OPTIMIZING THE IAEA SAFEGUARDS SYSTEM

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Cover photo: IAEA training exercise at the Reactor Hall of the Mochovce Nuclear Power Plant (Mochovce, Nuclear Power Plant, Levice, Slovakia, January 17-21, 2005). Dean Calma/IAEA Image Bank.

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LIST OF ABBREVIATIONS

- ABACC: Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials
- AP: Additional Protocol
- CA: Complementary Access
- CNSC: Canadian Nuclear Safety Commission
- CSA: Comprehensive Safeguards Agreement
- DIV: Design Information Verification
- E&R: Enrichment and Reprocessing
- ESARDA: European Safeguards Research and Development Association
- ESO: Euratom Safeguards Office
- EXPO: IAEA Office of External Relations and Policy Co-ordination
- IAEA: International Atomic Energy Agency
- INFCIRC: Information Circular
- IS: Integrated Safeguards
- LOF: Locations Outside Facilities
- MBA: Material Balance Area
- NPA: New Partnership Approach
- NPT: Non-Proliferation Treaty
- NSG: Nuclear Suppliers Group
- NWS: Nuclear Weapon States
- NNWS: Non-Nuclear Weapon States
- NWAL: Network of Analytical Laboratories
- PDIs: Person-Days of Inspection
- PIV: Physical Inventory Verification
- RSAC: Regional System of Accounting for and Control
- SAGSI: Standing advisory Group on Safeguards Implementation
- SAL: Safeguards Analytical Laboratory
- SLA: State-level Approaches
- SQP: Small Quantities Protocol
- SSAC: State System of Accounting for and Control
- UI: Unannounced Inspections
- VOA: Voluntary offer agreements.

EXECUTIVE SUMMARY

During the 2010 Non-Proliferation Treaty Review Conference, States parties recognized that the Additional Protocol (AP) provides increased confidence about the absence of undeclared nuclear material and activities in a State as a whole. They agreed in action 28 of the final document to encourage *"all States parties that have not yet done so to conclude and bring into force an AP as soon as possible and to implement them provisionally pending their entry into force"*. Today, 109 out of 189 States parties to the NPT have brought an AP in force. The remaining outliers have not yet done so for three types of reasons: they do not clearly understand what the AP entails; when they do, they refuse to accept new non-proliferation obligations either on the ground of lack of progress in the realm of disarmament, or simply because they are not ready to bear the burden of additional safeguards measures. Strong incentives are thus needed in order to facilitate universalization of the AP.

While external incentives would help make the AP a *de facto* norm and encourage its conclusion by reducing the deplored imbalanced implementation of non-proliferation and disarmament obligations, internal incentives developed by the Agency and its member States can also play an important role. In this respect, NPT States parties recommended in action 32 of the Review Conference final document *"that IAEA safeguards should be assessed and evaluated regularly. Decisions adopted by the IAEA policy bodies aimed at further strengthening the effectiveness and improving the efficiency of IAEA safeguards should be supported and implemented."*

The safeguards system should therefore be optimized: the most effective use of safeguards measures as well as safeguards human, financial and technical resources would indeed help enhance the acceptability and even attractiveness of the AP. Optimization can be attractive for States committed to a stronger verification regime independently from other claims, but still reluctant to bear the burden of it. Optimization can also weaken the argument according to which States should not accept new obligations while others are not committed to the existing ones, since 'new obligations' finally result in more effective and efficient verification scheme, benefiting to both States and the Agency.

The current evolution of the safeguards system tending to better allocate safeguards activities and resources, doing away with a quantitative approach and promoting qualitative, customized implementation of safeguards is reviewed in Chapter 2. The latter suggests that despite ongoing and positive efforts, remaining difficulties slow down the move to a real 'analytical' or 'factors' driven system. Chapter 3 therefore looks at ways to overcome weaknesses in safeguards approaches, institutional and collaborative practices, in order to develop safeguards resources and measures where the proliferation risk lies and not necessarily on States with large nuclear power and industries. In that sense, optimization implies targeting verification. Three main interconnected tracks are suggested: enhanced selectiveness of verification efforts could be based on a more flexible application of safeguards allowing for transparency and openness dividends; it would require improved institutional transparency; finally, it could be supported by furthering cooperation both at the regional level and with relevant international organisations.

CHAPTER 1.

TARGETING THE PROBLEM

1.1. The importance of implementing additional protocols to meet safeguards objectives

According to Article III.1 of the Non-Proliferation Treaty (NPT), *"Each Non-nuclear-weapon State (NNWS) Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency (IAEA) [...] with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices [...] The safeguards required by this article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere."*

Pursuant to this provision, the IAEA Board of governors approved in 1972 the model comprehensive safeguards agreement (CSA, also referred to as INFCIRC/153)[1], which serves as the basis for the conclusion of agreements and provides the framework for the conclusion of voluntary offer agreements (VOAs) voluntarily accepted by the five Nuclear weapon States (NWS). According to paragraph 28 of the CSA, *"the objective of safeguards is the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection"*. However after the discovery of the Iraqi clandestine nuclear weapons programme, this objective had to be clarified. Therefore the Agency explained *"the need for the safeguards system to provide assurances regarding both the correctness and the completeness of a State's nuclear material declarations was considered by the drafters of the INFCIRC/153 (Corr.) [...]. The scope of INFCIRC/153 was not limited to the nuclear material actually declared by the State; it also includes that which should be declared"*[2].

In order to enhance the Agency's ability to detect and have access to undeclared activities, the Secretariat engaged in an effort entitled 'Programme 93+2'. Its goal was to enable the Agency to effectively meet the completeness requirement by integrating a set of measures that would increase the capability to verify completeness and that would maintain the effectiveness of the current comprehensive safeguards system in a cost-efficient manner.[3] The committee on strengthening the effectiveness and improving the efficiency of the safeguards system was then established by the Board of Governors on 14 June 1996. Its work led to the adoption by the Board of Governors of the model additional protocol (AP, also referred to as INFCIRC/540),[4] which provides the Agency with a broader range of information and broader physical access, thus enabling it to detect undeclared activities.

1 The structure and content of agreements between the Agency and States required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons, doc. INFCIRC/153, 1972.

2 Doc. GOV/2784, 21 February 1995, § 5.

3 Ibid., § 9.

4 Model Additional Protocol to the agreement(s) between State(s) and the International Atomic Energy Agency for the application of safeguards, doc. INFCIRC/540, 1997.

Information and access obligations under articles 2 and 3, and 4 to 10 of the AP

- All parts of a State's nuclear fuel cycle, from uranium mines to nuclear waste and any other location where nuclear material intended for non-nuclear use is present

- All buildings on a site

- State's nuclear fuel cycle R&D activities not involving nuclear material

- Manufacture and export of sensitive nuclear related equipment and material

- Wide area environmental sampling

See IAEA safeguards: staying ahead of the game, IAEA, Vienna, 2007, p. 12.

Tangible progresses towards adoption of the model AP by a large number of States have been made since adoption of INFCIRC/540. As shown by table 1, 109 out of 189 NPT States parties today have an AP in force.

During the last NPT Review Conference, NPT State parties agreed in Action 28 of the Conference's final document to encourage *"all States parties that have not yet done so to conclude and bring into force an additional protocol as soon as possible and to implement them provisionally pending their entry into force."*

Table 1 STATUS OF ADDITIONAL PROTOCOLS (AS OF 27 JULY 2011)

NPT States parties	CSA and VOA in force	AP Board approval	AP Signature	AP Entry into force
189[5]	174	140	135	109

The Conference recognized the importance of the AP, and most States Parties today consider that both a CSA and an AP in force represent the verification standard or norm under Article III of the NPT.[6] However, conclusion of an AP remains legally voluntary, and the latter is not yet universal.

5 Including the Democratic People's Republic of Korea (DPRK), which announced its withdrawal from the treaty in 2003; however, the validity of the withdrawal is still debated.

6 For a brief legal analysis arguing in favour of the position that the AP is, on the contrary, not optional, see J. CARLSON 'Is the additional protocol 'optional', Trust and Verify, issue 132, 2011, pp. 7-8. For a different opinion, see M. ASADA, 'Confronting the challenges to the Non-proliferation treaty: a legal appraisal of recent proposals', Japanese Yearbook of International Law, No. 52, 2009, pp. 67-100.

1.2. The need for incentives to promote the entry into force and implementation of additional protocols

1.2.1 Categories of States without an AP in force

Among States without an AP in force, two types of distinctions can be made: one according to the scope of States' nuclear programmes, and the other according to the stage States have reached within the AP's entry into force negotiation process.

Within the first type of distinction, two categories emerge. The first category is that of States without significant nuclear activities, in other terms with quantities of nuclear material that do not exceed the limit set out in § 37 of INFCIRC/153 and with no nuclear material in a facility. Such States are eligible for a small quantities protocol (SQP) to their CSA. The original model SQP was set out in 1974, and allowed for some safeguards measures to be held in abeyance. In 2005, limitations of such SQPs with respect to safeguards and non-proliferation objectives led the Board of governors to endorse changes in the original model, with the effect of *"(i) making an SQP unavailable to a state with an existing or planned facility; (ii) requiring states to provide initial reports on nuclear material and notification as soon as a decision has been taken to construct or to authorize construction of a nuclear facility and (iii) allowing for agency inspection."*[7] The second category groups together States with significant nuclear activities, having an amount of nuclear material in at least one facility or location outside facilities (LOF) in excess of the exemption limits stated in § 37 of INFCIRC/153.

Within the second type of distinction, three chronological stages appear before entry into force of an AP for a given State, as shown in table 1: negotiations on an AP with the Agency have started, the Board of governors has approved an AP, an AP has been signed by the State.

All NPT States should comply with their non-proliferation obligations so that the Agency can provide the international community with credible assurances that all their nuclear activities remain peaceful. SQP States are also a target of the IAEA verification activities, especially those which have not yet accepted the revised model. However, States with significant nuclear activities have been of greater concern in terms of safeguards implementation. IAEA Deputy Director General Herman Nackaerts recently noted in that sense that *"the wider application of additional protocols is of particular importance, especially in States with significant nuclear activities"*.[8] Among them, more than 70% are currently applying an AP. Within the 30% left, some are well advanced in the process of bringing an AP into force, while others have explicitly refused to do so. International efforts should then focus on the latter, in order to bring them closer to the strengthened system. Table 2 highlights the current States which fall within this category, and gives an overview of the other main 'outliers', further advanced in the entry into force process.

7 J. COOLEY, The State-level approach to international safeguards, Journal of nuclear materials management, No. 4, vol. XXXVII, 2009, p. 12.

8 A Changing Nuclear Landscape: Preparing for Future Verification Challenge, by Herman Nackaerts, IAEA Deputy Director General, Head of the Department of Safeguards, International Forum on Peaceful Use of Nuclear Energy and Nuclear Non-Proliferation, Vienna, 2 February 2011.

Table 2 **Status of AP entry into force process for States with significant nuclear activities (as of 27 July 2011)**[9]

States	Negotiations not started	Board approval	Signature
Belarus		x	x
India		x	x
Iran		x	x provisional application in 2003; suspended in 2005
Iraq		x	x; provisional application as of 17 February 2010
Malaysia		x	x
Serbia		x	x
Thaïland		x	x
Tunisia		x	x
Vietnam		x	x
Algeria		x	
DPRK	x		
Venezuela	x		
Argentina	x		
Brazil	x		
Egypt	x		
Syria	x		

Such a brief account is nonetheless not sufficient: Iran is a good illustration of the fact that being, on paper, a signatory of an AP might not be a good 'non-proliferation sign'. Moreover, most of the signatory or 'Board approval' States reached those statuses years ago but a certain status quo remains as regards entry into force. Their situation with respect to strengthened safeguards implementation has thus not really improved. Deeper analysis of the political, legal and administrative reasons explaining some States' reluctance to bring an AP into force is therefore necessary.

1.2.2 Obstacles to entry into force and implementation of additional protocols[10]

Persistent factors slowing down entry into force and implementation of AP can be presented following three main categories, which are often simultaneously combined for a given State.

First, refusal of the AP might result from a misunderstanding of what it entails. Some States indeed show a *"lack of understanding as to what the AP involves"*[11] : the idea that under the AP, the Agency has 'anytime and anywhere'[12] access has especially been spread. INFCIRC/540 provisions

9 A similar table was done by J. CARLSON in its article 'IAEA Safeguards additional protocol', published on 20 January 2009, available on http://www.dfat.gov.au/asno/publications/index.html. The data were updated with the Status of additional protocols (as of 10 June 2011), available on http://www.iaea.org/OurWork/SV/Safeguards/protocol.html.

