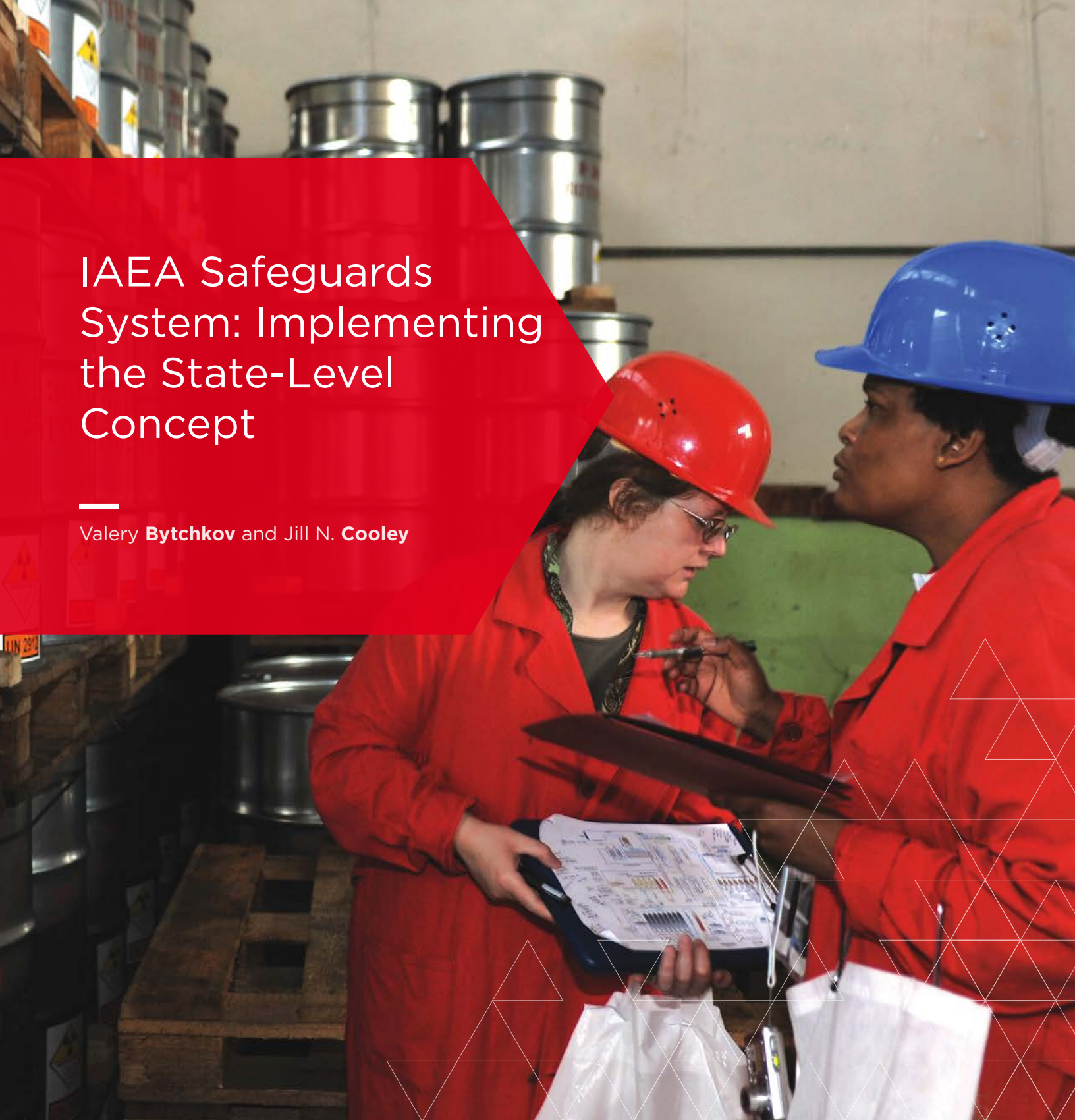


IAEA Safeguards System: Implementing the State-Level Concept

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The International Atomic Energy Agency (IAEA) safeguards system has evolved dramatically over the past 25 years: its primary focus on individual facilities placed under safeguards has been expanded to the state as a whole pursuant to the type of safeguards agreement concluded with the IAEA. Reporting in the Safeguards Implementation Report (SIR) changed from conclusions drawn with regard to nuclear material and other items placed under safeguards at individual safeguarded facilities in the 1999–2003 period to safeguards conclusions drawn for each state with a safeguards agreement in force. The Model Additional Protocol, which was introduced in 1997, provided the IAEA with additional tools for verification of the correctness and completeness of states’ declarations for states with comprehensive safeguards agreements (CSAs). Such verification tools could not be applied at the facility level only; they required state-level considerations. State-level considerations first resulted in the development of integrated safeguards for states with CSAs and additional protocols (APs) for which the broader conclusion¹ has been drawn. The initial version of integrated safeguards was a formal superposition of state-level verification procedures of additional protocols and facility-level verification procedures of CSAs. These two sets of verification activities, balanced to provide optimized effectiveness and efficiency, were defined in state-level approaches (SLAs) developed for each individual state under integrated safeguards.

Further elaborations led to formulating a more general idea of performing safeguards evaluations and verifications at the state level: the state-level concept (SLC) of safeguards implementation. This term was first introduced to the IAEA Board of Governors in the SIR for 2004. The idea arose on the grounds of safeguards effectiveness considerations. The traditional definition of the effectiveness of safeguards implementation—“the extent to which the safeguards objective is attained”—

had to be applied under the new circumstances of integrated safeguards. The safeguards objective—more precisely, the objective of verification procedures—was to be established now at the state level. Consequently, new generic objectives at the state level were developed for implementation in CSA states and reported in the SIR for 2005. The important clarification made in the SIR for 2005 was that the verification objective associated with the responsibility of the IAEA to verify the

¹ The “broader conclusion” is a safeguards conclusion for a state with a CSA and AP in force that all nuclear material in the state remains in peaceful activities. It is drawn when the IAEA determines it has sufficiently high confidence in both the correctness and completeness of the state’s declarations of nuclear material based on an evaluation of all safeguards-relevant information available to the agency and on finding no indications of diversion of declared nuclear material or of undeclared nuclear material or activities.

