Summary of the ESARDA Joint meeting on “IAEA’s State-Level Concept”

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**Introduction**

The IS, VTM and EXP ESARDA Working Groups invited the IAEA, EURATOM and all interested safeguards actors to review and discuss on the State-level concept in the context of the Additional Protocol. The meeting took place at European Commission JRC ITU in Ispra, Italy on November 12, 2013.

The topic is grounded on the IAEA’s combination of “classical” integrated safeguards inspections with the results of other sources of information and analyses, in order to reach conclusions on the absence of undeclared nuclear activities. These sources include satellite imagery, environmental analysis, acquisition pathway analysis, export declarations of Trigger List items (AP Annex II) and others.

There is hence a direct and strong link among the three ESARDA research areas that organised the event; three dedicated topical sessions and a panel discussion tried to identify subjects meriting further attention and focus in the interest of improved and more effective conclusions on the absence of undeclared activities.

**Opening session (Chair K. v. d. Meer)**

The IAEA, represented by J. Cooley, Director of Concepts and Planning division, Department of Safeguards, provided an extensive overview of the SLC motivations, framework and results.

EURATOM, represented by W. Kehnmeyer of Commission DG ENERGY, recalled the EU views and contributions to the IAEA SLC.

The Working Groups’ technical sessions followed.

**Implementation of Safeguards (Chair A. Vincze, HAEA)**

The session highlighted that the IAEA’s State-Level Concept (IAEA SLC) is not new, but a result of a continuously evolving approach. The very first elements of this approach can be traced back to the need of evaluating States with Comprehensive Safeguards Agreement (CSA) in force, which resulted in the State-level criteria as part of the safeguards criteria. The driving force of the next evolutionary step of this concept was the strengthening of the IAEA’s safeguard system by collecting and verifying more information about a State via the implementation of the Additional Protocol (AP). This new tool enabled the Agency to draw conclusions on the absence of undeclared material or activities in the State. By the development of State-Level Approaches for Integrated Safeguards (IS-SLAs) a more efficient system was designed where the resources needed for maintaining the broader conclusion in a State with CSA & AP in force are integrated in an optimised way taken the State specific characteristics and technological development into account.

Although there are many elements of the IAEA SLC that can be identified in the IS-SLAs, this concept can be regarded as a fundamental change from the “bottom-up” SLA based on facility level approaches, to the “top-down” SLA focusing primarily on the State as a whole. The driving force for
this approach is to have a more responsive system while maintaining or even increasing effectiveness and efficiency of the system.

There was a general agreement among the participants that one of the central elements of the SLC are the determination of the appropriate State-specific factors, the list of which – as appears in the report by IAEA DG to the Board (GOV/2013/38) – has generated a lot of debate. Some of the factors are objectively quantifiable (type of Safeguards agreement in force and the safeguards conclusion drawn by the Agency; nuclear fuel cycle and related capabilities of the State), while the factor of technical capabilities of the SSAC/RSAC seems really difficult to quantify. The remaining factors (the ability of the Agency to implement certain safeguards measures; the nature and scope of cooperation between the State and the Agency in the implementation of safeguards; the Agency’s experience in implementing safeguards in the State) can only be evaluated by the IAEA internally and have been criticized to be possibly open to subjective interpretation. It was also pointed out during the session that the current list of State-specific factors (6) seems to be far from complete and appropriate. Some other potential additional factors such as the existence of regional NP-Treaties (Rarotonga, Bangkok, Tlatelolco, etc.), the existence of regional safeguards systems (EURATOM, ABACC), multinational nuclear supplier companies (URENCO, AREVA, etc.), geographical, infrastructural and institutional features (borders, harbours, airports, export controls), etc. have been addressed. Several participants expressed their opinion that in the era of globalisation the IAEA should NOT considers States as entities disconnected from the rest of the world. Representatives of multinational companies raised concern about the possibility of having different safeguards approaches under the SLC for daughter companies in different States.