10 See J. CARLSON, 'Is the additional protocol 'optional', Trust and Verify, issue 132, 2011, p. 8

11 Ibid.

12 See for instance, as cited by John Carlson, Syrian President Bashar al-Assad Interview with the Wall Street Journal, 31rd January 2011 : 'Nobody will accept to sign [the AP]; this is something about sovereignty: to come any time to check anything under the title of checking nuclear activities, you can check anything. We have many secret things like any other country and nobody will allow them [...] It will definitely be misused'.

however explicitly provide for non mechanistic verification, managed access in order to prevent the dissemination of proliferation sensitive information and to protect proprietary or commercially sensitive information, and maintenance of a stringent regime to ensure effective protection against disclosure of commercial, technological and industrial secrets and other confidential information. Moreover, while adoption of the model AP indeed resulted from awareness that States could have undeclared activities, its implementation should be considered as being in the interest of the State itself, as it enables it to give solid and complete assurance of the peaceful nature of its nuclear programme. But as is the case for nuclear operators, some States still consider the AP as reflecting a 'police' approach to verification[13].

A second category of obstacles to entry into force of the AP is the fact that it encompasses burdensome obligations. In this respect, a former senior policy officer from the Office of External Relations and Policy Co-ordination (EXPO)[14] noted that *"Government officials hesitate to recommend to their authorities to make commitments that are perceived as potentially burdensome."*[15] States might indeed, here again, regard additional obligations more as a burden than as a means to show and improve transparency. The complicated declaration process especially indisputably leads to increased workload for the State. In this respect, the experience of Canada, which has an AP in force, shows that *"Canadian Nuclear Safety Commission safeguards staff typically spends nearly 330 hours over six months reviewing, revising, and compiling the information, which must then be re-formatted using software provided by the IAEA prior to submission. This work represents a significant use of the CNSC's Safeguards Program resources every year"*.[16]

A third category of obstacles lies in the fact that some States also denounce the increased unbalanced character of non-proliferation obligations, as show *"NNWS concerns that they alone would bear the burden of new measures"*.[17] It is nonetheless worth mentioning that all NWS have accepted to voluntarily submit their nuclear activities to safeguards. All have a voluntary offer agreement concluded on the basis of INFCIRC/153 and an AP in force. Finally, and further to the idea of 'unbalanced obligation', political arguments related to the link between non-proliferation and disarmament objective explain, at least partly, the explicit refusal of Brazil, Egypt and Argentina to even consider signing an AP. Brazil indeed stated: *"The Additional Protocol was not a part of that bargain. It was not fair to expect non-nuclear-weapon States, which had already undertaken unequivocal, credible and verifiable commitments to forswear nuclear weapons, to implement further enhanced verification measures, while the international community had yet to be presented with a time frame for achievement of a world free of nuclear weapons"*[18].

Such obstacles to the AP's universality show that adherence to and implementation of the enhanced verification standard (a CSA and an AP in force) results from a cost-benefit analysis. The persistence

13 This perception as it exists among nuclear operators has been expressed by R. WEH, 'The point of view of German facility operators', in E. HÄCKEL et G. STEIN, Tightening the reins: towards a strengthened international nuclear safeguards system, Berlin, Springer, 2000, p. 103.

14 EXPO is the division in charge of outreach activities related to the conclusion of safeguards agreements and additional protocols.

15 J. LODDING, 'Towards wider adherence to the strengthened safeguards system: Additional protocols and small quantities protocols', in Addressing verification challenges, Proceedings of an international safeguards symposium held in Vienna, 16-26 October 2006, contributed papers, IAEA, Vienna, 2007, p 21..

16 Canadian Nuclear Safety Commission, Safeguards Program annual report, 2007-2008, p. 12.

17 L. ROCKWOOD, « Strengthening the effectiveness and improving the efficiency of the I.A.E.A. safeguards system », Nuclear Law Bulletin, 1997, p. 47.

18 Amb. Guerreiro, 2010 NPT Review Conference, Main Committee II, 1st meeting, 10 May 2010, doc. NPT/CONF.2010/MC.II/SR.1, § 36.

of obstacles also reveals the lack of incentives which would outweigh, or at least reduce, the costs currently perceived. Those incentives would make the strengthened safeguards system more attractive or at least more acceptable, without compromising its objectives.

1.3. Optimization of the safeguards system as an incentive

Two types of incentives would help overcome the current obstacles described above. The first type are 'external incentives' which are being developed by States, organizations, or informal cooperation mechanisms outside the IAEA; the second type are 'internal incentives', which come from the Agency itself and from its member States.

1.3.1. External incentives

External incentives are of two types. They can either result from a policy that tends to make the AP a *de facto* norm, and are thus almost comparable to legal requirements; or they can reflect a policy of reciprocity.

The proposal to make the AP a condition of supply of nuclear material, technologies and equipments falls within the first category. During the last NPT Review Conference, many suggestions were formulated in that sense. However, no consensus was reached, the NAM countries especially being opposed to a final document recognizing the AP as the verification standard under Article III of the Treaty. Other channels can nonetheless be found in order to progressively impose the AP as the common norm, and supplier States have here a great role to play. In this respect, the Nuclear Suppliers Group (NSG) agreed during its meeting in Noordwijk in June 2011 to adopt a criteria-based approach to exports relating to enrichment and reprocessing (E&R).

Nuclear Suppliers Group (NSG)

The NSG is a group of 46 nuclear supplier countries which seeks to contribute to the non-proliferation of nuclear weapons through the implementation of Guidelines for nuclear exports and nuclear related exports.

NSG Guidelines are consistent with, and complement, the various international, legally binding instruments in the field of nuclear non-proliferation, including the NPT and IAEA safeguards.

The NSG regime is a voluntary association, not bound by a treaty, and therefore has no formal mechanism to enforce compliance.

Sources: www.nuclearsuppliersgroup.org;
'NSG', in Inventory of International Nonproliferation Organizations and Regimes, www.nti.org.

While former guidelines stated that *"suppliers should exercise restraint in the transfer of sensitive facilities, technology and material usable for nuclear weapons or other nuclear explosive devices"*[19], the new version provides that: *"suppliers should authorize E&R exports only if the recipient has brought into force a comprehensive safeguards agreement and an additional protocol to its IAEA safeguards agreement or 'pending this, if [the recipient State] is implementing appropriate safeguards agreements in cooperation with the IAEA, including a regional accounting and control arrangement for nuclear materials, as approved by the IAEA Board of Governors."*

This evolution is a significant step forward as it expressly mentions the AP as a condition of supply. However, it still allows for an exception for States *"implementing a regional accounting and control arrangement for*

19 INFCIRC/254/Rev.9/Part 1a, § 6.

nuclear materials". The latter is a clear reference to the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC);"[20] Brazil and Argentina, even if vigorously opposed to bringing an AP into force, will thus remain able to benefit from E&R technologies.

The second type of external incentives reflects a search for a better balance between non-proliferation and disarmament obligations. It lies on the idea that if Nuclear Weapons States (NWS) accept to further implement their disarmament commitments, refusal of the AP on the basis of (non-) reciprocity will lack its main raison-d'être. While disarmament initiatives must come from NWS, the IAEA can play a role by being ready to take on new verification missions in those States. In this respect, negotiations on a framework for IAEA verification of the agreement concluded between Russia and the USA concerning the management and disposition of plutonium designated as no longer required for defense purposes is an encouraging sign.[21]

1.3.2. Internal incentives

Internal incentives are those being developed within the safeguards system itself, through collaboration between the IAEA, its member States and NPT States parties which have a CSA and, for some of them, an AP in force. They tend to render the enhanced verification system more acceptable and to a certain extent, more attractive, by making the most effective use of safeguards measures as well as safeguards human, financial and technical resources. In other terms, such incentives are based on the concept of 'optimization' of the safeguards system. During the 2010 NPT Review Conference, some States suggested in that sense to *"request [the] IAEA to engage in discussion in order to identify incentives for States to implement an AP [...], including a reduction in verification costs. Such an approach could facilitate discussions on the Model AP."*[22]

Of great concern when considering the optimization process are the objectives of effectiveness and efficiency. The former was defined by the IAEA Secretariat as *"a measure of the extent to which Agency safeguards are able to achieve the safeguards objectives"*, while the latter is a *"measure of the productivity of Agency safeguards, i.e., how well the available resources (staff, equipment, money) are used to fulfil the Agency's part in the implementation of safeguards."*[23] The question of safeguards efficiency and effectiveness was at the core of the last NPT Review Conference discussions. In Action 32 of the last final document, the Conference indeed *"recommends that IAEA safeguards should be assessed and evaluated regularly. Decisions adopted by the IAEA policy bodies aimed at further strengthening the effectiveness and improving the efficiency of IAEA safeguards should be supported and implemented."*

In November 2010, IAEA Deputy Director General Herman Nackaerts then summed up the Agency's, and member States, challenge in the following terms: *"to apply safeguards more effectively and more efficiently – at a time of rising demand on our services and a static Agency regular budget. In other words, we need to further optimize the use of our resources by avoiding unnecessary effort and focusing instead on that which is most important [...] But – at the same time - we must not compromise our ability to draw independent and soundly-based safeguards conclusions: we must continue to apply safeguards in a fair and non-discriminatory manner to all States"*.[24]

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20 D. Horner, 'NSG Revises Rules on Sensitive Exports', 27 June 2011, on http://www.armscontrol.org/20110627/NSG_Revises_Rules_on_Sensitive_Exports.

21 Referred to as the Plutonium management and disposition (PMDA) agreement, as amended by the 2010 protocol.

22 Switzerland, 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of nuclear weapons, Main Committee II, Summary record of the 3rd meeting, doc. NPT/CONF.2010/MC.II/SR.3, 7 June 2010, § 19. See also Sweden, as reported in NPT News in Review, No. 10, 14 May 2010, p. 10.

23 Doc. GC (XXXVIII)/17, 29 August 1994, p. 4.

24 Statement at Symposium on International Safeguards: Preparing for Future Verification Challenge, by Herman Nack-

Optimization should then reconcile the *"conflicting demands of high-quality service and low cost"*[25], by ensuring both the effectiveness and the efficiency of the safeguards system. It should guarantee achievement of safeguards and non-proliferation objectives at minimum human, technical and financial cost. The AP would thus become more acceptable, but also attractive: States would see more clearly that its implementation is not as burdensome as expected and enhances national, as well as international security. As naive as it may appear to some, the idea that it is in every State's interest to bring an AP into force, not only to show good faith to other States[26] but also their own domestic security, remains a factor of the AP's acceptance.

1.3.3. Scope of the study

The study focuses on internal 'optimization' incentives that will enhance the acceptability and attractiveness of a strengthened safeguards system. The link between the latter and optimization is nonetheless not absolute. External incentives that have little to do with the safeguards system itself are also necessary. It is indeed doubtful that States firmly refusing to bring an AP into force on the ground of insufficient progresses in the realm of disarmament will change their mind once the verification process is fully optimized. In this respect, reflection on universalization of the AP from an external perspective should be given further consideration. Optimization can nonetheless be attractive for States committed to a stronger verification regime independently from other claims, but still reluctant to bear the burden of it. It can also weaken the argument according to which States should not accept new obligations while others are not committed to the existing ones, since 'new obligations' finally result in more effective and efficient verification scheme, benefiting to both States and the Agency.

After reviewing the evolution of the safeguards system in terms of optimization, the study suggests an evolution towards targeted and tailored verification, based on measures that make the most effective use of the Agency's financial resources, staff skills and experience but also of safeguards measures as provided for in the CSA and the AP and of information available to the Agency.

Chapter 1 Conclusion

Even though the additional protocol is now in force in 109 NPT States parties which widely recognize its importance, persisting factors slow down its universalization and full implementation. However, the remaining obstacles can be tackled through both external and internal incentives. Amongst the latter, optimization of the IAEA safeguards system to ensure its effectiveness and efficiency can help promote universalization of the AP. The IAEA has already adopted measures in that direction.

aerts, IAEA Deputy Director General, Head of the Department of Safeguards, 1st November 2010.

