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Panel Discussion: Considerations of the Model Additional Protocol Annexes

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INTRODUCTION

The Model Additional Protocol (Model AP) of 1997 was developed with the aim of improving the ability of the IAEA to verify the completeness and correctness of States' declarations regarding nuclear material and activities. The Model AP includes in its Annex I a list of nuclear fuel cycle-related activities, the scale of operations of which should be reported to International Atomic Energy Agency (IAEA), while Annex II contains a list of items deriving from the Nuclear Suppliers Group (NSG) Trigger List as it stood in 1997, the export—and upon request from the IAEA, the import—of which should be reported to the IAEA. More than 25 years after their approval by the Board of Governors, both Annexes would merit reconsideration and possible amendment in order to keep pace with the evolution of nuclear technologies and risks.

The purpose of the panel was to offer some considerations on the Annexes to the Model AP rather than endorsing a specific outcome. The panel focused on reviewing the genesis of the Annexes and motivations for a possible amendment that could be both useful and acceptable to IAEA Member States, including those not participating in the NSG nor adhering to its guidelines. The following is a summary of the discussion by the panel. As such, individual contributions are not highlighted.

PURPOSE OF THE AP

The panel recalled the historical developments of the Model AP, starting with efforts to strengthen safeguards as early as 1991.

The purpose of the Model AP was to strengthen the effectiveness and efficiency of IAEA safeguards in particular with a view to providing it with additional tools to help verify the correctness and completeness of States' declarations under comprehensive safeguards agreements (CSAs) regarding nuclear material and activities.

IAEA safeguards on nuclear material and activities in approximately 180 States with a CSA under the NPT have the objective to deter the development of nuclear weapons through the early detection of diversion of nuclear material, misuse of nuclear facilities/activities or indications of undeclared nuclear material or activities anywhere in the State.

Safeguards in-field and headquarters activities thus have as a goal to evaluate if States' declarations are correct and complete, i.e., fully consistent with all safeguards-relevant information received from the State itself, from other States as well as from other sources (e.g., publicly available sources).

The information provided under the Model AP Articles 2 a.(iv) and 2 a.(ix) (Annex I activities and Annex II transfers) contributes to the overall consistency analysis in an important and often unique way, both regarding nuclear fuel cycle activities and capabilities in the State and in partner States. The consistency analysis may uncover if a State is procuring or manufacturing beyond its ostensible [declared] nuclear fuel cycle needs.

In addition, some States report exports and imports to the IAEA under the Voluntary Reporting Scheme (VRS), and the IAEA Procurement Outreach Programme provide a voluntary mechanism for States and companies to share information with the IAEA on procurement attempts of possible nuclear relevance.

To allow the IAEA to assess consistency, States need to report fully and accurately. However, the provision of information to the IAEA may suffer from omissions due to under-declarations, e.g., concerning parts and components of larger plants, sometimes not considered necessary to be declared to the IAEA. This could also be the case of a component going to a lab, or a pilot activity, rather than to a full facility.

The panel noted that the Model AP is undoubtedly the most important element arising from efforts to strengthen the effectiveness and improve the efficiency of IAEA safeguards. An AP based upon the model provides the IAEA with increased access as well as increased information about a State's activities. As noted by former IAEA Director General Hans Blix: "There is a close interrelationship between the amount and quality of information and access provided to the Agency on the one hand and the level of assurance that can be gained from an absence of findings on the other."

An AP, coupled with a CSA, provides the basis for the IAEA to draw its broadest safeguards conclusion and, thereby, provide the highest level of assurance that that all nuclear material has remained in peaceful activities in a State.

It should also be noted however that, while currently three fourths of States with a CSA also have an AP in force, one fourth do not yet have one, including a couple of States with substantial fuel cycle activities.

HOW WERE THE ANNEXES DEVELOPED?

The panel recognized that the concept of reporting information to the IAEA to facilitate safeguards implementation, particularly information on the export and import of nuclear material and on the export of specified equipment and non-nuclear material dates back to 1993 with the introduction of the VRS.

In 1992, various recommendations were sent to the Board of Governors (herein after referred to as "the Board") for universal reporting on exports, imports and inventories of nuclear materials for peaceful purposes, as well as export and imports of certain equipment and non-nuclear material.

