The Evolution and Future of the UAE's Safeguards Systems

Luay Alhashimi
FANR

Stephen Brion
FANR

Ohood Al Shehhi
FANR

Abstract

Nuclear regulators face an ongoing challenge with the implementation of nuclear safeguards, given the rapid advancements in technologies and proliferation schemes witnessed throughout the years. The Federal Authority for Nuclear Regulation (FANR) in the UAE has therefore deemed it pivotal to keep pace with the rapidly evolving safeguards environment and upgrade its regulatory practices, especially in the fields of licensing, Nuclear Material Accounting and Control (NMAC), information sharing and inspections. The UAE's State System of Accounting for and Control of Nuclear Material (SSAC) has gone through several phases of development since the establishment of FANR, and is gradually embracing digitized and more secure methods to deliver on its mandate. In an effort to foster effectiveness and find greater efficiencies in fulfilling the UAE's safeguards obligations and supporting the IAEA, FANR continues to enhance its nuclear safeguards processes and explore the potential of innovative digital technologies such as Distributed Ledger Technology (DLT) that may be deployed in the future. This paper addresses FANR's strategy in harmonizing these advancements, highlighting the importance of R&D in regulatory approaches and the value of cooperation at regional and international levels.

Introduction

Nuclear state regulatory authorities (SRAs) play a central role in the oversight of national nuclear activities with nuclear material, ensuring that nuclear non-proliferation standards are applied and maintained in line with the latest international best practices. As the nuclear industry evolves and technology advances, it is crucial for SRAs to continuously review and update their safeguards practices and capabilities, particularly in the areas of nuclear material accounting and control (NMAC), licensing, inspection, and information exchange.

Effective and timely NMAC is vital to deter, detect and prevent the misuse of nuclear material or facilities. Organized and comprehensive information management systems support risk-informed inspection planning which improve the SRA's efficiency and minimizes the burden on low-risk entities. On-line licensing processes that take into account safeguards requirements in an integrated manner with safety and security requirements can lead to more timely regulatory assessments and effective regulatory decisions. Secure information management systems are necessary for handling and sharing sensitive data among national and international stakeholders.

This paper outlines the motivating factors and the approach taken by the Federal Authority for Nuclear Regulation (FANR) in the United Arab Emirates (UAE) to develop its safeguards information managements systems and apply novel technology in an incremental and sustainable fashion to address emerging safeguards challenges.

Safeguards Data Management and NMAC

Safeguards information management systems at FANR have been developed and evolved in an incremental and systematic manner over the past decade. The roadmap for the development and evolution of such systems was carefully established to address a number of pressing national needs.

Firstly, the signing of a comprehensive safeguards agreement (CSA) and additional protocol (AP), together with the fast-paced peaceful nuclear power program, necessitated a prompt regulatory response to track, account for, and control nuclear material. This was an essential first step to mitigate risks of nuclear proliferation and to satisfy the UAE's safeguards obligations with the IAEA and international partners supplying nuclear technology.

Secondly, the evolution of safeguards information management systems needed to be managed in a sustainable manner. Systems development was taken step-by-step to allow time for human capacity building, while keeping pace with the UAE's gradually expanding nuclear non-proliferation obligations. The approach taken by FANR was specifically aimed at cultivating the Emirati workforce in a manner that promoted the sustainability of the national safeguards systems. Establishing a safeguards department in FANR well before the operation of national nuclear facilities allowed sufficient time to develop the safeguards knowledge of young Emiratis and to involve them in the specification, development and incremental improvement of the safeguards systems. It was important to understand and leverage the opportunities of initially working under a Small Quantities Protocol (SQP) and to appreciate the timeline to full-scope safeguards implementation. The period under the SQP gave FANR time to recruit personnel, establish regulations, develop and test safeguards systems, engage with and receive support from the IAEA – including in the form of an ISSAS mission – and to educate users of nuclear material through national workshops and other outreach events.