The problem of how to measure effectiveness and efficiency was also addressed in general and it was concluded that it would really be a really difficult task to answer this question as far as the SLC is concerned. It is perhaps more appropriate to discuss the expectations for effectiveness and efficiency under the IAEA SLC as was addressed by one of the presentations. The main expectations of the safeguards implementation under the IAEA SLC were mentioned as follows. Safeguards should remain non-discriminatory by applying common State-level objectives to all States with similar types of safeguards agreements in force and utilizing uniform implementation processes in objectively determining the State-level approach for each State. Safeguards conclusions should be based on data gathered through the IAEA’s safeguards activities: collection, analysis, and evaluation of safeguards-relevant information and IAEA inspections. SLC implementation should not be designed as a functional substitute for the absence of the AP in a State. Under the SLC, the IAEA should make use of all relevant information and should exercise the full range of its available authorities such as IAEA Statute, CSAs, AP, decisions of the Board of Governors and UN Security Council resolutions.

It was highlighted that while the specific safeguards measures and the manner and intensity with which they are applied in an individual State are expected to differ based on State-specific factors and technical considerations, nuclear material accountancy should remain the basis for deriving a conclusion of non-diversion of declared material. Like the existing approach to safeguards implementation, the SLC should ensure high probability of detection of any violation by States of their safeguards agreements, therefore timely detection of the diversion of declared nuclear material and deterrence of such diversion by the risk of early detection should remain a
fundamental safeguards objective. In seeking to provide assurance about the absence of undeclared nuclear activities in the State as a whole, priority should be given to following up on specific indications as they arise, rather than to open-ended efforts that may add little to the detection probability.

In summary, the following main challenges of safeguards implementation under the IAEA SLC were identified by this session:

1. Safeguards under the SLC should be more effective, without any significant increase in cost. It should also be more efficient, without compromising effectiveness. The IAEA should have sufficient resources to identify and follow up on indicators of undeclared nuclear and nuclear-related activities. Inspection activities at declared locations and sites should be sufficient to maintain continuity of knowledge and to detect and deter diversion attempts, and address all technically plausible acquisition pathways that involve those locations and sites.

2. The IAEA should elaborate more clearly what opportunities exist beyond those already available under IS-SLAs for optimizing safeguards in States with the broader conclusion.

3. The IAEA should illustrate more clearly the ways to evaluate/quantify objectively the different State-specific factors, especially those that are more open to subjective interpretation. The IAEA should also consider additional factors that take globalisation into account and should not consider States as entities disconnected from the rest of the world. Safeguarding multinational facilities for example under the SLC may result in different approaches in the different States, which would be difficult to understand.

4. The IAEA SLC should be applied in all States independently of the type of the safeguards agreements in force. Implementation of SLC in Nuclear Weapon States (NWS) however seems difficult since the safeguards approaches for states with voluntary offer agreements (VOAs) differ considerably one from the other. None of the VOAs provide any basis for the IAEA to look for undeclared nuclear material and activities in the State as a whole. As such, opportunities for improvements in effectiveness and efficiency under the SLC in NWS are limited. Also for Non-NPT States, the INFCIRC/66-type agreements explicitly proscribe any use related to the manufacture of any other nuclear explosive device and do not allow the IAEA to look for undeclared nuclear material and activities in the State as a whole. In the absence of State-level objectives therefore, the opportunities for improvements in effectiveness and efficiency under the SLC are limited. However, for these States the IAEA should balance the efforts and resources towards the type of conclusions it can draw.

Export Control (Chair F. Sevini, European Commission JRC)

The session opened by recalling that export control was a barrier to proliferation that helped limit unauthorized access to strategic technology and goods. Governments should strive to apply controls consistently in a way that did not unduly interfere with legitimate business or distort competition. Even if a proliferator was able to manufacture or import key components, access to outside technology was still necessary, and export controls applied to technology acted as a bottle neck for proliferation programmes.

Some participants suggested moving from the concept of export control to the concept of export monitoring for non-sensitive transfers. This would be developed at the next WG meeting and is
essentially linked to assessing transfers according to risk and applying export control procedures proportionate to the risk involved.

Strategic export controls are intimately linked to international safeguards. Safeguards are a condition of supply for nuclear goods controlled by the Nuclear Suppliers Group Trigger List (TL). Countries with an Additional Protocol (AP) in force are inherently more safeguarded and thus having an AP in force minimizes proliferation risk, making positive export licensing decisions easier to make. The existence of an AP is also a key instrument for the IAEA to use to derive State-level conclusions.