25 B. Pellaud, 'The strengthened safeguards system : objectives, challenges and expectations', in E. Häckel et G. Stein, Tightening the reins: towards a strengthened international nuclear safeguards system, Berlin, Springer, 2000, p. 91.

26 In that sense, see R. Weh, 'The point of view of German facility operators', in E. Häckel and G. Stein, Tightening the reins: towards a strengthened international nuclear safeguards system, Berlin, Springer, 2000, p. 101 :'The objective of strengthening safeguards measures is quite obviously the desire of states to present themselves in a favourable light by removing, from the start, any doubt as regards non peaceful intentions by making their respective nuclear activities transparency'.

CHAPTER 2.

REVIEW OF THE SAFEGUARDS SYSTEM EVOLUTION

The Department of Safeguards has been working on new conceptual approaches to optimize the safeguards system. Herman Nackaerts, head of the Safeguards department, recently insisted on the need to *"move further away from an approach that is narrow, prescriptive, criteria-driven, and focused at the facility level – to one that is more objectives-driven, customized, and focused at the State level. This makes sense because we need to be guided by objectives rather than procedures: concerned with outcomes rather than processes."*[27]

The recently adopted Long-term Strategic Plan of the Department of safeguards seeks to implement this ideological evolution[28].

A brief analysis of relevant developed approaches nonetheless reveals room for improvement. Although the review is non exhaustive and focuses on what could be improved from a 'verification incentive' perspective, it highlights important implementation issues.

2.1. Safeguards concepts and approaches

2.1.1. Information-driven safeguards

Among the IAEA proposals for the 2010-2011 biennium, the move towards an 'information driven safeguards system' is of particular significance. Information-driven safeguards are *"safeguards whose planning, conduct and evaluation are based on an ongoing analysis of all safeguards relevant information available to the Agency about a State to focus verification activities in the field and at Headquarters"*[29]. They aim at *"understanding and assessing the consistency of information on a State's nuclear programme as a whole."*[30] To reach that goal, the IAEA tends to make maximum use of the broadest spectrum of information, including *"those (i) provided by States under safeguards agreements, additional protocols or voluntarily; (ii) derived from IAEA in-field verification activities or (iii) obtained from open and other sources of safeguards relevant information"*[31]. 'Third-party', in other terms intelligence information, is also taken into account.

Implementation issue 1

The expression 'information-driven safeguards' is neither self-explanatory nor revolutionary as such: safeguards activities have always been driven by information, obtained *via* States declarations and IAEA verification activities. A new concept should however reflect the real evolution of the Agency's work in the field of safeguards: the use of a wider spectrum of information, and consequently, the challenge of properly analysing this information in order to be able to give a coherent picture of State's nuclear programme as a whole by concluding on correctness and completeness of States' declarations.

27 Statement at Symposium on International Safeguards: Preparing for Future Verification Challenge, by Herman Nackaerts, IAEA Deputy Director General, Head of the Department of Safeguards, 1st November 2010.

28 J. COOLEY, 'Department of Safeguards Long-term strategic plan, 2012-2023', IAEA Symposium on international safeguards: 'Preparing for future challenges', 1 November 2010.

29 IAEA 2009 Annual report, p. 79.

30 The Agency's programme and budget, 2010-2011, GC (53)/5, p. 2.

31 IAEA safeguards : staying ahead of the game, IAEA, Vienna, 2007, p. 20.

Implementation issue 2

Using a broader spectrum of information, the IAEA does not only rely on States declarations and becomes more equipped to detect undeclared activities. While the majority of IAEA member States welcomes this evolution, development of an 'investigative' approach to verification and the use of some types of information might also be feared by a few.

Reliance on satellite imagery has for instance not been welcomed by all. Such source of information mainly comes from commercial providers and is analysed by the Satellite Imagery Analysis Unit of the Division of Safeguards Information Technology of the Department of Safeguards. Its use can help optimize on-site verification by better selecting locations that need to be visited and minimizing the impact on operators and States' activities. So far, it has provided *"insights into previously undeclared programmes and activities"* and *"proved to be a great asset to the Agency's investigations, particularly in those cases where access was restricted or denied."*[32]

Concerns and to a certain extent suspicions related to the use of commercially available satellite imagery nonetheless arose during the sessions of the Advisory Committee on Safeguards and Verification within the Framework of the IAEA Statute. The latter, named Committee 25, was established in June 2005 with an initial two-years mandate to consider ways and means to strengthen the safeguards system and to make relevant recommendations to the Board. Its work was reported in document GOV/2007/27[33], and revealed the expression by IAEA member States – but not by the Committee itself – of reluctance to support the development of satellite imagery by the IAEA. Such an attitude can reflect either ignorance of international rules allowing for remote sensing, or fear that the Agency does not independently analyse the information it receives.

In this respect, recourse to intelligence information, derived from national technical means or from human intelligence, has also raised doubts. So-called 'third-party information', solicited by the Agency or spontaneously provided, proved very useful during IAEA verification of the Iraqi nuclear programme. But as its use has become more common, *"one cannot ignore that [intelligence] information can be as unreliable as that provided by a concealing State. Numerous inspections triggered by a defector's information ended up with no finding at all, and, in some cases, wasted considerable resources."*[34]

The move towards true 'information-driven safeguards' therefore requires the necessary resources and training enabling the Agency to independently corroborate all the information gathered.

2.1.2. State-level approaches to safeguards implementation and evaluation

Development of 'strengthened safeguards' to detect diversion of nuclear material but also undeclared activities led the IAEA to rethink safeguards implementation and evaluation. 'State-level approaches' (SLA) are now developed for each States; SLA take into account State-specific factors to determine implementation of safeguards activities. Hence, SLA reflect a *"shift in emphasis from evaluating information on a facility-by-facility basis to the consideration of information for the State as a whole"*[35], and allow for more flexibility in safeguards implementation and evaluation.

Implementation issue 3

State-level approaches are also developed for States with only a CSA in force. In this respect, a current trend within the Agency consists in recognizing that while many States are reluctant to bring

32 IAEA 2009 Annual report, p. 85.

33 The distribution of this document is unfortunately restricted.

34 J. Baute, 'A concrete experience: the Iraq case', in R. Avenhaus (dir.), Verifying treaty compliance: limiting weapons of mass destruction and monitoring Kyoto protocol provisions, Berlin, 2006, Springer, p. 245.

35 R. Hooper, 'The changing nature of safeguards', IAEA Bulletin, No. 1 vol. 45, June 2003, p. 9.

an AP into force, there is nonetheless a need to move forward by adapting the system even to those States. Such a resigned, yet realistic (Brazil, Argentina and Egypt for instance do not seem quite ready to adhere to the AP, no matter what the Agency does) position could undermine the general conviction that the AP is of crucial importance to fulfil safeguards objectives. 'Rewarding' non AP States by allowing them to access a too flexible verification system could also raise discontent within AP States which fully play the game of transparency.

Implementation issue 4

While flexibility seems to be at the core of the evolving safeguards system, mechanistic and quantitative criteria to determine safeguards activities in a State remain too important. This current trend leads to devote a great portion of safeguards resources to verification in States with major nuclear programmes, but which seem to raise no 'proliferation concerns' as they fully comply with their safeguards obligations. Canada, Japan and Germany are thus today the biggest 'customers' of the IAEA, even though they all have an AP in force, strong State or Regional systems of accountancy for and control of nuclear material in place and general good cooperation with the Agency.

2.1.3. Integrated safeguards (IS)

The 'Conceptual framework for integrated safeguards' was adopted by the Board of Governors in 2002.[36] IS are *"an optimized combination of measures under comprehensive safeguards agreements and additional protocols."*[37] They are implemented in States with both a CSA and an AP in force, after the Secretariat has been able to draw the broader conclusion: the latter establishes that all nuclear material in a State has remained in peaceful activities or in other terms, that States' declarations are correct and complete. Consequently, due to increased assurance of the absence of undeclared nuclear material and activities for the State as a whole, the intensity of inspection activities at declared facilities and location outside facilities (LOFs)[38] can be reduced. The logic behind IS and the search for an optimum combination of safeguards measures can be illustrated by the following example: *"If the IAEA can draw a conclusion regarding the absence of any undeclared reprocessing plant in a state with both a CSA and an AP in force, it follows, prima facie, that it needs to spend less effort to verify that there has been no diversion of irradiated nuclear fuel in that state. This contributes to 'the optimum combination of measures' for effectiveness and efficiency"*.[39]

Integrated safeguards rely on a randomization of the verification process, as greater use of unannounced verification activities enables a significant reduction of IAEA presence in the field. The Agency may indeed carry a portion of routine inspections without advance notification[40] or with short notice. Moreover, under the additional protocol, complementary accesses (CA) shall be noticed 24 hours in advance, but that time is reduced to 2 hours when CA are sought in conjunction with design information verification visits or ad hoc or routine inspections on a site; in exceptional circumstances, notification time can be less than 2 hours.[41] Combination of these two measures *"allows for the*

36 'The Conceptual Framework for Integrated Safeguards', GOV/2002/8, 8 February 2002.

37 See Safeguards statement for 2010, § 10, 11, 12, 13, 14. The safeguards statement contains the safeguards conclusions drawn for all States with safeguards agreements in force and, where applicable, additional protocols in force, are reported; where applicable, it also reports on any case of non-compliance of a State with its safeguards agreement. It forms part of the Safeguards implementation report which is the 'main vehicle whereby the Director General of the IAEA reports to the IAEA Board of Governors on safeguards implementation in the preceding calendar year' (See IAEA Safeguards glossary, 2001 edition, Vienna, 2001, p. 103).

38 A Location outside facilities 'means any installation or location, which is not a facility, where nuclear material is customarily used in amounts of one effective kilogram or less' (INFCIRC/540, article 18, j.).

39 J. Cooley, 'Integrated nuclear safeguards: genesis and evolution', Verification yearbook 2003, Vertic, p. 33.

40 INFCIRC/153, § 84.

41 INFCIRC/540, article 4, b).

fastest access to any place on a site and [...] constitutes the greatest effect of surprise concerning the operator"[42]; potential undeclared activities are thus more easily detected.

Norway's experience of integrated safeguards implementation as reported in table 3 shows such an evolution. This country concluded in 2008 that: *"with the traditional safeguards regime the IAEA spent between 9 and 11 days every year. With integrated safeguards fully implemented the number of days stayed around the same for the first years, but has been reduced to 7 days for the last two years. It remains to see if this trend will continue."*[43]

Table 3 On-site activities in Norway after introduction of integrated safeguards[44]

Material balance area	Traditional safeguards	Integrated safeguards
NOC (Halden boiling heavy water reactor aimed at research on natural uranium with heavy water power production + storage for fresh and spent fuel)	4 Physical Inventory Verification[45] (PIV) /year	1 PIV /year + 2 unannounced inspections/year
NOA (Jeep II pool research reactor)	3 PIV /year	1 PIV/every 4 year
NOB (storages for fresh and spent fuel, metallurgical lab, pellet production plant)	3 PIV /year	1 PIV/year + 1 unannounced inspection /year
NOD (small locations outside facilities such as industrial radiography companies, University of Oslo, etc.)	1 PIV / every 3 year	1 PIV/every 4 year

Implementation issue 5

As indicated in table 4, implementing integrated safeguards (IS) once the AP is in force generally takes up to 5 years; different factors explain what can be considered a significant length of time. They should be examined following two stages: first, the drawing up of the broader conclusion and second, the implementation of IS after the broader conclusion has been drawn.

42 A. Rezniczek and C. Xerri on behalf of the ESARDA Working Group on Integrated Safeguards, 'Aspects of Unannounced Inspections- A View of the ESARDA WG on Integrated Safeguards', Esarda Bulletin No. 32, 2004, pp. 64-65.
43 T. Sekse, Norwegian radiation protection authority, 'Safeguards in Norway, Experiences with integrated safeguards', Esarda Bulletin, No. 38, June 2008, p. 6.
44 See T. Sekse, Norwegian radiation protection authority, 'Safeguards in Norway, Experiences with integrated safeguards', Esarda Bulletin, No. 38, June 2008, pp. 5-6.
45 Physical Inventory Verifications (PIV) are inspection activities during which data contained in the list of inventory items prepared by the operator are correlated with the physical inventory listing reports submitted by the State to the IAEA (See IAEA Safeguards glossary, 2001 edition, p. 56).