completeness of a state's declarations was to be applied to all states with CSAs. Whereas the 2004 SIR noted that the SLC would be extended to all states with CSAs,² IAEA efforts during the 2000s were concentrated on implementing APs being brought into force, conducting verification and evaluation activities necessary to draw broader conclusions, and progressively developing and implementing SLAs for such states. Although these original SLAs were customized for individual states, the primary basis for determining safeguards activities at declared facilities in states under integrated safeguards remained the safeguards criteria, albeit with their application adjusted to take into account the broader conclusion for such states.

In 2010, internal IAEA efforts were refocused to further develop the SLC and apply it to all states, specifically integrating the state evaluation process with safeguards verification activities and moving from criteria-driven to objectives-based implementation through SLAs. These efforts, with a detailed description of the elements of SLC implementation, were described in two IAEA Board of Governors reports, in 2013 and 2014.^{3,4}

Since 2014, the IAEA has been progressively developing and implementing customized SLAs as described in the two Board of Governors reports, with a first priority on updating the 53 SLAs for states under integrated safeguards that existed as of 2014. (The task was completed in 2016.) As detailed in the 2019 Safeguards Statement and Background to the Statement,⁵ as of December 31, 2019, SLAs had

been developed for 132 states: 67 states with the broader conclusion, 37 states with a CSA and AP in force without a broader conclusion (of which 25 are states with small quantities protocols (SQPs)), 27 states with a CSA only (all SQP states) and one NPT nuclear-weapon state with a voluntary offer agreement (VOA).⁶ In 2018, a Board of Governors report was prepared containing the IAEA Secretariat's analysis of experience gained and lessons learned in the updating and implementation of SLAs for states under integrated safeguards.⁷ Brief updates on the status of SLC development work and implementation are provided in the annual SIR and annual report to the General Conference. In addition, occasional technical meetings are conducted in Vienna for representatives of member states, providing more details on various aspects of safeguards implementation.

While the efforts to date are laudable and encouraging, there remain important questions and concerns from various member states on implementation of the SLC. This paper is structured around the five elements of SLC implementation. First the element and status of its implementation are described, and then relevant issues and concerns are identified. The paper concludes with recommendations regarding specific aspects of SLC implementation that warrant further development and/or reporting on in order for member states to understand safeguards implementation under the SLC; be assured that safeguards are being implemented objectively, effectively, efficiently, and without discrimination for all states; and have

² Later SIRs (beginning with the SIR for 2009) noted that the SLC was applicable to all states with safeguards agreements in force.