Besides providing a necessary barrier to proliferation, the export control framework also helps generate the licensing data for deliveries of Trigger List goods. This information must be sent to the IAEA to fulfill a specific AP requirement (Art. 2.a.(ix)(b)). Declarations to the IAEA must be based on actual exports, not just on exports authorised by licences. It is therefore necessary to examine customs declarations. At times, countries may also be requested to provide additional information on imported goods. This may be a difficult exercise involving various national stake-holders all dealing with exports (or imports). The process is further complicated by the fact that the codes used by licensing and customs differ and the correlation between the two datasets (e.g. the TARIC correlation table) is not an exact science. Besides the data formally due by States and collected during regular inspection activities, the IAEA makes wide use of various sources of information to detect potential indicators of undeclared nuclear material and activities, and for States with an AP in force, be able to derive broader conclusions on the absence of undeclared nuclear material and activities. Apart from regular open-source information, these include trade data analysis, based on customs data, together with the analyses of actual and attempted covert procurement for nuclear-related goods (both single and dual-use) – information which is received from States and their companies on a voluntary basis.

The recent Fundamental Review of NSG lists introduced 54 additional amendments, 23 of which belong to the Trigger List. These will be published by the IAEA as INFCIRC/254/Rev.12/Part 1 (and the Dual-use List as INFCIRC/254/Rev.9/Part 2). This exercise, which took three years to conclude, also clarified existing control language. For example that related to the ‘Especially Designed or Prepared (EDP)’ concept, which derives from NPT language.

The AP Annex II is still based on INFCIRC/254/Rev. 2 / Part 1, thus missing list amendments introduced since 1995. The AP includes the possibility of updating the list, but this hasn’t been done yet. Amending Annex II to the latest TL would facilitate on the one hand matching the export control framework with data declarations and on the other would better address evolving proliferation threats. The NSG tries to counter these threats, although compromises are sometimes required to reach consensus among its Participating Governments. Apart from updating the control list the NSG also needs to address harmonization of national rules, practices and interpretations. For example, it was recognized that re-export controls applied by some States outside the EU can hamper legitimate intra-EU nuclear trade. Greater harmonization would both minimize the risk of distortion of competition amongst suppliers and reduce the risk of exports reaching programmes of concern because of differing interpretations amongst States about what the list actually covers.

Little would be effectively possible without informed, aware, collaborative and complaint suppliers and exporters. The IAEA encourages suppliers to provide information on procurement attempts for nuclear-related (dual and single use) goods. This is a valuable source of information to enable the
early detection of potential undeclared nuclear activities and help States identify covert procurement networks worldwide.

Exporters rely on internal compliance measures and vigilance; the supply chain's diversity presents threats and complexities. Nuclear exporters are willing to comply with the non-proliferation framework for various reasons, but for this to be effective they need a clear picture of the controls in place. The illustrative character of the TL does not help. Some States interpret it as an indicative list while others consider that TL export controls only apply to the items specifically mentioned on the list.

New challenges are posed by the ease with which it is possible to make intangible technology transfers, globalization of production and the increasing importance of dual use research across national borders. The latter, owing to the inherent instinct of researchers to share data, poses particular proliferation concerns. Awareness of, and a natural aversion to controls in the research and academic community present particular challenges for regulators.

Monitoring technology transfers by intangible means poses its own set of problems. As there is no physical export there is no customs declaration to complete. IAEA reporting requirements do not cover supply of Trigger List technology, although States may report such transfers, where they are known, on a voluntary basis.

Verification Technologies and Methodologies (Past Chair I. Niemeyer, FZ Juelich)

Verification technologies and methodologies supporting the SLC were discussed in the third thematic session. In the introductory remarks, reference was made to the Geospatial Exploitation System of the IAEA, and R&D projects related to GIS-based information management and integration (JRC ITU Ispra), geology for the country report (CEA), ontology-based semantic information technology (Sandia National Laboratories), development of safeguards equipment considering the SLC (Juelich), acquisition path analysis and performance targets (Los Alamos National Laboratories).

Special focus was given to the APA methodology and the importance of case studies with regard to the development of SLAs.

An acquisition path (AP) is defined as a sequence of activities which a State could consider in order to acquire weapons usable material. The acquisition path analysis (APA) analyzes all plausible APs, aiming to determine whether a proposed set of safeguards measures will be effective. APA is a key element of the SLC. By considering the State's nuclear profile, the APA generates a list of acquisition paths ranked by their attractiveness for the State. The IAEA's requirements state that APA must be objective, reproducible, transparent, standardized, documented and as a result non-discriminatory.