Table 4 INTEGRATED SAFEGUARDS IMPLEMENTATION TIMELINE, FOR STATES WHERE IS IMPLEMENTATION STARTED IN 2009 AND 2010 [46]

State	AP's entry into force	Implementation of Integrated Safeguards	Total number of years required to implement Integrated safeguards.
Armenia	28 June 2004	2009	5 years
Belgium	30 April 2004	2009	5 years
Burkina Faso	17 April 2003	2009	6 years
Denmark	30 April 2004	2009	5 years
Estonia	1 December 2005	2009	4 years
Germany	30 April 2004	2010	6 years
Madagascar	18 September 2003	2009	6 years
The Netherlands	30 April 2004	2010	6 years
Slovakia	1 December 2005	2009	4 years
Spain	30 April 2004	2010	6 years
Sweden	30 April 2004	2009	5 years

- *Factors explaining the time to draw the broader conclusion*

The process of drawing a broader conclusion starts with entry into force of an additional protocol. Within 180 days thereafter[47], the State must submit an initial declaration containing the information identified in relevant paragraphs of article 2 of the model AP. Upon receipt of the initial declaration, the Agency performs a detailed review and evaluation of the information provided during which clarifications or questions on the declaration may arise. Complementary access may be conducted and followed by other actions. An evaluation of all the information obtained is then carried out for the State as a whole; only then the broader conclusion can be drawn.[48]

Various factors can slow down or at least complicate the whole process. In this regard, Sweden's experience of IS implementation as summarized in table 5 highlights a few difficulties arising out when completing the initial declaration, such as identification of all the research projects and nuclear-related activities in a State. Answering requests for clarifications on past activities can also take some time. In the case of Ukraine, it was reportedly problematic to trace back information on uranium conversion and past nuclear weapon related infrastructure, as major part of information was owned by the Ministry of Defense of the Soviet Union and therefore not entirely available.[49]

With respect to other factors slowing down the process, some States also complain about the timeliness of IAEA reporting, stating that it might take up to two years to get the result of an inspection.

46 Source: Safeguards statements for 2009 and 2010.

47 Article 3, a) of INFCIRC/540.

48 See K. MURAKAMI, 'Implementation of the additional protocol : progress and experience', Symposium on International Safeguards: Verification and Nuclear Material Security, 29 October -2 November 2001.

49 S. LOPATIN, 'Steps of Ukrainian SSAC to integrated safeguards', Symposium on International safeguards, preparing for future verification challenges, Session 14 : Furthering IAEA-State safeguards cooperation, 3 november 2010.

Table 5 SWEDEN'S EXPERIENCE OF THE INTEGRATED SAFEGUARDS IMPLEMENTATION PROCESS

AP's entry into force	Initial declaration and difficulties	IAEA verification activities	Broader conclusions	Integrated safeguards
30 April 2004	Completed by 20 October 2004 Difficulties *"related to the research projects, as it was difficult both to identify the possible actors for reporting research and, also, which projects were to be selected for the final declaration. In total Sweden ended up with about 30 projects"*.	CA at research facility on 16 march 2005 ↓ Request for clarifications; around 50 questions, especially on uranium prospecting and mining activities performed during the 1950s-60s.	2006	15 January 2009 Among other things, obtaining a functioning mailbox system/ drawing an approach for fuel fabrication plants took time.

▪ *Factors explaining the time to implement IS after the broader conclusion has been established*

According to table 6, integrated safeguards were implemented in 47 out of 57 States for which broader conclusions had been drawn. Thus, IS implementation is neither automatic nor immediate; in Sweden, it took around 3 years (see table 5).

Table 6 STATUS OF INTEGRATED SAFEGUARDS IMPLEMENTATION (AS OF 31 DECEMBER 2010)[50]

	States with a CSA and AP in force	Broader conclusion drawn	Integrated safeguards implemented
Total	99	57	47

A State-level integrated safeguards approach needs indeed be prepared, taking into account features and characteristics of the State's nuclear activities, State-specific factors and the Agency's experience in the State.[51] Difficulties at this stage reflect each State nuclear features, but also encompass classical administrative or technical issues, such as obtaining a 'functioning mailbox system' as was the case for Sweden. Those problems seem inevitable but reinforce the perception that IS implementation is a long and complicated process.

50 As stated in the Safeguards statement for 2010.

51 See J. COOLEY, 'The State-Level Approach to IAEA Safeguards Implementation', INMM/ESARDA Workshop, Santa Fe, New Mexico, 30 October to 2 November 2005, p. 19.

Implementation issue 6

IS lead to a significant drop in the number of IAEA inspections. On the other hand, the number of national inspections conducted by the State System of Accounting for and Control (SSAC) might increase. In the case of Finland, STUK [the national radiation and nuclear safety authority] inspections indeed considerably multiplied[52]. South Korea's experience on the contrary shows a decrease of national inspection efforts, but only up to 17%, whereas the IAEA saves almost 40%.[53] The verification burden thus shifts from the Agency to States. This trend was actually welcomed by Finland which was eager that the IAEA and Euratom *"utilise more the expertise of the Finnish SSAC. The inspectors of STUK can perform all kind of safeguards inspections alone. A reasonable goal of all three agencies could be that STUK could carry out routine safeguards activities under the control of the IAEA and/or Euratom."*[54]

However, more efforts on the part of the national authority are consequently required. South Korea recently highlighted in this respect *"hidden chores under integrated safeguards"* which include a tension between *"randomness and preparedness (standby alert and hurry-up for accompany); physical reduction of inspection support but increase of other jobs; increase of IAEA technical work but increase of corresponding support (visiting arrangement and technical support)."*[55] Canada also underlined the fact that while randomized verification is of high cost-effectiveness for the IAEA, difficulties associated with short-notice or unannounced inspections remain for the State and the operator: *"It is much more difficult for the Canadian Nuclear Safety Commission (CNSC) safeguards staff to attend short notice randomized inspections given the short lead time. [...] Unannounced inspections [...] are called with no prior notice at all, making it impossible for the CNSC to attend [...]. Similarly, CAs are typically arranged on a short notice basis; as a result, and based on a risk assessment of the locations chosen for access, CNSC safeguards staff do not attend all CAs conducted by the IAEA; out of six CAs carried out in 2007-08, only one was attended by a safeguards staff."*[56]

Implementation issue 7

Even though IS consist in finding the 'better combination' of safeguards measures, the risk of a 'better addition' of the latter remains. The idea has been expressed in the following terms: *"IAEA safeguards manager could have the inclination to bring to the additional protocol the same rigid planning mentality used for nuclear material accountancy, rather than assuming their responsibility in deciding what to do on a case-by-case basis and how frequently to do it."*[57]

This is currently the perception of a few which state that ***"****the IAEA - and to some extent Euratom also - seem to use the expression of 'improving the effectiveness and efficiency of safeguards' to justify any extra measures. There really should be a more critical evaluation of existing and proposed new safeguards measures in order to choose the right ones. To keep on adding new safeguards measures on*

52 E. Martikka, 'Integrated safeguards in Finland', States experiences/views on implementation of integrated safeguards, Forum Session 13, Symposium on international safeguards, 2 November 2010; Implementing nuclear non proliferation in Finland, Regulatory control, international cooperation and the Comprehensive Nuclear-Test-Ban Treaty, Annual report 2010, STUK, p. 23.

53 G.-S. Min, 'Korea's experience on the integrated safeguards implementation', States experiences on implementation of integrated safeguards, Forum Session 13, Symposium on international safeguards, 2 November 2010.

54 M. Tarvainen and M. Antilla, Integrated safeguards proposal for Finland, Final report on Task FIN C 1264 of the Finnish Support Programme to IAEA Safeguards, STUK, Helsinki, 2000, p. 14.

55 G.-S. Min, 'Korea's experience on the integrated safeguards implementation', States experiences on implementation of integrated safeguards, Forum Session 13, Symposium on international safeguards, 2 November 2010.

56 Canadian Nuclear Safety Commission, Safeguards Program Annual Report, 2007-08, p. 22.

57 B. Pellaud, The strengthened safeguards system: objectives, challenges and expectations, in E. Häckel and G. Stein, Tightening the reins: towards a strengthened international nuclear safeguards system, Berlin, Springer, 2000, p. 92.

top of those in place is not good practice, as it merely increases costs - both for the plant operator and for the inspectorates (and therewith the international taxpayer) . There should be the aim of cutting back on those safeguards measures which are evaluated to have low effectiveness or efficiency."[58]

Some States also denounce multiple controls of the same item within a short period of time.

Conclusion 1

The move from a mechanistic to an 'information-driven' and flexible safeguards system is in progress. However, verification activities could be determined with more flexibility, keeping quantitative criteria to a minimum compatible with effectiveness while developing more qualitative criteria. In this respect, there is room for improvement in the development and implementation of safeguards concepts and approaches, especially integrated safeguards.

2.2. Technological and analytical capabilities improvements

The IAEA has been working to make the most effective use of analytical capabilities at its disposal but also to develop new efficient and effective safeguards techniques and technologies. Remote monitoring systems have proven very useful in this respect. Without undermining the added value of on-site presence, the Deputy Director General indeed recently underlined that *"the availability of remotely-acquired information can be extremely useful to make our work more effective and efficient. In this respect, we will soon be benefitting from our next generation surveillance system: designed to provide a modern and secure environment that will allow us to easily record and store authenticated and tamperproof surveillance data, and to transmit them to Agency headquarters here in Vienna."*[59]

Technological concepts and approaches are also being developed, such as 'safeguards by design'; the latter is defined as *"a new approach to the design and construction of nuclear facilities in which nuclear safeguards provisions and features are designed into the facility from the very beginning of the design process."*[60]

Finally, improvements of the analytical infrastructure are being undertaken: a project to enhance the capabilities of the safeguards analytical services (the ECAS project) was established in order to ensure that the Agency's laboratories can keep up with the task of providing the necessary analytical support for the analysis of nuclear material and environmental samples in a cost-effective, timely and reliable manner.

Implementation issue 8

While 1125 facilities are today under safeguards, the IAEA has at its disposal only 2 truly international laboratories, with one of them exclusively dedicated to safeguards analysis: the Safeguards Analytical Laboratory (SAL), located in Seibersdorf (the other laboratory being in Monaco). Nuclear material samples analysis as well as environmental samples of water, soil and vegetation analysis are conducted in SAL, in order to verify both the non-diversion of nuclear material and the absence of undeclared activities. Safeguards analysis is also delegated to the Network of analytical laboratories (NWAL).

58 P. Friend, 'Urenco's views on international safeguards inspections', 8th International Conference on Facility Operations – Safeguards Interface, March 30 – April 4, 2008.

59 Statement at Symposium on International Safeguards: Preparing for Future Verification Challenge, by Herman Nackaerts, IAEA Deputy Director General, Head of the Department of Safeguards, 1st November 2010.

60 T. Bjornard, R. Bean, P.C. Durst, J. Hockert and J. Morgan, 'Implementing safeguards by design', Idaho National Laboratory, February 2010, p. 2.

The latter gather 19 laboratories in 8 States, the European Community and the United Nations[61]. The laboratories remain national but have contracts with the Agency.

NWAL's support is necessary for various reasons: the laboratories provide complete analytical backup in case of single-point failure of SAL, they can carry out special or unusual analyses that are not ready available at IAEA SAL, and they can accommodate any additional workload.[62] The Agency could not keep up with samples analysis without NWAL, as repartition of the workload shows: 75% of environmental samples analysis is done by NWAL, and while *"nuclear sample NWAL has fallen dormant due to shipping and State restrictions and timeliness requirements"*, 95% of most sensitive particle analyses are done by the network. The Agency's analytical capabilities are thus closely related to national analytical capabilities. They also constantly face the challenge of ageing infrastructure, space constraints and safety and security standards.[63]

Conclusion 2

Technological and infrastructure improvements are clearly one of the major means to optimize the safeguards system. To keep up with its increasing workload, the IAEA needs to make the most effective use of its analytical resources, and constant member States support in that sense is necessary.