³ IAEA, *The Conceptualization and Development of Safeguards Implementation at the State Level* (GOV/2013/38), August 2013, armscontrolaw.files.wordpress.com/2012/06/state-level-safeguards-concept-report-august-2013.pdf.

⁴ IAEA, *Supplementary Document to the Report on the Conceptualization and Development of Safeguards Implementation at the State Level* (GOV/2013/38) (GOV/2014/41), August 2014, armscontrolaw.files.wordpress.com/2014/09/iaea-state-level-safeguards-document-august-2014.pdf.

⁵ www.iaea.org/sites/default/files/20/06/statement-sir-2019.pdf.

⁶ As of this date, there were 183 states with safeguards agreements in force and being applied as follows: 69 states with the broader conclusion, 62 states with a CSA and AP in force without a broader conclusion (43 with SQPs), 44 states with a CSA only (34 with SQPs), 5 states with VOAs, and 3 states with item-specific safeguards agreements.

⁷ IAEA, *Implementation of State-Level Safeguards Approaches for States under Integrated Safeguards — Experience Gained and Lessons Learned* (GOV/2018/20), July 2018.

confidence in the safeguards conclusions being drawn and reported. Although the SLC is applicable to all states, detailed descriptions for several SLC elements are provided only for states with CSAs.

Elements of State-Level Concept Implementation

Establishment of Safeguards Objectives for a State

Element description and its status: The purpose of IAEA safeguards is to verify a state's compliance with its obligations under its safeguards agreement with the agency. To this end, the IAEA conducts verification and evaluation activities aimed at detecting possible indications of non-compliance. To develop and implement effective verification and evaluation procedures, the IAEA Secretariat establishes generic objectives on the basis of states' safeguards agreement; these generic objectives are common to all states with the same type of safeguards agreement. Under a CSA, the agency seeks to verify that all nuclear material required to be safeguarded is not diverted to nuclear weapons or other nuclear explosive devices. To do so, it conducts safeguards verification and evaluation activities to address the three generic objectives common to all states with CSAs, namely:

- To detect any diversion of declared nuclear material at declared facilities or locations outside facilities where nuclear material is customarily used (LOFs)
- To detect any undeclared production or processing of nuclear material at declared facilities or LOFs and
- To detect any undeclared nuclear material or activities in the state as a whole.

To address the generic objectives for a state, the secretariat establishes technical objectives to guide the planning, conduct, and evaluation of safeguards activities for that state. For states with CSAs, technical objectives are

established and prioritized through acquisition path analysis, a structured analytical method aimed at identifying technically plausible paths by which a state could acquire nuclear material suitable for a nuclear explosive device. Each path is made up of steps connecting the different stages of the nuclear fuel cycle (processes or activities), both declared and undeclared, leading to weapons-usable nuclear material. A technically plausible path is described by the secretariat as a path where a state could acquire a significant quantity of weapons-usable material in five years or less (path length). The technical objectives are focused on detecting and deterring any proscribed activity for each step along each technically plausible path. Technical objectives are prioritized to focus verification effort where it is most effective (i.e., not all steps in a path nor all paths need to be covered with the same level of verification effort). Factors considered in prioritization include path length, type and quantity of nuclear material, the state's technical capabilities, the agency's ability to address the path step, and the number of paths covered by a technical objective. Acquisition path analysis is conducted for a state by the state evaluation group (SEG) responsible for that state. (The roles of SEGs are described in more detail below.)

Issues/concerns:

- The results of acquisition path analysis depend on the judgment of each SEG about the technical capabilities of a particular state and the time it would need to develop a missing capability.
- The desire to produce narrow, customized technical objectives for each state may be, at the end, counterproductive; the results may lack objectivity and transparency.
- Comparative analysis of the existing SLAs by the IAEA Secretariat should be carried out to ensure consistency of SLAs with regard to technical objectives and the safeguards measures to attain them.

Development of a Customized Safeguards Approach for a State

Element description and its status: An SLA contains the generic and prioritized technical objectives and the applicable safeguards measures to address the objectives for an individual state. The identification of applicable measures takes into consideration the scope of the IAEA's legal authority and other state-specific factors (e.g., the possibility for the IAEA to carry out unannounced inspections effectively). Where possible, an SLA identifies more than one measure that could be used to address each technical objective, to provide for flexibility in implementation as well as comparison of the cost-effectiveness of the different measures. Frequency and intensity of implementing safeguards measures are determined on the basis of priority assigned to each technical objective. An SLA is executed through an annual implementation plan (i.e., a schedule of safeguards activities to be conducted for a state during a calendar year to meet the technical objectives).