A revised Secretariat paper on a reporting system on nuclear material and specified equipment and non-nuclear material(GOV/2629) was considered by the Board at its meeting in February 1993.

The Board encouraged Member States to participate in the scheme, providing the Agency with relevant information relating to their exports and imports of nuclear material and exports of specified equipment and non-nuclear material. The Board also invited States that were willing

to do so to provide information on their production of nuclear material and on their imports of specified equipment and non-nuclear material. This has come to be known as the VRS.

The Board endorsed the proposal and encouraged Member States to participate in the VRS providing the Agency with relevant information on export and imports of nuclear materials, and exports of equipment and non-nuclear materials specified in a list.

CONTENTS OF THE AP ANNEXES

The panel noted that the Model AP of 1997 requires a State to describe the scale of operation of each location engaged in fifteen activities related to the nuclear fuel cycle listed in its Annex I (Art. 2 a.(iv)):

- i. The manufacture of centrifuge rotor tubes or the assembly of gas centrifuges.
- ii. The manufacture of diffusion barriers.
- iii. The manufacture or assembly of laser-based systems.
- iv. The manufacture or assembly of electromagnetic isotope separators.
- v. The manufacture or assembly of columns or extraction equipment.
- vi. The manufacture of aerodynamic separation nozzles or vortex tubes.
- vii. The manufacture or assembly of uranium plasma generation systems.
- viii. The manufacture of zirconium tubes.
- ix. The manufacture or upgrading of heavy water or deuterium.
- x. The manufacture of nuclear grade graphite.
- xi. The manufacture of flasks for irradiated fuel.
- xii. The manufacture of reactor control rods.
- xiii. The manufacture of criticality safe tanks and vessels.
- xiv. The manufacture of irradiated fuel element chopping machines.
- xv. The construction of hot cells.

These activities had been chosen for their relevance to uranium enrichment, reactor operation and fuel reprocessing, see Fig. 1.

The Model AP also requires a State to report exports of specified equipment and non-nuclear material listed in its Annex II (Art. 2 a.(ix)), as well as confirmation of imports on request by the IAEA. Annex II is based on the NSG Trigger List Rev.2 of 1995, available at the time of the approval of the Model AP by the Board.

The list of equipment and non-nuclear material required to be reported was derived from the VRS list, based on the NSG's export Trigger List of single-use equipment and non-nuclear material published in INFCIRC/254/Rev.2/Part.1 in October 1995.

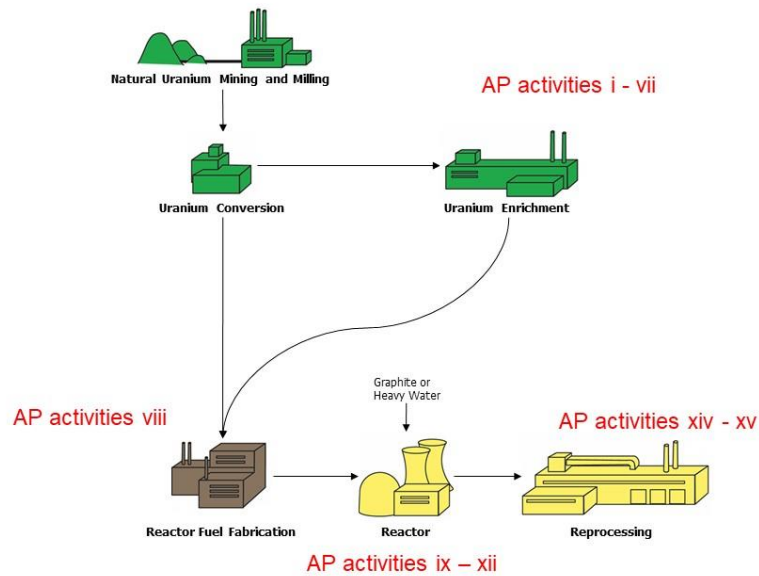


Fig. 1 – AP Annex I’s activities and the nuclear fuel cycle

This was done simply as a practical matter to avoid having to negotiate a whole new list. However, the title of Annex II was specifically crafted in such a way as not to require strict symmetry with the NSG’s Trigger List or to preclude the later inclusion of dual-use or weaponization-related equipment or material.