2.3. Cooperation with SSAC and RSAC

Increased co-operation with State and regional systems of accounting for and control of nuclear material (SSAC and RSAC) has been a recurrent aspect of efforts to strengthen the effectiveness and improve efficiency of the safeguards system.[64] A New Partnership Approach (NPA) between the IAEA and Euratom was developed in this context, in order to improve efficiency. It was based on optimization of the necessary practical arrangements and the use of commonly agreed safeguards approaches and inspection planning, procedures, activities, instruments, methods and techniques. It included use of commonly shared analysis capabilities in order to reduce the number of samples to be taken, transported and analyzed, co-operation in research and development and in the training of inspectors with the aim to achieve a reduction of resources spent on both sides and to lead to commonly agreed products and procedures, and increasing common use of technologies to replace, to the extent possible, the physical presence of inspectors by appropriate equipment.[65]

An IAEA report concluded that *"the implementation of the NPA ha[d] resulted in a sizeable reduction (about 50%) in Agency person-days of inspection (PDIs) in States belonging to the European Union without any relaxation of the requirement that the Agency draw its own independent conclusions."*[66]

Implementation issue 9

When considering the potential for further cooperation between the IAEA and SSAC/RSAC, the

61 A. Hamilton, 'Network of analytical laboratories (NWAL), Current Status', IAEA Safeguards symposium 2010, Session 12, The Network of Analytical Laboratories - Expansion and Reform, 2 November 2010.
62 J. W. Neuhoff, 'Network of analytical laboratories: expansion and reform', IAEA Safeguards symposium 2010, Session 12, The Network of Analytical Laboratories - Expansion and Reform, 2 November 2010.
63 See C. Schmitzer, 'The IAEA's New Nuclear Material Laboratory (NML)', IAEA Safeguards Symposium 2010, Session 4, Nuclear Material and Environmental Sample Analysis: New Horizons, 2 November 2010.
64 See for instance Task 4 of Programme 93+2, in Strengthening the effectiveness and improving the efficiency of the safeguards system, A report by the Director general, doc. GC (XXXVIII)/17, 29 august 1994, p. 18.
65 Doc. GC (XXXVII)/1073, 6 September 1993, § 20-21.
66 Doc GOV/2807, § 33.

Standing Advisory Group on Safeguards Implementation (SAGSI) insisted on the preservation of *"IAEA reserved powers"*, in other terms *"functions that cannot be delegated or otherwise accomplished by organizations or personnel other than the IAEA and its inspectors"*.[67] CSA provisions indeed state that the Agency independently verifies SSAC/RSAC findings.

However, it also provides that *"the Agency, in carrying out its verification activities, shall make full use of the State's system of accounting for and control of all nuclear material subject to safeguards under the Agreement, and shall avoid unnecessary duplication of the State's accounting and control activities."*[68] Moreover, *"the criteria to be used for determining the actual number, intensity, duration, timing and mode of routine inspections of any facility shall include [...] the effectiveness of the State's accounting and control system"*.[69]

Despite legal provisions foreseeing and trying to avoid the tensions between non-duplication and IAEA independent verification, such tensions remain. Finland for instance pointed out that *"the amount of international safeguards work has almost doubled in Finland after her EU membership, because the representatives of both the IAEA and Euratom participate still in almost every inspection"*.[70]

Conclusion 3

Even if both the IAEA and SSAC/RSAC recognize the need to improve cooperation, persisting tensions slow down full optimization of existing provisions and arrangements, and result in duplication of verification efforts.

2.4. Institutional issues

As noted by the Deputy Director General, the new safeguards approaches and concepts have *"implications for how the Agency operates internally."*[71] Information-driven safeguards, implementation of integrated safeguards and further cooperation with SSAC/RSAC indeed pose great challenges from an internal institutional perspective. The Deputy Director General indeed recognizes the need *"to revise some of our business processes, better define responsibilities, and make changes to the organization itself"*, as well as the *"need to enhance the skill sets of our workforce and to foster the required organizational culture."*[72] The IAEA indeed currently faces major challenges in terms of institutional functioning.

Implementation issue 10

The move towards a true 'information-driven' safeguards system raises institutional issues in terms of 'cost-balance'. The Secretariat has recognized a possible *"increase in costs related*

67 J. Casterton, 'The further evolution of SSAC/IAEA cooperation : SAGSI's considerations', A presentation to the IAEA Safeguards Symposium, 3 November 2010.
68 INFCIRC/153, § 31.
69 INFCIRC/153, § 81.
70 M. Tarvainen and M. Antilla, Integrated safeguards proposal for Finland, Final report on Task FIN C 1264 of the Finnish Support Programme to IAEA Safeguards, STUK, Helsinki, 2000, p. 11.
71 A Changing Nuclear Landscape: Preparing for Future Verification Challenge, by Herman Nackaerts, IAEA Deputy Director General, Head of the Department of Safeguards, International Forum on Peaceful Use of Nuclear Energy and Nuclear Non-Proliferation, Vienna, 2 February 2011.
72 Ibid.

to the implementation of safeguards in any State during the period after an AP enters into force and pending a conclusion of the absence of undeclared nuclear material and activities". Benefits resulting from decreased verification in the field are then challenged by other costs associated with increased analysis at headquarters and technical visits in the field, since there are increased expenses *"related to information review and evaluation at Headquarters, to the follow-up of questions and inconsistencies, to the implementation of complementary access on a selective basis, to the purchase of new equipment and the covering of increased communication costs following the progressive use of remote monitoring where relevant."*[73] Costs related to the maintenance and upgrading of installed equipment are also important.

Implementation issue 11

Tensions remain especially between the evolution of the safeguards system and adaptation of the organizational 'culture'. Compartmentalization within Departments, divisions and units are still observed and there is a lack of horizontal communication. The 'need to know' principle, at the core of the Agency's confidentiality regime, confronts the 'need to share', and a few years ago, members of the Agency have in this respect noted that *"the current organizational spread [was] not conducive to an optimal communication between the evaluators."*[74]

Implementation issue 12

Difficulties also appear on a more external institutional perspective. The International Commission on Non-proliferation and Disarmament in that sense concluded that there was a need for *"greater transparency of [the Agency's] own processes, and a re-evaluation of its longstanding practice that information provided to it is confidential"*[75], while others noted that *"confidentiality has been a hallmark of reporting on the Agency's safeguards implementation, and the general rule has been 'no news is good news'"*.[76] Such comments show that there is a deficit of perception of the Agency's transparency.

Implementation issue 13

One of the most problematic institutional challenges currently facing the Agency is that of politicization, as failure of previous institutional attempts to optimize the safeguards system reveal. Committee 25 was indeed unable to reach an agreement on recommendations to submit to the Board.[77] According to a few sources from the Agency, the work of the Committee was even starting to become counterproductive as political considerations took over what should have remained a technical review. Iran indeed denounced *"the US proposal to establish the committee on strengthening safeguards, which of course failed after two years' as one of the 'examples of a pre-planned hidden agenda."*[78]

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73 Doc. GC (44)/12, 16 August 2000, § 31.

74 L. Bevaart, F. Claude, J. Lepingwell, M. Nicholas, H. Rilakovic, P. Caulfield, 'Safeguards information analysis: Progress, challenges and solutions', in Addressing Verification Challenges, proceedings of an international safeguards symposium, Vienna, IAEA, 2007, pp. 57-58, p. 62.

75 G. Evans and Y. Kawaguchi (co-chairs), Eliminating nuclear threats, a practical agenda for global policymakers, Canberra, International commission on nuclear non-proliferation and disarmament, 2009, p. 86.

76 J. Larrimore, M. Kratzer, J. Carlson, and B. Moran 'Transparency and openness : roles and limitations in the nuclear nonproliferation verification system', Journal of Nuclear Materials Management, Fall 2006, Volume XXXV, No. 1, p. 12.

77 Doc. GC(51)/8, 23 July 2007, § 3.

78 Statement by H.E. Ambassador Soltanieh, permanent representative of Islamic Republic of Iran, Board of governors of the IAEA, 17th June 2009, in doc. INFCIRC/761, 29 June 2009.

Bipolarisation of the Board of Governors reflects the persistent tensions between non-proliferation and disarmament obligations on the one hand, and non-proliferation obligations and right to peaceful uses on the other. Conventional imbalances are thus illustrated by institutional ones, contributing to an erosion of the Agency's legitimacy.

Conclusion 4

Institutional culture and practices need to follow the legal and policy-formulated evolution of the safeguards system. Adaptation nonetheless requires strong political support In this respect, it is possible, and needed, to work on optimization within the existing legal framework. New instruments are neither desirable nor realistically conceivable, due to the current political environment.

Chapter 2 Conclusion

Current evolution of the safeguards system tends to better allocate safeguards activities and resources, doing away with a quantitative approach and promoting qualitative, customized implementation of safeguards. However, despite ongoing efforts, remaining difficulties in the development and implementation of safeguards approaches, techniques, cooperative practices and institutional organization slow down the move towards a fully optimized system.

Chapter 3 of this study therefore looks at ways, through shared efforts between the Agency and States, to overcome, those weaknesses in order to better target safeguards activities where they are needed.

CHAPTER 3.

TARGETING VERIFICATION

Optimization of the IAEA safeguards system consists in implementation of 'intelligent safeguards': this implies that safeguards resources and measures are developed where the proliferation risk lies[79] and do not necessarily focus on States with large nuclear power industries. [80]

A real 'analysis-driven', 'factors-driven' or 'State-level driven' safeguards system (rather than 'information-driven') would help tailor verification for each State and target safeguards activities where they are really needed. Determination of the proliferation risk and selection of sensitive activities and States can nonetheless only rely on objective factors. Doing away with the quantitative approach to safeguards implementation does not mean that qualitative factors should not be 'quantifiable', clearly identifiable and non-discriminatory. According to its Statute, the IAEA is founded on the principle of sovereign equality of all its members. With respect to safeguards, the concept of 'differentiation without discrimination' is thus central.

Three main interconnected tracks are suggested in order to optimize the system by targeting verification activities: enhanced selectiveness of verification efforts could be based on a more flexible application of safeguards allowing for transparency and openness dividends; it would require improved institutional transparency; finally, it could be supported by furthering cooperation both at the regional level and with other relevant organizations.

3.1. Enhancing flexibility of safeguards implementation and evaluation

State-level approaches to safeguards implementation should be flexible enough to give less importance to quantitative factors and reward more States' transparency and openness. Safeguards implementation would consequently fluctuate according to the overall State's overall 'safeguards' behaviour. This approach would help focus safeguards efforts on 'non-transparent' and 'non-cooperative' States.

3.1.1. Framework for flexibility

Flexible implementation of safeguards is compatible with the existing legal framework. First, determination of the safeguards implementation efforts can fluctuate and second, qualitative State-factors can be taken into account.

On the first aspect, CSA provisions on access to information and on inspectors both insist on the fact that the Agency shall *"require only the minimum amount of information and data consistent with carrying out its responsibilities under the Agreement"*[81] and *"the visits and activities of Agency inspectors shall be so arranged as to reduce to a minimum the possible inconvenience and disturbance*

79 See K. NAITO, in 'Transcript of Interview with Current and Former SAGSI Members: J. CASTERTON, D. TILLWICK, R. HOWSLEY, K. NAITO and J. TAPE, Interviewed in Tucson, AZ by T. Shea and R. Hooper, 13 July 2007, on http://pnwcgs.pnl.gov/fois/doclib/5.0Tucsontranscript.pdf, p. 23.

80 SEE J. ACTON, 'A change in leadership at the IAEA', Q&A, 1 December 2009, on http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=24240: 'There is always a debate about whether the Agency should focus its limited resources on states with large nuclear power industries or those believed to present higher proliferation risks.'

81 INFCIRC/153, § 8.

to the State and to the peaceful nuclear activities inspected"[82]. Also, as shown by table 7, CSA and AP provisions on the frequency and intensity of on-site activities indicate a 'maximum' inspection effort; Article 4 of the AP explicitly states that the Agency *"shall not mechanistically or systematically seek to verify the information referred to in Article 2"*. More generally, preamble of INFCIRC/540 insists that *"the frequency and intensity of activities described in this Protocol shall be kept to the minimum consistent with the objective of strengthening the effectiveness and improving the efficiency of Agency safeguards"*.

On the second aspect, it is worth mentioning that current approaches reflect a bottom-up perspective on safeguards implementation; the latter seems a *"more manageable approach for an inspectorate, since the process starts at the bottom, at the facility level before moving up with accumulation of evidence to the country level, rather than the other way around"*[83]. Nuclear material accountancy is therefore the starting point of safeguards implementation, as CSA provisions show. But while reflecting such quantitative aspects and focusing at the facility level, CSA provisions also leave room for more 'qualitative' criteria such as the State system of accounting for and control (SSAC), the promptness to submit reports, etc.