Issues/concerns:

- The customized SLAs developed for individual states are internal documents not available to safeguards experts outside the IAEA Secretariat, including the state itself; an independent assessment of the effectiveness and efficiency of SLAs has not been performed.
- There is a need for evaluating the effectiveness of implementation of each SLA in order to see to what extent and how efficiently the technical objectives for each state have been attained and what implementation problems have been encountered.
- To enable the evaluation of the effectiveness of SLA implementation, performance targets determining the intensity and frequency for verification and evaluation activities need to be established.



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Consideration and Use of State-Specific Factors

Element description and its status: State-specific factors are safeguards-relevant features and characteristics particular to an individual state that are used in the development of an SLA and in the planning, conduct, and evaluation of safeguards activities for that state. The IAEA has identified six state-specific factors: (1) the type of safeguards agreement in force for the state and the nature of the safeguards conclusion drawn by the IAEA; (2) the nuclear fuel cycle and related technical capabilities of the state; (3) the technical capabilities of the state or regional system of accounting for and control of nuclear material (SSAC/RSAC) (e.g., does the state authority conduct national inspections or audits; does it possess and use its own verification equipment); (4) the ability of the IAEA to implement certain measures in the state (e.g., remote data transmission; unannounced/short-notice inspection schemes); (5) the nature and scope of cooperation between the IAEA and the state in the implementation of safeguards (e.g., the timeliness and completeness of state reports; facilitation of inspector access; responsiveness to addressing anomalies,

questions, or inconsistencies); and (6) the IAEA's experience in implementing safeguards in the state (e.g., the number and type of unresolved anomalies; local security conditions impeding IAEA access). These six factors have been identified based on experience gained during safeguards implementation in states for many years. Under the SLC, more systematic consideration and better use of state-specific factors is intended to facilitate the further optimization of safeguards implementation.

Issues/concerns:

- The objectivity of several state-specific factors (e.g., cooperation, SSAC technical capabilities) has been questioned.
- How state factors are systematically and objectively assessed and specifically used in safeguards implementation for an individual state is not clear.
- Implementation of state-specific factors should be analyzed within the framework of the effectiveness evaluation and the results reported in the SIR.

Evaluation of All Safeguards-Relevant Information Available to the IAEA about a State

Element description and its status: The collection and evaluation of all safeguards-relevant information available to the IAEA underlies all aspects of SLC implementation. Collection and analysis of a wider range of safeguards-relevant information regarding states' nuclear and nuclear-related activities began in the mid-1990s to assess the correctness and completeness of state declarations, in particular for states with CSAs. Over the years, the agency has improved its infrastructure and analysis capabilities to collect, validate, evaluate the consistency of, disseminate, protect, and archive safeguards-relevant information. Enhancements continue to be made. Under the SLC, the types of information used (i.e., state-provided information, information generated from

safeguards activities, and other relevant information, such as open-source information and information provided voluntarily by other states) remain the same, with the overwhelming majority of information coming from states themselves and agency safeguards activities.

A key element supporting the move from safeguards implementation and conclusions drawn at the facility level to implementation and conclusions drawn at the state level is the state evaluation process. This process involves the ongoing evaluation of all safeguards-relevant information available to the IAEA about a state, in order to assess the consistency of that information in the context of the state's safeguards obligations. Information provided by the state is reviewed for internal consistency, for coherency with results of safeguards verification activities, and for compatibility with all other available information. Critical to the state evaluation process is the identification of anomalies or inconsistencies requiring follow-up through, for example, the acquisition of further information or the performance of additional in-field verification activities.

State evaluation for an individual state is conducted by a SEG assigned to the state. A SEG is a team of safeguards staff members with the appropriate expertise to collaboratively evaluate all safeguards-relevant information available to the IAEA about a state and document the consistency analysis and its findings, including all anomalies, questions, and inconsistencies, in a State Evaluation Report (SER). A SEG is also responsible for conducting the acquisition path analysis, developing the SLA, and preparing annual implementation plans.

