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INFORMATION-DRIVEN SAFEGUARDS: A COUNTRY OFFICER'S PERSPECTIVE

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Abstract. Since the transition from "traditional" to strengthened safeguards, the evaluation and analysis of information has played an increasingly important role in the International Atomic Energy Agency's (IAEA's) safeguards activities. During the State evaluation process, the IAEA utilizes all available information for drawing soundly-based safeguards conclusions. Besides State declared information and data gathered during inspections, a large number of information sources are reviewed for any indications of safeguards relevance. The State level approach – in contrast to the facility-based approach under traditional safeguards – considers possible acquisition paths available to a State and adjusts safeguards activities accordingly. An additional protocol broadens the declared information base available to the IAEA for analysis and evaluation and extends the IAEA's access rights in the field. The use of all information available to the IAEA for determining safeguards activities is often referred to as "information-driven safeguards". Country officers are inspectors in the Department of Safeguards Operations Divisions who have been assigned responsibility for specific States and who thus form the core of the evaluation process. Information-driven safeguards has led to a significant change in the role of inspectors as country officers. While the verification of declared nuclear material remains the cornerstone of the IAEA Safeguards System, country officers are now not only expected to be knowledgeable about the inspection-related aspects of their work, but they also need to act on information on the State they are responsible for from a variety of sources on an ongoing basis, in order to identify proliferation indicators and assess risks at an early stage. To perform this task, country officers analyse developments in the State as well as the State's relations and co-operation with other States; review scientific literature for research activities that could potentially be of safeguards relevance; evaluate satellite imagery of declared and potential nuclear sites; assess reports on nuclear trade between the State and other States; and review data provided by the State and corroborate it with information from other sources. This work is carried out in a collaborative effort with other Safeguards staff, who receive, collect and analyze information on an ongoing basis. This paper examines the work and the challenges of country officers under information-driven safeguards.

1. INTRODUCTION

Until the early 1990s, the IAEA's safeguards approach was based on nuclear material accountancy complemented by containment and surveillance (C/S) measures, with a focus on verifying the correctness of State declarations. The approach took only limited account of State factors.

While nuclear material accounting continues to play a role of fundamental safeguards importance for detecting the diversion of declared nuclear material, the implementation of safeguards has evolved in response to new verification challenges, the development of new verification technologies and on the basis of experience gained by the IAEA through its verification activities. At the same time, the evaluation and analysis of all sources of information has been playing an increasingly important role in the IAEA safeguards system. The IAEA's findings and conclusions, documented in State evaluation reports and summarized in the annual Safeguards Implementation Report, are based on a continuous, iterative process of integration and assessment of all of the information available to the IAEA about the State's nuclear activities. Information has become the heart of modern verification and this concept is frequently referred to

as “information-driven” safeguards.

Information-driven safeguards can be described as safeguards whose planning, conduct and evaluation are based on an ongoing analysis of all safeguards-relevant information available to the IAEA about a State to focus verification activities in the field and at Headquarters. Such safeguards are responsive to changes in the analysis to ensure that the assurances provided to the international community remain credible and up-to-date.

Under information-driven safeguards, safeguards activities are implemented in a more flexible manner, based on information available to the IAEA from diverse sources – including that provided by States or collected by the IAEA. The type of information provided by States and the IAEA’s access rights in the field depend on the provisions of the different types of safeguards agreements in force between the IAEA and a State.

2. SAFEGUARDS AGREEMENT PROVISIONS

Article III of the Treaty on the Non-proliferation of Nuclear Weapons (NPT) requires all Non-nuclear Weapon States to conclude a comprehensive safeguards agreement (CSA) with the IAEA and to place all nuclear material under safeguards. Under a CSA, the IAEA has the right and obligation to ensure that safeguards are applied to all source or special fissionable material in all peaceful nuclear activities within the territory of a State, under its jurisdiction or carried out under its control anywhere, for verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

The information provided by States under CSAs includes design information, nuclear material accounting reports and, possibly, voluntary information. Safeguards implementation is based on defined safeguards criteria and comprises inspections of declared facilities for detecting the diversion of declared nuclear material, as well as design information verification (DIV) visits for confirming the status of safeguards relevant facility features and the absence of undeclared activities. Under a CSA, the information provided by States is focused on declared nuclear material and facilities and the IAEA lacks the necessary tools to ensure the completeness of State declarations.

In 1997 the Board of Governors approved the Model Additional Protocol (AP) to “strengthen the effectiveness and improve the efficiency of the safeguards system as a contribution to global nuclear non-proliferation objectives”.i The additional information and broader access for IAEA inspectors provided for in the AP are designed to “fill the gaps” in information and access required under CSAs. The AP expands the IAEA’s access to information and locations in a State and thereby significantly strengthens the IAEA’s ability to verify the peaceful use of all nuclear material in that State.