Therefore, it seems possible to work on a more balanced approach: without doing away with nuclear material accountancy or characteristics of States' fuel cycles, more importance should be given to factors such as transparency and openness in order to determine safeguards implementation. The 'bottom-up' would then evolve towards a more 'top-down' approach.

82 INFCIRC/153, § 9.

83 B. Pellaud, The strengthened safeguards system : objectives, challenges and expectations, in E. Häckel and G. Stein, Tightening the reins: towards a strengthened international nuclear safeguards system, Berlin, Springer, 2000, p. 93.

84 Sources : INFCIRC/153, § 48 (DIV), § 71 to 73 (inspections), § 78 to 81 (frequency and intensity of routine inspections), INFCIRC/540, article 4 ; IAEA Safeguards glossary, 2001 edition, IAEA, Vienna.

Table 7: IAEA ON-SITE ACTIVITIES UNDER CSA AND AP[84]

Type of activity	Purpose	General principles for determining the frequency and intensity of on-site activities
Design information verification (DIV).	- to verify the design information of facilities provided by the State.	Continuing right of the IAEA throughout all phases of a facility's life cycle until the facility has been decommissioned for safeguards purposes
Inspections	- to verify that the nuclear material declared and placed under safeguards in facilities or locations outside facilities remains in peaceful nuclear activities or is otherwise adequately accounted for.	Ad hoc inspections Prior to entry into force of the subsidiary arrangement and/or before or upon transfer of nuclear material out of or into the State Routine inspections The number, intensity, duration and timing of routine inspections shall be kept to the minimum consistent with the effective implementation of the safeguards procedures; the Agency shall make the optimum and most economical use of available inspection resources Determination of the maximum inspection effort depends principally on the quantity (understood as content or annual throughput) of nuclear material contained in facilities or at locations outside facilities, and of conversion and target detection times for the different types and form of nuclear material

Table 7: IAEA ON-SITE ACTIVITIES UNDER CSA AND AP

Inspections		The criteria to be used for determining the actual number, intensity, duration, timing and mode of routine inspections of any facility shall include: - The form, chemical composition and accessibility of nuclear material - Effectiveness of the SSAC - the promptness of reports submitted to the Agency; their consistency with the Agency's independent verification; - the amount and accuracy of the material unaccounted for, as verified by the Agency; - Characteristics of the State's nuclear fuel cycle - International interdependence concerning nuclear material - Technical developments in the field of safeguards Special inspections After a special report has been transmitted, or if the Agency considers that information made available by the State, including explanations from the State and information obtained from routine inspections, is not adequate for the Agency to fulfil its responsibilities under the safeguards agreement
Complementary access	- to assure the absence of undeclared nuclear material and activities, - to resolve a question relating to the correctness and completeness of the information provided or to resolve an inconsistency relating to that information, and - to confirm, for safeguards purposes, the decommissioned status of a facility or of a location outside facilities where nuclear material was customarily used.	Under Article 4 of the Model Additional Protocol "the Agency shall not mechanistically or systematically seek to verify the information referred to in Article 2

3.1.2. State-level approaches insisting on transparency and openness

A report published in 2006 in the Journal of Nuclear Materials Management on transparency and openness and their role and limitations in the nuclear non-proliferation verification system provides helpful guidance on the exact meaning of such terms. According to the report, transparency in international safeguards and non-proliferation can be defined as: *"the condition in which a state's nuclear programs, activities, facilities, capabilities, and intentions are known to other members of the international community, through explicit policies and actions of the state, by reason of its general climate and culture of openness, and by independent information available on the state."*[85]

Openness on the other hand is defined in relation 'to the Agency'. Indeed, *"openness in international safeguards and non-proliferation can be defined as the relationship between a state and the Agency with respect both to the information and access that a state provides."*[86] CSA provisions only refer to 'cooperation,' which has a slightly different meaning. As paragraph 3 of INFCIRC/153 reads *"the agreement should provide that the Agency and the State shall co-operate to facilitate the implementation of the safeguards provided for therein"*, commentary on this provision underlines that *"what was intended by [...] was something subjective and general, the state should not make unnecessary difficulties for the Agency, and vice versa [...] to the contrary, [...] openness [means] something very concrete and objective: access to information and places."*[87]

The relation between transparency and openness is then summarized as follows: *"transparency means the availability of information on a state that allows others to see more clearly what the state's activities and capabilities are, while openness means the provision by a state to the Agency of information and access. Transparency should be considered the primary term, which can include openness. Openness should be used only with reference to information and access provided by a state to the Agency."*[88]

The Agency's Secretariat also concludes in the same sense, defining transparency as *"an acquired state achieved through a high level of cooperation between the Member State and the Secretariat involving access - access to information and physical access."*[89]

Following those definitions, State-level factors can be categorized around four aspects of transparency and openness: their condition (the relevant legal framework), their object (States nuclear activities), their scope (safeguards implementation) and finally, their evaluation.

- *Conditions for transparency and openness: right legal framework*

One important State-factor is the non-proliferation and safeguards legal framework in force. The latter can only be considered comprehensive and fully satisfying if both a CSA and an AP are in force. States concerned should also have a revised SQP in force. The following elements should then be included in the national legislation: [90]

- a clear statement of the objectives of the law;
- a basic undertaking of the general principle affirming the exclusively peaceful use of nuclear energy in the State;

85 J. Larrimore, M. Kratzer, J. Carlson, and B. Moran 'Transparency and openness : roles and limitations in the nuclear nonproliferation verification system', Journal of Nuclear Materials Management, Fall 2006, Volume XXXV, No. 1, p. 4.
86 Ibid, p. 5.
87 Ibid, p. 6.
88 Ibid, p. 15.
89 Doc. GC(XXXVIII)/17, § 34.
90 C. Stoiber, A. Cherf, W. Tonhauser and M. Vez Carmona, Handbook on nuclear law, implementing legislation, IAEA, Vienna, 2010, pp. 113-114.

- clear definitions of key terms used in implementing the relevant safeguards agreement(s) and protocols thereto;
- designation of a regulatory body to coordinate the implementation of safeguards;
- provisions regarding authorization or licensing, inspection, and enforcement measures relevant to nuclear material, nuclear facilities and other items subject to the safeguards agreement(s) and protocols thereto;
- establishment and maintenance of an SSAC;
- arrangements for supporting verification activities conducted by the IAEA and for the submission of amplifications or clarifications of any information requested by the IAEA;
- requirements for record keeping by those authorized to produce, process or use nuclear material and for reporting of information to the regulatory body and to the IAEA.

A comprehensive legislation on export controls going beyond the requirements of the AP provisions on export information would also be an indicator of State's commitments towards non-proliferation objectives and hereby of its transparency.

▪ *Object of transparency and openness: State nuclear programme and fuel cycle characteristics*

Paragraph 6 of INFCIRC/153 provides for *"concentration of verification procedures on those stages in the nuclear fuel cycle involving the production, processing, use or storage of nuclear material from which nuclear weapons or other nuclear explosive devices could readily be made, and minimization of verification procedures in respect of other nuclear material, on condition that this does not hamper the Agency in applying safeguards under the Agreement."*

Characteristics of the nuclear fuel cycle and scope of the national nuclear programme are thus important State-factors. They are precisely the object of a State's transparency and openness.

With respect to safeguards implementation, they should be considered according to a true 'State-level fuel cycle' and not a 'facility-by-facility' approach. Canada's State-level integrated safeguards approach for instance currently divides the domestic fuel cycle into four sectors:[91] sector 1 includes power reactors and associated dry storages, as well as conversion and fuel fabrication facilities; sector 2 comprises Chalk River Laboratories; sector 3 groups together research reactors, static dry storages, and other small locations and finally, sector 4 includes mines, mills, and decommissioned facilities. Such division is 'based on commonality of function from a safeguards perspective', and consequently allows for more optimization of safeguards implementation.

▪ *Scope of transparency and openness: implementation of safeguards measures*

States need not only to have a comprehensive legal framework in force, they also have to implement it fully. The level of transparency and openness is therefore established by evaluating effectiveness of the SSAC/RSAC, compliance with reporting obligations, promptness to answer questions and provide clarification in due delays, facilitation of access of IAEA staff to places they are allowed to go, and voluntary submission of further information or access. In this respect, the Agency noted that *"unlike nuclear material accountancy, whose quantification is well known, transparency is not quantifiable. Qualitative judgments can, however, be made as to the degree of transparency which derives from various levels of information [...]The additional information that will come from the Agency's on-site and evaluation activities and from the clarifications and explanations provided by States in response to specific Agency requests will be an essential contribution to transparency."*[92]

91 Canadian Nuclear Safety Commission Safeguards program annual report 2007-2008, p. 14.
92 Doc. GOV/2853, § 50.

Both the Agency and States need to cooperate in order to enhance transparency and openness. There is especially room for improvements in the area of SSAC/RSAC- IAEA cooperation. Reliance by the IAEA on national and regional systems should be encouraged, as long as there are clear signals of SSAC/RSAC's willingness to go in the same direction as the Agency in order to fully meet safeguards objectives. Indeed, *"the level of co-operation [...] is dependent on the capabilities and functions of the respective systems and their transparency. Thus, the extent to which savings can be made in practice will depend on the technical capabilities of individual SSACs and on the interest and willingness of qualified SSACs to participate in the various forms of cooperation. For SSACs generally, a higher level of co-operation would imply, prima facie, more effort and thus higher costs, but the extent to which this would be so is dependent upon the nature of the SSAC and the activities it is already carrying out."*[93]

In the case of Euratom, the High level expert group appointed by the European Commission Directorate has already made concrete suggestions in order to optimize the complementarities between Euratom and IAEA inspectorates. It especially recommended that the Euratom safeguards office (ESO) *"should indeed seek savings and simplifications for its own sake through the use of IAEA inspection results, of samples and other measurements. The Commission should give ESO the option not to send inspectors all the time to attend IAEA inspections."*[94]

Euratom on the other hand insists that according to the safeguards agreement and protocol concluded between Community States and the IAEA, the latter *"shall apply its safeguards [...] in such a manner as to enable it to verify [...] findings of the Community safeguards system"*,[95] the aim of both instruments being the development of conditions and means *"according to which co-operation in the application of safeguards provided for under the agreement shall be implemented in such a way as to avoid unnecessary duplication of the Community safeguards activities."*[96]

The High level group eventually suggests how difficulties can be overcome, by clearly dividing responsibilities between Euratom which applies a 'conformity control' and the Agency which applies a 'finality control'. In other terms, *"the best complementarities between the two inspectorates will be achieved by having each concentrate on its specific mission: nuclear material accounting and control for ESO, clandestine activities in a finality of non-proliferation for the IAEA. ESO must accept the fact that the IAEA has to carry out a minimum of inspection activities in the EU to draw its own conclusions; the more transparency there is at ESO, the lower that minimum, a minimum that the IAEA should in good faith try to gradually achieve."*[97]

Even though many recommendations have already been formulated, one of the major obstacles to optimization of IAEA-SSAC/RSAC cooperation nonetheless seems to lie in the persistence of bureaucratic practice and mentalities that lead to a 'status quo'.

- *Evaluation of transparency and openness*

All the aforementioned factors must be evaluated in a comprehensive manner in order to conclude on the overall State's safeguards behaviour and to determine future safeguards efforts. The task is considerable but not so complicated as all factors remain objective, even if not always quantifiable.

93 Doc. GOV/2807, § 33.
94 Review of the Euratom Safeguards Office by a High level expert group appointed by the European Commission Directorate- General for Energy and transport, main report, 15 February 2002, pp. 38-39.
95 INFCIRC/193, article 3, b).
96 INFCIRC/193, protocol.
97 Review of the Euratom Safeguards Office by a High level expert group appointed by the European Commission Directorate- General for Energy and transport, main report, 15 February 2002, pp. 38-39.

More difficult is the task of evaluating the proliferation risk beyond implementation of the existing transparency and openness requirements. As raised in an explanatory document on safeguards, *"an often asked question is why the IAEA does not concentrate its safeguards on countries whose intentions are regarded (by the questioner) as suspect. It is, however, both constitutionally and politically impossible for an international organization to make a judgement of this type about a Member State unless the State has openly violated its international obligations and has been found delinquent by the Board of Governors"*.[98]

The IAEA is thus neither legally nor technically equipped to make any assessment on States' intentions. Information obtained by sources other than the State itself can nonetheless provide indications of a State's transparency. As noted in the previously quoted report on transparency and openness, the Agency's assessment on the latter involves a number of factors, including *"whether information from open sources is consistent with the nuclear activities declared by the state."*[99] A set of clues, or themes, could therefore guide the IAEA in evaluating transparency at the State-level.