It was reported in an IAEA paper presented at a professional society meeting in 2019 that the internal template and guidance for producing SERs had been recently updated to explicitly include state-specific factors, the continued validity of the acquisition path analysis, key assessments supporting the SLA, an evaluation of the state's fulfillment of its safeguards obligations, the consistency of safeguards-relevant information, and the effectiveness in

implementing planned safeguards measures.⁸ A presentation and/or report describing the guidance details and its application would address a number of concerns raised in this paper. Furthermore, it appears that the assessments being conducted and documented in SERs would support more detailed reporting in the SIR.

Issues/concerns:

- Concerns have been raised with respect to the functioning of the SEGs and the thoroughness of their reviews and documentation. (These concerns were recently acknowledged, *inter alia*, in the publication cited above.)

Drawing and Reporting of a Safeguards Conclusion for a State Each Year

Element description and its status: The final products of safeguards implementation are safeguards conclusions. These conclusions must be independent and soundly based—that is, they must be drawn by the IAEA on the basis of its technical findings. Once a year, the agency draws a safeguards conclusion for each state with a safeguards agreement in force on whether the state has complied with its safeguards obligations. These conclusions are reported to the agency’s member states in the annual SIR. These conclusions serve to provide member states with credible assurances that states are meeting their safeguards obligations. The type of conclusion drawn is a function of two aspects: the safeguards agreement in force, and any protocols thereto, and the results and findings of agency verification. The bases for these conclusions are the results of

state evaluations conducted during the course of the previous year, which are documented in an SER prepared for each state by the relevant SEG. To draw an independent and soundly based safeguards conclusion for a state, the agency needs to have conducted a sufficient level of safeguards activities and a comprehensive evaluation of all safeguards-relevant information available to it about the state, including the results of its verification activities. It also needs to have addressed all anomalies, questions, and inconsistencies identified in the course of its safeguards activities, and assessed whether there are any indications that constitute a proliferation concern. A safeguards conclusion that a state is complying with its safeguards obligations is drawn when the necessary safeguards activities have been completed and no indication has been found (i.e., there are no “findings”) by the IAEA Secretariat that, in its judgment, would constitute a proliferation concern.

Issues/concerns:

- The SIR as currently written provides little detail on the IAEA Secretariat’s performance in achieving its safeguards objectives (safeguards effectiveness) or on the performance of individual states in meeting their safeguards obligations. Member states are not able to ascertain with the information provided that safeguards implementation was effective and efficient, and the conclusions drawn were technically sound, for each state. More detailed information on state and agency performance needs to be provided in the SIR or another type of report available to member states.

⁸ Massimo Aparo and Therese Renis, “Implementation of Safeguards at the State Level—Developments Based on Recent Experience,” in *Proceedings of the 60th Annual Meeting of the Institute of Nuclear Materials Management* (Red Hook, NY: Curran Associates, 2020), 759–764, <http://toc.proceedings.com/53287webtoc.pdf>.




RECOMMENDATIONS

Recommendations to address the issues and concerns raised throughout this report hinge on the development or refinement of several methodologies and on transparency in the reporting of processes and results. Although transparency needs to be balanced with confidentiality concerns, objectivity, and consistency, the effectiveness and efficiency of safeguards implementation under the SLC need to be demonstrated to member states through more reporting to the IAEA Board of Governors (e.g., through the annual SIR, annual General Conference report, technical meetings, additional board reports). In recognition that the development efforts are a work in progress, the IAEA Secretariat should be encouraged to provide more detailed status reports to the board on the work as it develops, as opposed to presenting it as a *fait accompli* after implementation begins. The following recommendations can be offered to the IAEA Secretariat:

1. Develop standardized methods for assessing states' technical capabilities and estimating the time it would take proliferators to complete acquisition path steps and paths.
2. Develop a technical procedure for establishing performance targets to determine the intensity and frequency for conducting activities and to evaluate the effectiveness of safeguards activities in meeting the technical objectives.
3. Create a presentation (e.g., technical meeting) and/or report on the new SER template as well as guidance for a better understanding of consistency analysis, the evaluation and application of state-specific factors, the evaluation of a state's fulfillment of its safeguards obligations, and the agency's performance in safeguards implementation.
4. Provide more detailed information in the SIR (or other report available to member states) on the IAEA Secretariat's performance in achieving its safeguards objectives (safeguards effectiveness) and on the performance of individual states in meeting their safeguards obligations (state-by-state reporting).



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