The development and incremental improvement of safeguards systems has also been guided by the UAE government. The government has issued specific directives and standards for federal authorities to provide excellent customer experiences through the development of smart, on-line systems. Such directives have served to support industry (licensees) by minimizing unwieldly bureaucratic processes, and which ultimately contribute to improved national economic performance.

Safeguards information management was initially characterized by manual and paper-based processes with calculations and reporting being performed in Microsoft Excel. The evolution continued with prototyping a more purpose-designed database system that offered extensive safeguards information management and reporting functions. This

prototyping stage equipped Emiratis with an appreciation of safeguards functional requirements and a deeper safeguards technical knowledge. Ultimately, Emiratis were able to take the role of "intelligent customer" in a commercial tendering exercise - specifying user requirements for an SSAC system, selecting a software supplier, testing the delivered software system and maintaining the system on an ongoing basis.

Today, FANR has completed a key step in moving on from a paper-based national reporting system to a fully-fledged web-based platform. The platform, accessible through the main FANR website, provides a service for licensees at locations outside facilities (LOFs) to efficiently submit inventory change reports (ICRs) and physical inventory listings (PILs) to FANR. The platform reduces the amount of information that LOFs need to provide and validates the information before it is submitted. This has resulted in a reduction of rework, increased the timeliness and quality of safeguards reports, increased customer satisfaction with FANR processes and minimized the processing effort by FANR.

Licensing

Initially, FANR authorized regulated activities with nuclear material by granting "safeguards-specific" licenses. However, by 2020 FANR had adopted a fully integrated licensing approach, and started to issue licences, commonly referred to as "3S" (safeguards, safety and security) licences, that cover all licensable activities in a single licence. Recently, the licensing of the import and export of items listed in the Nuclear Suppliers Group guidelines have also been included in the 3S licence.

The move to integrated 3S licensing was facilitated by the FANR "E-Licensing System" (ELS) that was introduced in 2016. The ELS is a web-based platform that offers online regulatory services to licence applicants and licensees. It incorporates back-office capabilities for FANR to efficiently manage and analyze the extensive and growing quantity of licensee data. With the ELS now combining 3S services, cross-functional evaluation and approval of licence applications and authorizations for the import and export of nuclear material and other regulated material can take place in an efficient and coordinated manner. Additionally, the ELS supports inspection activities, including inspection planning, issuance of inspection notifications and preparation of inspection reports – all electronically. Specialized tablet devices are used during on-site FANR inspections to capture data and transfer it directly to ELS. FANR licensees are able to register for an ELS account from the main FANR website. Once FANR approves the registration, licensees may apply for licences. Licensees subsequently submit various regulatory requests, notifications and reports to FANR, as well as request amendment or renewal of licences.

The 3S nature of the ELS will form the basis for the next planned evolution in the management of safeguards information. The ELS will replace certain functionality in safeguards-specific systems that are aging and already becoming a challenge to maintain.

This is anticipated to yield greater efficiency and effectiveness for both FANR and its customers.

Inspections

Access to high quality, well organized and accessible data is fundamental to carrying-out an effective and efficient regulatory inspection program. The FANR safeguards information systems have therefore continued to evolve and will continue to do so in-line with FANR's 3S approach to regulatory oversight.

At present, FANR provides regulatory oversight on approximately 80 entities utilizing nuclear material at LOFs (as part of its approximately 4000 licensees). This oversight is primarily carried out through licensing, routine analysis of licensee safeguards submissions and by regulatory inspection. Inspections which incorporate safeguards activities are carried out in a risk-informed manner, based on factors such as the category and quantity of nuclear material, the amount of transactions involving such materials, compliance history, the scope of operations, and licensee staff turnover rates. High staff turnover rates have been shown to be a significant contributory factor to declining regulatory performance. This risk-informed inspection approach requires well-organized and comprehensive information management but has resulted in greater efficiency for FANR and reduced inspection load on entities with relatively low risk to the UAE's international safeguards commitments. Inspections at LOFs are conducted using a 3S approach with a multidisciplinary inspection team. It is recommended that 3S integration be considered early in the SRA's establishment, as transitioning poses a substantial challenge, particularly on the development of information systems.