The panel also noted that, while the NSG Trigger List included the control of “technology” exports – also back in 1995 – the Model AP Annex II does not. The Model AP only indirectly refers to technology in two instances:

- Art. 2.a.(i), which calls States to provide a description of and information specifying the location of nuclear fuel cycle-related research and development activities not involving nuclear material that are funded or controlled by the State.
- Art. 2.b.(i), requiring a general description of and information specifying the location of nuclear fuel cycle-related research and development activities not involving nuclear material which are specifically related to enrichment or reprocessing, but which are not funded or controlled by the State.

These requirements however refer only to research activities executed in the State, but not to collaborations and exchanges involving technology transfers to other countries. In order to assess these, the European Commission JRC has performed a study of scientific publications and collaborations related to AP Annex I activities using the *TIM Dual-use web platform*, published in the ESARDA Bulletin¹.

REVIEW PROCESS

¹ https://esarda.jrc.ec.europa.eu/publications/supporting-additional-protocol-declarations-nuclear-research-and-technology-jrc-tim-du-platform_en

“Supporting the Additional Protocol declarations on nuclear research and technology by the JRC TIM DU platform”, ESARDA Bulletin - The International Journal of Nuclear Safeguards and Non-Proliferation, 2021

The panel noted that Article 16.b of the Model AP provides a simplified process for amending the two Annexes. This mechanism was included to ensure that, if and when the Annexes were amended, all APs would be simultaneously amended so as to avoid a proliferation of divergent reporting requirements.

The panel recalled that in 2006, the Secretariat prepared a paper at the request of the Advisory Committee on Safeguards and Verification within the Framework of the IAEA Statute (Committee 25) in which the Secretariat reviewed certain analytical capabilities required for safeguards and proposed measures for improving those capabilities. In that paper, the Secretariat noted that it would be “useful at this time to review the Annexes of the Model Additional Protocol to ascertain whether amendments should be made” and proposed that consideration be given to reviewing the two Annexes “with a view to assessing the need for their amendment”.

Among the recommendations offered by the Secretariat for the Committee’s consideration was that the Committee recommend to the Board that it establish an open-ended working group to review the Annexes and advise the Board on their amendment. The Secretariat issued another note on the recommendations, expanding on the previous note, as follows:

“With the aim of reflecting the evolution of nuclear technology, improving safeguards effectiveness and efficiency, and obtaining a complete picture of States’ nuclear activities, consideration might be given to including in the Annexes additional activities and items relevant to safeguards.”

The Committee was however unable to agree on any recommendations.

CURRENT STATUS OF THE AP ANNEXES

The panel recognized that more than two decades have passed since the Board approved the Model AP. The list of activities in Annex I and the list of equipment and non-nuclear material in Annex II have never been amended. Since the Model AP was approved in 1997, the NSG Trigger List has been intensely modified from the Rev.2 of 1995, reaching its Rev.14 in 2019. Besides editorial improvements, a substantial number of items have been added, shown in chronological order in Table 1.

Table 1 – NSG Trigger List additions since 1997²

NSG TL Annex B item	Title	Since	Year
1.8	Nuclear reactor internals	Rev. 3	1997
1.9	Heat exchangers	Rev. 3	1997
1.10	Neutron detectors	Rev. 3	1997
1.11	External thermal shields	Rev. 12	2013
3.5	Neutron measurement systems for process control	Rev. 12	2013
5.2.1.c	Solidification or liquefaction stations	Rev. 12	2013
5.2.3	Special shut-off and control valves	Rev. 9	2007
6.8	Complete heavy water upgrade systems or columns therefor	Rev. 3	1997
6.9	NH ₃ synthesis converters or synthesis units	Rev. 12	2013

² ESARDA Symposium 2019

7.1.9	Especially designed or prepared systems for the conversion of UO ₂ to UCl ₄	Rev. 4	2000
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The panel noted that these discrepancies and the need to follow technological progresses motivate the recurring debate about the possible need to update Model AP Annexes I and II and to what extent, for example also considering items of the NSG Dual Use List.

WHY A REVIEW?

The VRS of 1993 included a list of items which was updated in 1994 and 1996. But since the approval of the Model AP in 1997, a possible update of the Annexes has only been considered once, by Committee 25, as recalled above, without success.