Up until now, the IAEA has implemented APA mainly based on expert judgment. This has led to a procedure that, although standardized, cannot fulfill the requirements mentioned above. Therefore, the IAEA has requested support from the Member States Support Programmes (MSSPs) looking for a methodology and software tool that helps structuring the process of APA. The tool should visualize the acquisition paths in order to help the analyst maintain an overview of the situation in a State. It
should automate the process in order to be independent of subjective reasoning and thus guarantee reproducibility. Finally, a software tool assisting the analyst should integrate into existing systems and models at the IAEA.

One of the MSSP contributions was presented. The methodology is based on a three steps approach: network modeling, network analysis and strategic assessment. As a solution of this process, a Nash-equilibrium can be found that provides an indicator on the effectiveness of the implemented safeguards system. Furthermore, it also reveals the potential behavior of both actors, i.e. the State and the IAEA.

Moreover, case studies may help participants gain a better understanding of the State-level concept during the transition period and to identify ways that Member States can support the successful implementation of the concept. Case studies aim at familiarizing workshop participants with some of the key elements of implementing the State-level concept, while recognizing that the IAEA’s approach continues to evolve.

Against this background, the objectives and results of the INMM Workshop entitled “Evolving the IAEA State Level Concept”, held at the University of Virginia in May 2012, were presented. During the workshop, participants were divided into four groups, each with a mix of expertise, in order to develop SLAs for four different fictional countries. Each group considered all four case studies. The four cases covered fictional countries with varying fuel cycles, a wide range of technical and industrial capability, and a variety of past and present non-technical factors.

The case studies were not intended to accurately simulate the IAEA’s development of State-level approaches which would draw upon far more comprehensive knowledge and analysis than would be realistic in a workshop setting. However, the case study exercises introduced participants to some key elements of the State-level approach process, as well as demonstrated how different State characteristics result in different approaches, even for States with similar fuel cycles.

Though very limited in depth, the case studies were a vehicle for exploring challenges involved in developing State-level safeguards approaches, such as the level of detail in which acquisition paths should be specified, the representation of acquisition paths and the issue of paths prioritisation. Identifying safeguards technical objectives and potentially applicable safeguards measures was not hard for participants, but choosing what to do what frequency and intensity raised several questions and concerns, such as assessing pathway coverage.

The workshop turned out that cases studies enable better understanding of the importance of State Factors. The workshop affirmed the importance of transparency, and it provided a better understanding of the challenge of trying to ensure effort is appropriately allocated across acquisition paths. The participants recognized that focus had to be maintained on safeguards-relevant information rather than all information about a State.

The workshop raised the awareness that IAEA safeguards, based on a holistic approach to each State, is becoming more focused while maintaining effectiveness. The participants also appreciated the challenges the Agency faces in developing and implementing the State-level concept. The workshop demonstrated that the goals of the State-level concept are desirable and achievable.
Conclusions
ESARDA has several research activities in support of research for a better understanding and improvement of the State Level Concept.

Investigation of the inspection effort in nuclear facilities in the EC countries before and after introduction of Integrated Safeguards revealed that there has generally been a decrease of the resources needed, although differences are observed per type of facility and per country. The role of a Regional System of Accountancy and Control in the SLC, and specifically the role of EURATOM being the most developed RSAC, will be subject for further research and discussion within ESARDA.

The export control session recalled that IAEA’s safeguards do not impose export controls, but benefit from their existence. The Working Group allows bringing together various stakeholders, including representatives of larger nuclear industries. In the framework of the AP, information is exchanged with the IAEA about exports of nuclear items. Additionally the IAEA has agreements with some States to exchange information about refused export control licenses. This provides the IAEA with the possibility to detect at an earlier stage illicit trafficking networks.

The activities of the VTM Working Group focus on specific techniques in support of the SLC, but have also a more conceptual direction with substantial efforts in discussing and further elaboration of acquisition path analysis concepts and performance targets, which are indispensable for a State-specific approach. Case studies turned out to be a helpful tool to gain better understanding and confidence.

The initiative of the 2012 INMM Workshop held at the University of Virginia with elaboration of case studies enabled participants to better understand several aspects of the SLC.

ESARDA has offered the IAEA to organise a similar workshop to explore this further in depth and plans also to organize again joint meetings on the topic.