At the Barakah NPP site, FANR conducts approximately one safeguards inspection per quarter, in addition to facilitating IAEA safeguards verification activities. Further, during the first quarter of each year, FANR verifies the completeness and correctness of the Barakah NPP site declaration prior to submitting the annual additional protocol update to the IAEA. Evidences collected during inspections are submitted by the licensee electronically using FANR's Enterprise Project Management (EPM) system.

To maximize the effectiveness and efficiency of 3S inspection management, the functional components from the current safeguards information systems that relate to inspections at LOFs are being migrated to the ELS. Similar functional components relating to the Barakah NPP are being migrated to a system recently developed by FANR for performance monitoring and regulatory oversight at Barakah NPP (the Regulatory Oversight Management System - ROMS). ROMS, awarded an intellectual property certification in 2021, and ELS provide integrated solutions to manage all regulatory aspects of licensee performance and are used to inform future inspection plans.

Information Exchange and Novel Techniques

Timely and accurate information exchange becomes more important as a state's peaceful nuclear energy program expands. Enhanced information sharing helps states collaborate on safety, security, and non-proliferation efforts. Furthermore, it helps the SRA learn from past incidents, identify emerging threats, and implement best practices. Upgraded information sharing leads to better decision-making, improved transparency, and enhanced public trust in the nuclear industry.

The UAE implemented domestic legislation to forgo the sensitive activities of uranium enrichment and spent fuel reprocessing. As a result, the UAE's peaceful nuclear energy program is heavily dependent on the import of nuclear material and technology, with ten nuclear cooperation agreements (NCAs) currently in place to facilitate such imports. NCAs, through related administrative arrangements (AAs), and ad-hoc government-to-government assurances (GTGAs) generally require the coordination of requests, consents, notifications, confirmations of conditions of supply and reports between the parties exporting and importing nuclear material, materials, components, equipment and technology. The procedure typically involves multiple stakeholders and creates many opportunities to lose track of the process and to create delays that operationally and financially impact on nuclear operators. FANR is currently researching novel technologies that are more secure and employ real-time functionality, such as distributed ledger technology (DLT), to track obligated nuclear items and conditions of supply under NCAs and GTGAs. The application of such technology could improve the transparency and efficiency of GTGA and AA processes, ultimately minimizing transfer delays that can severely impact on a country's peaceful nuclear energy program.

It is recommended to consider the application of advanced technology in the SRA's research and development (R&D) program, and to look for opportunities to share experiences and prototype systems through national and international collaboration.

Conclusion

Successful safeguards information systems underpin nuclear non-proliferation efforts and commitments and promote global security. The development and evolution of such systems must therefore be well planned and managed to meet national imperatives and international commitments. For counties embarking on peaceful nuclear energy programs for the first time, special attention should be placed on human capacity development in recognition of its importance to the sustainability of the SSAC. The success of the SSAC also depends on creating excellent customer services through which licensees and other entities engage with the SRA and submit mandatory safeguards information required by national regulations. Customer experiences, and the effectiveness and the efficiency of the SRA, can also be boosted by adopting modern on-line applications and by careful consideration and integration of safeguards, security and safety requirements (3S). SRAs should continue to assess the application of new technologies to address challenges, provide solutions and drive continuous improvement in delivering on their mandate and supporting the needs of their licensees. The assessment and adoption of cutting-edge technologies should be included in the organizations R&D program and opportunities

للاستخدام الرسمي فقط -

should be sought to engage with national and international partners to conduct joint studies, share experiences and adopt best practices.

Through careful planning, FANR continues to incrementally develop effective, efficient customer-friendly and sustainable safeguards information management systems. This approach underpins safeguards excellence and the recognition that the UAE now commands for its efforts in maintaining the highest standards of nuclear non-proliferation.