The panel pointed out the importance of maintaining updated Model AP Annexes following relevant nuclear technological developments, like small modular reactors, or emerging technologies. This is important to support the IAEA in verifying the correctness and completeness of the information and derive safeguards conclusions.

Since, as noted by Director General Blix, safeguards-relevant information makes a significant contribution to the level of assurance provided by the Agency, it seems obvious that the type and scope of the information provided to the Agency should be periodically reviewed to ensure that the information is appropriate and that it continues to be relevant to the implementation of safeguards.

The panel noted that in the context of the Annexes to the Model AP, this suggests that a technical review of the Annexes is warranted whether or not such a review results in any changes. The overall objective is the same as that originally established in 1997, that is, to provide information to the IAEA on a State's activities that is safeguards relevant and thereby strengthens the effectiveness and improves the efficiency of IAEA safeguards.

The panel indicated that amending Annex II to synchronize with the NSG's current Trigger List would be relatively low-hanging fruit that could go a long way towards strengthening the implementation of APs. The lists could also be improved in some places to ensure full reporting, reducing the observed common causes of States' "underreporting" to IAEA.

Nuclear-related product and technology developments over the last 25 years could be better captured in a potential amendment, e.g. NSG Part 1 updates for possible inclusion in Annex II, but also other areas, e.g., potential new/additional Annex I activities of safeguards significance, as for instance operating or constructing accelerators and neutron sources capable of special fissionable material production, or advanced/additive manufacturing of certain components especially designed or prepared for nuclear use.

WHAT COULD THE ANNEXES' REVIEW INCLUDE?

The panel recalled that a recent Vienna Center for Disarmament and Non-Proliferation (VCDNP) project report³ analysed 38 technologies from a technical viewpoint, to assess whether any of them justified their addition to the Model AP Annexes, both as Annex I activities and Annex II related items.

³ Noah Mayhew, "Reflecting on the Annexes to the Model Additional Protocol in Support of Nuclear Governance", Vienna Center for Disarmament and Non-Proliferation, 10 March 2023. Available at: <https://vcdnp.org/reflecting-on-the-annexes-to-the-map/>.

Besides the lack of updates since 1997, Annex II also lacks detail in places, making it difficult to interpret the specifications, e.g., equipment for the cladding could be better detailed.

The panel discussion noted that a technical review could focus on a number of elements such as:

- Whether or not the activities or items currently identified in the Annexes remain valid for inclusion;
- Whether or not the detailed technical specifications of the items in Annex II remain valid; and
- Whether or not additional activities or items should be added to Annex I or Annex II. Among other things, this consideration could look at the advances in relevant technology that have occurred since the Model AP was agreed in 1997. For example, it would be useful to look at emerging technologies such as small modular and advanced reactors and their related fuels to see if certain activities, components or items would be suitable candidates for inclusion in either Annex.

The panel acknowledged that an important criterion that needs to govern the technical review is the recognition that, regardless of any previous links to other lists of activities or items, Annex I and Annex II of the Model AP belong to the Agency. This means that, subject to Board approval, any activity or item can be added to the appropriate Annex if the information on the activity or on the export or import of the item is safeguards relevant. One ramification of this is particularly relevant to Annex II. While Annex II currently relies on the phrase “especially designed or prepared” in describing specific items in the Annex, I suggest that it need not be a condition or a requirement for including future items in Annex II.

Consideration could also be given to amending Annex II to include certain dual-use materials and equipment, drawing on the Dual Use List in Part 2 of the NSG’s guidance on “Transfers of Nuclear-related Dual-use Equipment, Materials, Software and Related Technology” (which is on its 12th iteration since its original publication in 1992), and other dual-use items that could be used for weaponization.

DISCUSSION ABOUT HOW THE REVIEW COULD BE ORGANISED

Notwithstanding the simplified amendment process provided for in Article 16 b., 26 years after the Model AP was approved by the Board, this provision has never been invoked and the Annexes have remained unchanged.

Article 16 of the Model AP sets out the process whereby the Board can amend the Annexes. Any amendment by the Board must be based upon the advice of an open-ended working group of experts established by the Board. The panel noted that it is important to emphasize the word “experts” which, indicates that consideration of possible amendments to the Annexes should be based upon technical rather than political input.