Before the IAEA draws the conclusion that all nuclear material in a State has been placed under safeguards and remains in peaceful nuclear activities (the so-called “broader conclusion”), it carries out a thorough evaluation of the State, supported by complementary access (CA) activities in the field, to confirm the absence of undeclared nuclear material and activities. In addition, the IAEA performs a complete review of the correctness and completeness of the State’s declarations all the way back to its initial declaration upon joining the safeguards regime.

Once the broader conclusion has been drawn for a State, safeguards measures are optimized through the implementation of integrated safeguards (IS). While inspections of declared facilities remain the foundation of safeguards implementation, the safeguards criteria are replaced by the State level IS approach. Field activities are optimized through the use of random, unannounced inspection schemes, when feasible, and complemented by continuous all-source information analysis at Headquarters. This is the time when the concept of information-driven safeguards can be applied to its fullest extent.

3. INFORMATION SOURCES FOR SAFEGUARDS PURPOSES

The following information sources form the basis of information evaluation and analysis for safeguards purposes.

3.1. Information declared by States

This is information provided by States pursuant to their reporting obligations or on a voluntary basis. Reporting obligations include nuclear material accounting reports, import/export notifications, design information on nuclear facilities, reports on illicit trafficking incidents, and AP declarations. Voluntary information may include the reporting of separated neptunium and americium and information on export denials.

3.2. Information resulting from safeguards activities

The results of safeguards activities – such as inspections, DIVs, technical visits, CAs, observations made in the field and any interactions with the State – are captured in inspection, DIV, CA and special reports, Notes to File and analytical reports on destructive analysis and environmental sample results.

3.3. IAEA internal information

The IAEA maintains a large number of databases, many of which are of safeguards interest, such as the databases of the Department of Technical Cooperation (TC), the Research Reactor Database, the Research Contracts Database, the Nuclear Reactor Information System and the Illicit Trafficking Database.

3.4. Information from open sources

A great variety of open sources are monitored, collected and analyzed by the Department of Safeguards' Division of Information Management (SGIM) on a regular basis. These are news reports, conference proceedings, scientific and technical publications, nuclear and State-specific web sites, satellite imagery and many others. The newsfeed is made available to Safeguards staff through the daily highlights service. Open source information is used for State evaluation purposes, for answering specific questions and resolving inconsistencies, and for planning field activities.

3.5. Third Party information

Information provided by Third Parties is corroborated with all other information available to the IAEA. Due to its sensitive nature, it has very limited distribution.

4. WORK AND RESPONSIBILITIES OF COUNTRY OFFICERS UNDER INFORMATION-DRIVEN SAFEGUARDS

So, who are country officers (COs) and how is the concept of information-driven safeguards implemented at the CO level?

COs are inspectors in the Department of Safeguards, who, upon their recruitment by the IAEA, are comprehensively trained to inspect diverse nuclear facilities. Their work involves preparing for inspections at Headquarters by determining the inspection, DIV or CA activities to be performed, selecting and ordering the required equipment, preparing the working papers, arranging the travel etc. In the field, inspectors carry out inspection, DIV or CA activities, such as examining and reconciling records and reports, preparing a sampling plan, making non-destructive assay (NDA) measurements, taking destructive analysis (DA) and environmental samples, servicing surveillance cameras and reviewing surveillance data, applying seals, assessing the conformity of the facility layout and equipment with the design information provided by the

State, and making safeguards relevant observations. Back at Headquarters, inspectors debrief on the field activities performed and observations made, analyze inspection results and report on field activities in a computerized reporting system.

When inspectors are assigned to be COs, they become primarily responsible for safeguards implementation issues in the State under their responsibility. They interact with State authorities, organize bilateral meetings, draft correspondence, direct the Facility or Site Officers, and draft the annual work or implementation plan, which defines safeguards activities at Headquarters and in the field. They inspect the nuclear facilities in the State for which they are responsible on a regular basis and thereby obtain a thorough knowledge of that State's nuclear infrastructure and activities.

In addition, COs become investigators and analysts. Their work at Headquarters increases, as they review and evaluate all safeguards-relevant information available on the State in a collaborative effort with other staff in the Department. The results of this analysis are periodically documented in State evaluation reports, which are drafted and compiled by State Evaluation Groups, led by COs.

Under information-driven safeguards, the COs' analytical work is a continuous process. COs always have to be on top of any safeguards-relevant issues in the State so as to identify proliferation indicators at an early stage. The daily work of COs consists of reading news reports so as to be informed about any new developments in the State. They have alerts set up from major news feeds. They receive State-specific information from SGIM, either directly from the information analysts or through the daily highlights service.