A report on an integrated safeguards proposal for Finland[100] noted in this respect that *"the past activities of a state regarding the use of nuclear energy and nuclear non-proliferation as well as her present political system should have reviewed in the evaluation of the Agency."*[101] However, making a judgement on the nature of the political regime itself and nuclear options would go well beyond the scope of the Agency's mandate. History of the relationships between the regime and the organization can however easily be taken into account. Plausibility of a proliferation scheme could also be examined in light of[102]: the existence of sufficient technical, industrial and financial resources, the State military structure, the overall historical and geopolitical context, history of conflicts, regional or international tensions in which the country is involved. The nature and content of official statements relevant to the field of nuclear energy, both civil and military, could also be studied. Finally, the existence of international alliances and dependences of the State concerned would be relevant.

3.1.3. Transparency and openness dividend

Current principles of safeguards implementation do not sufficiently reward States which play the game of transparency and openness. The ESARDA working group on integrated safeguards indeed noted that *"it is not clear how a State or an operator will benefit from being more open and demonstrating transparency and a responsible behaviour towards the IAEA."*[103] Moreover, as mentioned earlier, transparent States with significant nuclear activities but good transparency records still pay the burden of having chosen a full or large nuclear fuel cycle. While safeguards provisions insist on the need to focus safeguards activities on sensitive parts of the fuel cycle such as enrichment and reprocessing, more credit should be given to transparency and openness through the whole integrated safeguards implementation process. Three stages can be distinguished.

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98 The Evolution of IAEA Safeguards, International Verification series No 2, IAEA, Vienna, 1998, p. 36. See also, J. Acton, 'The problem with nuclear mind reading', Survival, vol. 51, n° 1, 2009, pp. 119-142.

99 J. Larrimore, M. Kratzer, J. Carlson, and B. Moran 'Transparency and openness : roles and limitations in the nuclear nonproliferation verification system', Journal of Nuclear Materials Management, Fall 2006, Volume XXXV, No. 1, p. 4.

100 M. Tarvainen and M. Antilla, Integrated safeguards proposal for Finland, Final report on Task FIN C 1264 of the Finnish Support Programme to IAEA Safeguards, STUK, Helsinki, 2000.

101 Ibid., p. 13.

102 Inspired by an approach developed by J.C. Archambault, C. Grand, X. Pasco and B. Sitt, « Dynamique des pouvoirs proliférants, pour une nouvelle approche interdisciplinaire », A.F.R.I., 2002, pp. 591- 613.

103 C. Xerri and H. Nackaerts, on behalf of the ESARDA Integrated Safeguards working group, 'Integrated safeguards: a case to go beyond the limits Consequences of boundary limits set to the reduction of "classical safeguards measures" on efficiency and resources allocation in Integrated Safeguards', ESARDA Bulletin No. 32, 2004, pp. 71-72.

Stage 1: accelerating the broader conclusion process

States with an additional protocol in force should benefit from a transparency dividend as soon as they have started implementing the AP. The latter is in itself a positive factor which should help draw the broader conclusion and not complicate the whole process.
At the same time, while nuclear information 'diggings' are time-costly, they are necessary to get a complete and coherent picture of a State nuclear programme. Their conduct is also in the State's interest as it lets it know what is, and was, going on in its own territory.

So more resources and efforts should be devoted to tackle the problems identified in part I which slow down the broader conclusion process, in order to reduce the burden associated with the AP's implementation. The Agency and States could work together on ways to accelerate submissions of initial declaration, avoid involuntary omissions and misunderstanding without compromising safeguards objectives. Efficient national systems of communication and investigation can for instance help accelerate the gathering process. The IAEA should then work on ways to accelerate the drawing of broader conclusions once all the information has been transmitted and on-site verification activities conducted.

Stage 2: working on a transparency and openness dividend before implementation of integrated safeguards

Once the broader conclusion has been drawn, a State should be able to see the immediate benefit of implementing an AP and being transparent. Two tracks could be explored: first, feasibility of a reduction of safeguards implementation with respect to non sensitive nuclear activities and to a certain extent, more sensitive one; second, acceleration of the integrated safeguards implementation process.

Stage 3: improving integrated safeguards

More flexibility is required in the search for a 'better combination of safeguards measures'. As a brief analysis of the exiting legal framework has showed, the frequency and intensity of safeguards activities need not be fixed but can fluctuate over time, taking into account State-specific factors, including transparency and openness.

States and the Agency should also work together in order to minimize intrusion and disturbance of activities, especially in a context of increased use of unannounced and unattended verification. CSA provisions themselves state that *"in carrying out any unannounced inspections, the Agency shall make every effort to minimize any practical difficulties for facility operators and the State"*[104]. National solutions have already been found in order to ease implementation of IS measures; Canada for instance has noted that *"with the introduction of a safeguards officer to the CNSC's AECL Chalk River Laboratory site office, it is now possible for CNSC safeguards staff to attend nearly all IAEA inspections carried out at this site, including CA and UIs*."[105]

On the contrary, maximum verification should be implemented in non-transparent States. The Agency should then make full use of its legal authority as provided for in safeguards agreements. In this respect, many debates are ongoing as to why the Agency has not called for more special inspections in cases where it would have had legal right and legitimate reasons to do so. As explained by the Secretariat, *"the Agency may make special inspections wherever relevant if information available to it makes it reasonable to conclude that the Agency may otherwise be unable to fulfil its obligation to ensure that safeguards are being applied to all source or special fissionable material in all peaceful nuclear activities in the State in question"*[106].

104 INFCIRC/153, paragraph 84.
105 Canadian Nuclear Safety Commission, Safeguards Program Annual Report, 2007-08, p. 22.
106 Doc GOV/2554, 12 November 1991, § 11.

Recently, Syria has been presented as being the "*textbook definition of a case in which a special inspection is merited*"[107]. The IAEA Secretariat has itself noted that *"Syria has not yet provided a full explanation of the activities and experiments involving nuclear material conducted at the miniature neutron source reactor that may have been the source of the particles found there. Therefore, further clarification from Syria is necessary in order to resolve this issue"*[108]. The Board has now even adopted a resolution calling Syria in non-compliance with its safeguards agreement. However, it never requested a special inspection. It seems that reluctance of the Secretariat or Member States to ask and decide to conduct such inspections today relies on political rather than technical reasons. The non-use of special inspections might either lead to consider it a useless tool, or hamper the credibility of the IAEA.

Conclusion 5

Flexibility in safeguards implementation through the development of State-level approaches insisting on and rewarding transparency and openness would help target verification efforts where they are needed. Optimization of the safeguards system would thus reflect a shift from a 'quantitative' to a 'qualitative and risk-oriented' system, matching the objectives of efficiency and effectiveness.

3.2. Improving the Agency's transparency

Transparency as it relates to safeguards is a two sided concept: it does not only refer to States transparency but also to the Agency's transparency in verifying and evaluating States nuclear activities. Optimization thus requires improving institutional and informational transparency: by promoting efforts to enhance communication and cooperation, it will tend to reduce unnecessary duplication of activities and save time and expenses that a lack of communication and cooperation can generate.

In this domain, *"the safeguards system needs to be transparent and understandable - internally to those who are implementing it, as well as externally to Member States and the general public"*, and improvements are needed in the fields of *"openness and quality of the IAEA´s reporting and other communications on safeguards and verification matters and build States´ knowledge of the processes for drawing safeguards conclusions, to enhance their understanding of, and confidence in, the IAEA´s assurances."*[109]

Four aspects are of particular importance: clarity of the Agency's mission, guarantees of the Agency's independence, review of the Agency's internal processes and rethinking of regional offices.

3.2.1. Clarity of mission

One of the Agency's institutional transparency requirements has been defined as *'clarity of mission'* which *'requires a common understanding of the objectives, processes and standards applied in the safeguards system, and the way major decisions, such as compliance determinations, are made'*.[110] Many improvements can be suggested in this field.

First, better and constant communication on the safeguards system includes communication on safeguards information collection, analysis and evaluation. The legal framework for the Agency's

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107 J. Acton, M. Fitzpatrick and P. Goldschmidt, 'The IAEA should call for a special inspection in Syria', Proliferation analysis, February 26, 2009. See also O. Heinonen, 'The case for an immediate IAEA Special inspection in Syria', Policy Watch, 5 November 2010.

108 Doc GOV/2010/11, § 16.

109 A Changing Nuclear Landscape: Preparing for Future Verification Challenge, by Herman Nackaerts, IAEA Deputy Director General, Head of the Department of Safeguards, International Forum on Peaceful Use of Nuclear Energy and Nuclear Non-Proliferation, Vienna, 2 February 2011.

110 J. Carlson, 'Key nuclear verification priorities- Safeguards and beyond, 2010 Safeguards symposium.

activities need be constantly visible, accessible and explainable to States and the public. In this respect, the right balance needs be found between confidentially and transparency.

Second, transparency on how effectiveness and efficiency of the safeguards system are evaluated and rethought is also important. In this respect, some regret the *"limited visibility of SAGSI's work"* and the *"long-standing Secretariat policy not to share SAGSI reports to the Board or Member States."*[111] Without necessarily encouraging wider publication of SAGSI's work, one could reasonably expect the group to be more transparent on its process, including its composition, the frequency of its meetings and its exact mandate.

Third, institutional transparency implies being clear on what exactly is expected from States in the field of safeguards. Commentators have noted that there was *"room for improvements of INFCIRC/540 with regard to a more precise formulation of the requirements,"* and that *"extensive question-and-answer procedures between the inspector and the operator will harbour a risk of deliberate misinterpretation"*.[112] Thus, continual reassessment of safeguards objectives is necessary, and reason for asking information and requesting access should be substantially and independently explained.

Finally, results of verification activities should be given in a transparent and timely manner. CSA provisions indicate in that sense that the *"conclusions [...] drawn from [the Agency's] verification activities in the State, in particular by means of statements in respect of each material [...] shall be made as soon as possible after a physical inventory has been taken and verified by the Agency and a material balance has been struck."*[113]

3.2.2. Enhanced independence

Institutional transparency closely relates to institutional independence. As information coming from States themselves needs be confronted to other sources of information sometimes considered as 'non-voluntary transparency'[114] sources, independent analysis of the latter is crucial to the Agency's credibility. Constant assessment of the Agency' independence and expertise when analysing information balances the perception that 'information-driven' or 'analysis-driven' safeguards sometimes reflect an investigative approach that could question the non-discriminatory nature of safeguards. It also strengthens assurances that the Agency's conclusions are credible. The IAEA therefore needs be able to independently corroborate all the information it receives.

In this respect, suggestions have been formulated to enhance the Agency's autonomous analytical skills. As underlined in part I, reliance on NWAL is inevitable and necessary; SAL should nonetheless remain the central point of samples analysis. In order to facilitate centralization and avoid administrative and political difficulties, a standardized model contract for IAEA-NWAL cooperation could also be developed while the process for selecting national laboratories should remain un-politicised.[115]

More generally, reliance on national techniques, equipment and initiatives to strengthen safeguards should be encouraged only to the extent that they reflect the interest of the Agency on the whole, and not only those of one or a few States interests.

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111 J. Carlson, 'SAGSI : its role and contribution to Safeguards development', 2007, on www.dfat.gov.au.

112 R. Weh, 'The point of view of German facility operators', in E. Häckel et G. Stein, Tightening the reins: towards a strengthened international nuclear safeguards system, Berlin, Springer, 2000, p. 103.

113 INFCIRC/153, § 90, b).

114 On 'non-voluntary transparency', see W. Walker, « Reflections on transparency and international security », in N. Zarimpas (ed.), Transparency in Nuclear Warheads and Materials: The Political and Technical Dimensions, Oxford University Press for SIPRI, 2003, pp. 15- 31.

115 See F. Goutelard, 'The NWAL : Expansion and reform', IAEA Safeguards symposium 2010, Session 12, The Network of Analytical Laboratories - Expansion and Reform, 2 November 2010.

3.2.3. Reviewed internal process

Transparency towards external actors (here including members States) implies transparency at the internal level first; review of internal practices therefore appears as a precondition for transparency.

