the prospect that Indonesia itself may proliferate). On the other hand, known proliferators might not fit such a clear proliferation profile, including Saddam's Iraq, Libya and others.

It is clear that motivation is central to current thinking the ability to utilize IA in the ambitious ways many proponents put forward. In this context, let us discuss motivations in greater detail. It seems clear that trying to define a State as either "good" or "bad" will not be acceptable. If a more concrete, operationalization of motivations is needed, how can it be done at some level? How can motivations be defined in greater specificity?

As suggested, the definition of motivations we utilize involves a limited, concrete operationalization of the concept, in which motivations are suggested by either capabilities or by evidence.

As part of an assessment of motivation based on capabilities, we might address rationales for legitimate government investment in nuclear power:

- economic advantage;
- availability of supply;
- energy security/independence/diversity;
- strategic technology development/hedging;
- relationship of nuclear to military investments – no military or no military/industrial complex;
- multinational ownership of company;
- international interdependence of fuel cycle;
- domestic industrial patronage; and
- global warming.

The idea here is to look at key capabilities and investments and to assess their consistency internally and in terms of civilian v. military use.

Evidence suggestive of motivations (not direct evidence of proliferation, yet potentially relevant) includes:

- government statements regarding nuclear weapons (desire for capability or from a prestige perspective);
- government statements or analyses that recognize a nuclear/strategic threat to them, e.g., Japanese arguments about the DPRK threat;
- status of security assurances/guarantees and the strength of those assurances;
- geopolitical/military posture of state (i.e., as an aggressor);
- evidence of chemical and biological weapons development;
- evidence of delivery system development; and
- existence of front companies.

These considerations pose a danger insofar as they can rapidly regress to broad and ill-defined concepts of motivations. For example, security guarantees can be seen as suggesting a State's insecurity is being addressed. However, to what degree? If the conditions in which those guarantees were established change, do they remain credible? These are serious issues analytically and must not be allowed to be reduced to simple checklists.

There are no doubt other such considerations in assessing motivations. Transparency could come into such calculations to the extent that if we do not know something, we may assume the worst. The interpretation of ambiguous data will remain a challenge, and will ultimately have to be done on a State-specific basis. Even here, as suggested, there may be a temptation to old, unhelpful patterns of analysis.

Conclusions

The conceptual findings of Phase 1 are now being assessed in Phase 2 through the use of case studies. In this phase, which is in its critical stages, we are examining IA strategies that could provide an answer to the question: can IA guide IAEA resource allocation? A key element of our approach is the operationalization of motivation. We are not yet in a position to say whether this approach works. If it does, it should be a useful innovation in terms of the overall joint study, and more broadly in thinking through difficult nonproliferation challenges.