Scientific and technical literature is an important open source of information on research and development (R&D) carried out by universities and research institutes that can potentially reveal activities of safeguards relevance. It is most often scientific publications that show the focus (or change of focus) of R&D in a State, the scientists involved, the locations where the work is carried out, the material and equipment used at those locations and many other important details. Scientific and technical literature therefore requires a regular and thorough review and expertise in nuclear engineering, the nuclear fuel cycle and related fields, a sound knowledge of proliferation and weaponization indicators and the ability to recognize activities of potential safeguards significance. This work is done in a collaborative effort by COs and information analysts, supported by specialized experts within and outside the Department if required.

COs review satellite imagery of nuclear sites in the State on a regular basis. Satellite imagery is typically used for determining the history of a site, current and past nuclear-related activities, structures of safeguards relevance, the corroboration of AP site declarations etc., and it often serves as a basis for planning and conducting field activities. While satellite imagery alone often does not yield a definitive result, if viewed together with other information available on a particular location and complemented by field activities, it is an invaluable safeguards information source.

COs are provided with information on trade involving sensitive nuclear items and technology between entities operating in different States. These transactions may potentially reveal acquisition patterns by States or covert procurement networks and point to undeclared nuclear activities. This information also serves for verifying the completeness of export declarations under the AP.

Nuclear material accounting reports are assessed over time and the material balance for each facility under safeguards is evaluated on an annual basis. Any inconsistencies, such as significant amounts of Material Unaccounted For (MUF) or major differences between nuclear material declared and verified by inspectors, may be indicative of diversion and need to be followed up and clarified with the State. The consistency of AP declarations is corroborated by open source and other information as well as field activities.

COs also need to establish contact with staff from other IAEA departments. For example, officers from the

Department of Technical Cooperation travel to the States of interest under TC projects. They visit locations to which inspectors many times do not have access. They know the counterparts in the field and are able to provide valuable information on the scope and content of TC projects and the assistance provided by the IAEA, often before it becomes available in the TC database. Staff from the Department of Nuclear Safety and Security (NS) undertake missions to support States in protecting nuclear and other radioactive material. NS staff work in areas complementary to safeguards missions and they often have information that is of safeguards interest. The Department of Nuclear Energy (NE) assists States in introducing nuclear power and in upgrading nuclear fuel cycle and waste management facilities. NE staff thus is an important internal source of information on activities that are potentially of safeguards relevance.

COs assess the information obtained from field activities with all other information available to the IAEA. They verify the consistency of this information and identify potential proliferation indicators at an early stage. This analytical work is carried out as a collaborative effort between COs, State-level assistants and support staff and a pool of experts within the Department of Safeguards. SGIM employs a large number of information and technical analysts for this purpose and thus plays a fundamental role as the Department's hub of State-declared and open source information analysis. The Satellite Imagery Unit has built up considerable expertise in the area of satellite imagery analysis since its establishment more than a decade ago. The Nuclear Trade and Technology Analysis Unit, created in response to the detection of A.Q. Khan's covert nuclear network, assesses trade-related information. Several other SGIM units provide support in open source information collection and analysis, the assessment of State-declared information and material balance evaluation. Technical analysts evaluate analytical results from environmental samples and DA samples taken in the field.

COs thus are the central point where all safeguards-relevant information on a specific State comes together. Together with the safeguards analysts and support staff, they form the core of the implementation of information-driven safeguards. They therefore need to have the right profile and the necessary skills and expertise in order to fulfil their duties in the best possible manner.

5. COUNTRY OFFICER PROFILE

COs are in the unique position of knowing the State's nuclear facilities from field work and having access to all other information on the State available to the IAEA. Their work consists of a wide variety of tasks that require both attention to detail and broad analytical thinking. For the inspection-related part of their job, COs need to have a sound technical background; good negotiation and communication skills; and detailed knowledge of the operational aspects of nuclear fuel cycle facilities, the different types of safeguards equipment used in the field, safeguards criteria and procedures, and the legal provisions of safeguards agreements. For the all-source information analysis on the States, on the other hand, COs need to possess a good knowledge of proliferation and weaponization relevant technologies, equipment and materials and the respective indicators; a sound understanding of the physical model of the nuclear fuel cycleii; familiarity with geopolitical issues; open-mindedness; curiosity; an investigative mind set; the ability to assimilate information from a wide variety of sources and identify information of safeguards relevance; as well as good English writing skills.

The concept of information-driven safeguards has led to a major change in the role of inspectors and, in particular, COs. They have transitioned from "accountants" to all-source information analysts and investigators. The replacement of the safeguards criteria by the much less prescriptive concept of information-driven safeguards has necessitated a major culture change within the Department of Safeguards.