The panel acknowledged that this sounds like a very straight-forward process but the difficulty lies in carrying out an essentially technical exercise in a very politicized environment. The template for the way not to carry out a technical review of the Annexes was crafted by Committee 25, which was set up by the Board in 2005 to consider ways and means to further strengthen safeguards, including possible amendments to the Annexes of the Model AP.

The panel discussion included the following consideration of how the amendment process could be undertaken. In order to increase the likelihood of success, the process for considering

possible amendments to the Annexes could be a gradual, multi-step process leading up to the Board establishing an open-ended working group of experts. In other words, Article 16 should be invoked near the end of the process rather than at the beginning.

This gradual, multi-step process could be characterized by initial informal discussions between the Secretariat and a small group of countries that are primarily technology holders. Consideration might be given to having these initial informal discussions undertaken in the framework of a Member State Support Programme task.

This process of gradually broadening the participation in informal technical discussions on possible amendments to the Annexes of the Model AP could ultimately lead to an open-ended technical briefing by the Secretariat to all interested IAEA Member States. One objective of such a briefing would be to gauge the level of support for the proposed amendments to the Annexes. If the support is widespread, the Board could then establish an open-ended working group of experts to finalize consideration of the possible amendments and to so advise the Board. Of course, if serious opposition arises at any time during this gradual, multi-step process, consideration will have to be given as to whether or not the exercise should continue and, if so, how?

The panel noted that some resistance to updating the Model AP Annexes could be motivated by the fear to require modifications of the associated legal instruments in force in states.

In addition to the above, other considerations concerning the amendment process were identified by the panel. The panel discussed who should make the first move to amend the Annexes – Member States or the Secretariat? Either would prefer that the other did it. Ideally, it should come from both sides, while Article 16 should be evoked at a later stage. Any progress would need “fertile ground” for negotiations to have success. A purely technical process without investigating first the interest of particular States. The panel noted that, in order to avoid the outcome of Committee 25 an open-ended working group should include technical experts and have a clear mandate.

How often should the review be undertaken? Who should start it? Maybe the Standing Advisory Group on Safeguards Implementation (SAGSI)? The review could also consider revising the illustrative versus descriptive character of the text, choosing also whether technical specifications should be very specific for accuracy or general for comprehensiveness.

Future Opportunities

Finally, the panel discussion noted that, pending a suitable political environment for amending the Model AP Annexes, a number of steps could be taken to lay the groundwork for the amendment process.

- SAGSI could be a useful vehicle for advancing discussion on this issue. It would be beneficial if SAGSI could conduct a study explaining the gaps in the existing formulations of the Annexes and the impact that amending them might have on Member States. However, SAGSI should not operate in a way as to take the place of the open-ended working group, either in perception or reality.
- Another potential preliminary step would be for Member States that are supportive of amendment to start including mention of this in national statements at the Board of

Governors or other fora such as the General Conference. This could aid in the process of “socializing” this issue among Member States that are unaware of it or prioritise other issues.

- Awareness raising of the Annexes themselves is another way to “socialize” the issue. This includes presentations at events such as the INMM/ESARDA annual meetings and IAEA symposia, specific reference to the Annexes in training/education programmes (also important, as an amendment to the Annexes may require additional training for Member States), and other such events. Such awareness-raising activities should include a discussion of the value to Member States of updating the Annexes.
- Should the Secretariat place priority on amending the Annexes, it could take several steps. Such steps include: clear explanations on how the Secretariat benefits from the information submitted under the Annexes and what it is not getting without an amendment (and how this affects the IAEA’s job); mention in technical briefings by the Secretariat, focusing the discussion of amending the Annexes on potential improvements in safeguards efficiency as well as effectiveness; and a potential report by the Director General on the issue.
- Incrementally attempting to include language about the need to update the Annexes in the annual safeguards resolution at the General Conference would be a potentially positive step, but one that would require great care and not taken immediately. This is because the safeguards resolution has been based for a number of years on previously agreed language that had been very carefully negotiated. Opening the safeguards resolution to the addition of new language on the Annexes (or other issues) could lead to very contentious debate or to a renegotiation of the entire resolution. This step could be taken further in the future, when and if there was widespread support for the amendment process.