One of the major suggested institutional evolutions is that of rethinking the inspectors' work in order to make them become real investigators. Rather than spending efforts to retrain qualified personal at the risk of ignoring their respective skills, it would be more effective and efficient to further the development of true collaborative analysis. Analysts can better guide inspectors in the field *via* effective communication systems but also through enhanced cooperation and discussions at headquarters. Members of the Safeguards department have in this respect noted that *"the situation would be improved if all the evaluation units and sections were brought together into one organizational entity. Such a new organization would improve communication between evaluators and allow the production of a comprehensive consolidated evaluation report, which then could be given to the respective Operations Divisions for inclusion in the safeguards evaluation reports. This could be done by the appointment of individuals who would serve as a unique contact point for the inspectors, thereby streamlining communication between evaluators and inspectors"*.[116]

3.2.4. Rethinking regional safeguards offices

While 174 countries today have safeguards agreements in force, there are only 2 regional IAEA safeguards offices. Mirroring the 'quantitative approach' to safeguards implementation, they are located in the territory of two 'major customers' of the Agency: Canada and Japan.

Feedback on their utility is mitigated. On the one hand, the IAEA noted that its 'regional' inspectors are sometimes disconnected from what is going on at headquarters, and do not follow the general evolution of safeguards approaches and practices. On the other hand, States concerned welcome a useful on-site presence, which for instance enables real unannounced inspections.

Rethinking the missions and organization of regional liaisons therefore seems necessary. In doing so, not only individual States' interests in terms of safeguards implementation should be taken into account but also the Agency's interest in terms of safeguards and non-proliferation objectives.

Conclusion 6

Optimization of the safeguards system should not only focus on optimization of safeguards measures but also on optimization of safeguards institutional practices. Many improvements are necessary in this domain; although they would not be revolutionary as such, they imply a global rethinking and adaptation of bureaucratic patterns and behaviours.

3.3. Developing external cooperation

Maximum use of existing verification systems and organizations would help the IAEA focus on its own mandate, thus optimizing its resources. In this perspective, closer cooperation with other international verification organizations as well as NGOs would be useful.

116 L. Bevaart, F. Claude, J. Lepingwell, M. Nicholas, H. Rilakovic and P. Caulfield, 'Safeguards information analysis: Progress, challenges and solutions', in Addressing Verification Challenges, proceedings of an international safeguards symposium, Vienna, IAEA, 2007, pp. 57-58, p. 62.

3.3.1. Cooperation with other verification organizations

The IAEA and other organizations such as the Preparatory Commission of the Comprehensive Test-Ban Treaty Organization (CTBTO) or the Organisation for the Prohibition of Chemical Weapons could benefit from sharing best practices in relevant fields. On the one hand this would lessen the risk of duplicating certain activities, therefore help focusing on more relevant ones; on the other hand, this would help improve the verification processes.

Persistence of political motives however currently prevents further cooperation, and it is still difficult to organize official channels of communications. Member States of the respective organizations opposed the meeting of a 'verification summit' as initiated by the UN Secretary General. More recently, cooperation between the IAEA and the CTBTO during the Fukushima accident has not been optimum, and enhanced cooperation to help mitigate the consequences of the accident had to be encouraged by the UN Secretary General. Monitoring data from the CTBTO global network of radionuclide monitoring stations was finally provided to the Agency, and consultations were conducted between the various organizations in order to ensure effective coordination of activities.[117] The existence of cooperation agreements and mechanisms would nonetheless certainly have helped accelerate the process.

Suggestions have already been made in order to overcome such tensions and develop an acceptable framework for cooperation.[118] Guiding cooperation principles would for instance include: respect for information confidentiality, assessment of the cost-saving potential resulting from cooperation and of its impact on improving the effectiveness of treaty monitoring, and preservation of institutional independence. Potential areas of cooperation would include: infrastructure and equipment, training of staff, sharing open source information.

3.3.2. Cooperation with NGOs

The second category of actors which could be more associated to IAEA's activities are non-governmental organizations. Distinction between global think tanks, expertise centres and militant NGOs should nonetheless be made. While presence of the latter during meetings of the Agency's organs might ensure a necessary degree of transparency, the rationale behind the Agency's mandate implies inherent restrictions to the access of certain NGOs. The rules on the consultative status of non-governmental organizations with the Agency therefore explicitly provides that *"the work of the organization shall be directly related to that of the Agency, and the organization shall be able to make a significant contribution to the Agency's work; the aims and purposes of the organization shall be in conformity with the spirit, purposes and principles of the Agency; the organization shall undertake to support the work of the Agency and promote knowledge of its principles and activities, in accordance with the organization's aims and purposes and the nature and scope of its own competence and activities."*[119]

Relevant organizations can nonetheless be helpful and support the Agency's activities, especially in the field of safeguards. 'Societal verification' could be encouraged to a certain extent,[120] a concrete example being the NGO monitoring satellite imagery. This would also help optimize the use of the Agency's own human and financial resources.

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117 See doc. GOV/INF/2011/8.

118 T. Findlay and O. Meier (VERTIC), « Exploiting synergies between nonproliferation verification regimes: a pragmatic approach », paper presented at the Symposium on international safeguards, held in Vienna, IAEA, 29 octobre- 2 novembre 2001.

119 INFCIRC/14, II., 2.

120 J. Carlson, 'New verification challenges', ICNND, 4 June 2009.

Conclusion 7

Optimization of the safeguards system calls for more cooperation with existing verification organizations, as well as relevant non-governmental organizations. As in other identified areas, suggestions have already been made but their non-implementation shows that further efforts are needed, on part of both the institutions and their member States.

Chapter 3 Conclusion

Optimization of the safeguards system can be realized through reallocation of verification efforts in order to target the Agency's activities where the proliferation risk lies. Such reallocation implies enhanced selectiveness of safeguards implementation. The latter should rely on qualitative, yet objective, criteria such as transparency and openness.

Parallel to conceptual rethinking of safeguards implementation, institutional practices need be changed in order to match with the objectives of optimization.

Finally, the latter can be enhanced through development of collaborative schemes between the IAEA and other relevant governmental and non-governmental organizations.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Conclusions established throughout the study are summarized below, under three main themes.

Optimization of the safeguards system as a means to universalize of the additional protocol

1. While entry into force and implementation additional protocols depends on multiple factors, including political ones, incentives such as optimization of the IAEA safeguards system in order to ensure its effectiveness and efficiency can help promote universalization of the AP.
2. The IAEA and its member States should therefore pursue their effort to better allocate safeguards activities and resources.

Global principles of optimization

3. Optimizing the safeguards system requires doing away with a quantitative approach and promoting a more qualitative, customized implementation of safeguards in order to target verification activities where the proliferation risk lies.
4. Redefining safeguards implementation and evaluation can only be done in a non-discriminatory and objective manner, differentiation without discrimination being a central concept of the optimization process.

Suggested tracks for optimization

5. More flexibility in safeguards implementation and evaluation for each State would allow for enhanced selectiveness thereby better allocation of safeguards activities. Flexibility would be reflected by:
    a) State-factors in insisting on transparency and openness;
    b) Safeguards implementation and evaluation rewarding transparency and openness.
6. Transparency and openness dividends would consist in effective and efficient measures such as: avoiding duplication of SSAC and RSAC activities, accelerating the integrated safeguards implementation process, looking for alternatives to integrated safeguards when broader conclusions are drawn, deploying safeguards activities in non-transparent States.
7. Optimization of the safeguards system also includes optimization of safeguards institutional practices. The IAEA should therefore work on measures to ensure institutional transparency, including:
    a) Clarity of its mission to its member States and the public;
    b) Independence of its analytical capabilities;
    c) Review of its internal processes;
    d) Rethinking of the existing regional offices.
8. Optimization of the safeguards system could be reached through enhanced cooperation with other verification organizations as well as relevant non-governmental organizations.

ANNEX 1
Interviews conducted in Vienna, 1st- 3rd March 2011

Name	Function
Baude, Stéphane	Conseiller nucléaire AIEA, Mission permanente de la France auprès de l'Office des Nations Unies et des organisations internationales.
Baute, Jacques	IAEA, Head, Division of information management, Department of Safeguards.
Claude, Frédéric	IAEA, Advisor to the DDG, Department of Safeguards.
Cooley, Jill	IAEA, Head, Division of Concepts and Planning, Department of Safeguards.
Crété, Jean Maurice	IAEA, Head, Training Section, Division of Concept and Planning, Department of Safeguards.
Elbez, Julien	IAEA, Satellite Imagery Analyst, Division of Information Management, Department of Safeguards.
Iqbal, Lalu	First Secretary, Permanent Mission of Indonesia.
Kessler, Kurt G.	Deputy Counselor for IAEA Affairs, United States Mission to the United Nations and IAEA.
Mangin, Florence	Ambassadrice, Représentante permanente de la France auprès de l'Office des Nations Unies et des organisations internationales.
Nackaerts, Herman	IAEA, Deputy Director General; Head, Department of Safeguards.
Negm, Heba	Second Secretary, Permanent Mission of Egypt.
Pujol, Eric	IAEA, Senior Safeguards Analyst, Division of Concept and Planning, Department of Safeguards/ SAGSI Secretary.
Rockwood, Laura	IAEA, Head, Section B Non-Proliferation, Office of Legal Affairs.
Vallim Guerreiro, Antonio José	Ambassador, Permanent representative of Brazil to the IAEA and CTBTO.
Zehnder, Olivier	Deputy Permanent representative, Permanent Mission of Switzerland to the United Nations and the International organizations in Vienna.

ANNEX II
Review Seminar in Glion, Switzerland, 14th-15th April 2011

Participant	Function
Combrink, Michiel	Counsellor Disarmament, South African Permanent Mission, Geneva, SOUTH AFRICA
Cooley, Jill	Director, Division of Concept and Planning, Department of Safeguards, IAEA, Vienna
Ellacott, Tom	Senior Safeguards Advisor, International Safeguards Division, Directorate of Security and Safeguards, Nuclear Safety Commission, CANADA
Etienne, Arlette	Inspecteur nucléaire, Agence fédérale de Contrôle nucléaire AFCN, BELGIUM
Fuegg Jean-Christoph	Head Section International Affairs, Swiss Federal Department of Energy SFOE, SWITZERLAND
Martikka, Elina	Section Head for Nuclear Materials Regulation, Radiation and Nuclear Safety Authority, STUK, FINLAND
Martin, Georges	Assistant State Secretary, Federal Department of Foreign Affairs, SWITZERLAND
Masmejan, Laurent	Desk Officer, Arms Control and Disarmament Section, Federal Department of Foreign Affairs; SWITZERLAND
Medici Fausto	State Inspector Safeguards, Section International Affairs, Swiss Federal Department of Energy SFOE, SWITZERLAND
Moning Renate	State Inspector Safeguards, Section International Affairs, Swiss Federal Department of Energy SFOE, SWITZERLAND
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ANNEX II
Review Seminar in Glion, Switzerland, 14th-15th April 2011

Pellaud, Bruno	Former IAEA DDG, Former Head of the Department of Safeguards, SWITZERLAND
Persbo, Andreas	Acting Executive Director VERTIC, UNITED KINGDOM
Praz, Jean-Daniel	Deputy Head, Arms Control and Disarmament Section, Federal Department of Foreign Affairs, SWITZERLAND
Rezniczek, Arnold	ESARDA, UBA Unternehmensberatung GmbH, Herzogenrath, GERMANY
Schoenenberger, Christian	Head, Task Force on Nuclear Disarmament and Non-Proliferation, Federal Department of Foreign Affairs, SWITZERLAND
Sekse, Tonje	Research Scientist, Norwegian Radiation Protection Authority, Østerås, NORWAY
Stein, Gotthard	Former member of SAGSI and current member of ESARDA GERMANY
Tsalas, Stamatios	Head of the Nuclear accountancy, methods & evaluation Unit, EURATOM, LUXEMBURG
Van Aarle, Jan	Responsible Safeguards Officer, Beznau NPP facilities, AXPO, SWITZERLAND
Wieland, Beat	Former Head of the Swiss SSAC, Nuclear Consultant, SWITZERLAND
Zehnder, Olivier	Deputy Permanent Representative, Mission of Switzerland to the UN and International Organizations in Vienna, Federal Department of Foreign Affairs, SWITZERLAND

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