6. CHALLENGES AND POSSIBLE IMPROVEMENTS

COs face several challenges, both at the personal and at the organizational level.

A.1.1. Personal challenges

COs are required to have two very different, but equally well developed sets of skills: they have to remain good inspectors, and they have to become good analysts. However, for an individual, one set of skills is often better developed than the other. While new training courses in the area of information analysis have recently been incorporated into the safeguards training programme,iii an integrated training curriculum for COs would further strengthen their preparations for the job. This could be comprised of training in all areas required for the CO job, which they would need to complete before becoming COs. It could be complemented by a mentoring programme, with experienced COs guiding new COs through the process until the latter become knowledgeable enough to do the job on their own.

Individual strengths and weaknesses should be taken into account when assigning CO duties, as some inspectors are more effective performing the well-defined, traditional activities than information analysis related tasks. Since the IAEA will continue to need inspectors for field activities, it may be beneficial to allow for more specialization – COs could lead the work at the State level, spending more time at Headquarters, supported by inspectors who would spend more time in the field. Such a system could be managed by sharing the work on States between COs, who would primarily be responsible for the analytical work, and Alternate COs, who would do more field work.

A.1.2. Challenges related to information and equipment technology

The IAEA Safeguards Information System Re-engineering Project (IRP) is underway to upgrade the current safeguards information system to present-day departmental needs. However, this is a complex and lengthy process, which will take some time to complete. The existing Computerized Inspection Report (CIR) system was not designed to accommodate the newer field activities being conducted under IS. The Department needs additional analytical tools to support COs' work and to provide secure desk-top access to all sources of information. The Virtual State File, which is under development as part of the IRP, is expected to give valuable support to the SER teams in State evaluation work by providing access to all information available for a State. It could be complemented by a Geographical Information System (GIS)-based system for every State, containing facility-specific information (satellite imagery, photos taken in the field, environmental sampling locations, certain design information etc.), which would be extremely useful for the work of both inspectors and COs. Recently the Safeguards Portal, a departmental intranet web site, was introduced, which may prove to become an important tool to access departmental and certain open source information, to share information, and to foster knowledge management across the Department.

With respect to safeguards equipment used by inspectors, newer technology is being developed or deployed to replace older instruments and the IAEA is evaluating instruments needed to identify additional signatures of undeclared nuclear fuel cycle-related activities. The IAEA's Novel Technologies Project is expected to bring about necessary improvements in this area.

A.1.3. Procedural challenges

Safeguards culture and working methods are changing to meet the new departmental requirements; although, due to operational needs, it is not always possible to assign CO duties merely based on individual skills, capabilities and expertise. COs are sometimes rotated before they become knowledgeable about a State. It is often difficult to accommodate analytical work at Headquarters within a tight inspection schedule. Initiatives are underway to address some of these issues. An update of the current inspection reporting system would free COs' time for analytical work.

A.2. CONCLUSION

Information-driven safeguards are the future of modern nuclear verification.[iv] They strongly support the following departmental strategic objectives:

- To deter the proliferation of nuclear weapons, by detecting early the misuse of nuclear material or technology, and by providing credible assurances that States are honouring their safeguards obligations; and
- To continually improve and optimize departmental operations and capabilities to effectively carry out the IAEA's verification mission.

COs, together with the analytical and support staff of the Department of Safeguards, are the foundation of information-driven safeguards. In order to make this concept work in the most effective and efficient way, the main challenges need to be addressed to provide all staff involved the training and support they may need, and to create an analysis-friendly environment. Further challenges, beyond the IAEA's control, will persist, since the IAEA will hardly ever have at its disposal all safeguards-relevant information and uncertainties will always remain. Thus, the greatest challenges will be to identify early warnings from available information and to balance "monitoring the known" with "searching for the unknown".

A.3. ACKNOWLEDGEMENTS

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A.4. *REFERENCES*

[i] Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards (INFCIRC/540(Corr.)).

[ii] "A detailed overview of the nuclear fuel cycle, identifying, describing and characterizing every known technical process for converting nuclear source material to weapon usable material, and identifying each process in terms of the equipment, nuclear material and non-nuclear material involved. The physical model is used by the IAEA, inter alia, for acquisition path analysis and for safeguards State evaluations" (Safeguards Glossary, INVS No. 3, Vienna, 2001).

[iii] For example, the Analytical Skills Workshop and State Evaluation Strategy Seminar.

[iv] Barletta, M., Zarimpas, N., Zarucki, R., Open Source Information Acquisition and Analysis in the IAEA Department of Safeguards, Global 2009, Paris, France, September 6-11, 2009.