

Safeguards-Related Activities in Slovenia since 2000 – Some Outcomes in a Nutshell and a Quick Look Forward

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ABSTRACT

This article would like to address the Slovenian experience with the safeguards activities, i.e. those activities by which the international inspections from the International Atomic Energy Agency (IAEA) and the European Commission (Euratom) can verify that Slovenia fulfils its international commitments not to use nuclear programmes for nuclear-weapons purposes. The Slovenian state system of accountancy and control will be presented together with some major changes after the Slovenian membership in the European Union (EU) and the implication of the “Additional Protocol” to safeguards agreement.

Beside the known international treaties and agreements, the Slovenian legislation does provide a sound basis for safeguards-related obligations, commitments and confidence-building measures so as to assure that all nuclear material and activities are intended for peaceful purposes only. Both the Ionising Radiation Protection and Nuclear Safety Act as well as the Resolution on Nuclear and Radiation Safety in the Republic of Slovenia (for the period 2013-2023) are two important pillars.

The Slovenian Nuclear Safety Administration (SNSA) has been in a vivid interaction with domestic holders (and users) of different kinds of nuclear material. In addition, the interaction of the Member States of the EU, i.e. their nuclear regulators, with the European Commission (Euratom) is also salient, not to miss out the regulators’ own engagements and new(er) topics and interfaces – which have emerged recently.

The inspections of IAEA and the European Commission (Euratom) have been a regularity (also) in Slovenia and their number has been fairly stable regardless of the introduction of the so-called integrated safeguards years ago. The SNSA’s staff have participated at nearly all international inspections; this pro-active approach has not been important only for a bunch of small holders of nuclear material¹ but also for nuclear facilities – in particular when inspections are conducted based upon “Additional Protocol”.

Over the years, and as it has been the case in most countries worldwide, smaller quantities of nuclear material (by definition) have been found. It will be briefly touched upon why such historical sources – or sudden orphan sources in scrap – are the issue – and how to establish adequate accountancy and control of such nuclear items (“batches” in safeguards terminology).

Covid-19 has had certain, fortunately quite limited influence on safeguards-related activities (e.g. inspections or “paperwork”) and SNSA has pursued a proactive approach vis-à-vis international organisations and domestic holders of nuclear material.

¹ Known in the literature also as “small-scale holders of nuclear material” or “minor nuclear material holders”

Last but not least, the Commission Regulation (Euratom) No. 302/2005 on the application of Euratom safeguards has been in force for a number of years, and some insights will be addressed to unveil the necessity for possible future amendments of this relevant regulation.

1 INTRODUCTION

The application of safeguards for Slovenia under the NPT² bilateral safeguards agreement (INFCIRC/538), in force since 1 August 1997, was suspended on 1 September 2006, when the agreement of 5 April 1973 between the non-nuclear-weapon States of Euratom, Euratom and the Agency (INFCIRC/193), to which Slovenia had acceded, entered into force. The same day in 2006, the accession to the Additional protocol to safeguards agreement (INFCIRC/193/Add. 8) was put in place.

It is worthwhile to note that Slovenia was one of the first countries in the world that ratified the Additional Protocol (hereinafter referred as AP). The inaugural report was prepared and sent in the first half of 2001. Quite many steps have coalesced and been accomplished since then, as described in the following text.

One of those notable steps was accomplished in September 2005 when IAEA informed Slovenia (SNSA) about the commencement of the implementation of the so-called “integrated safeguards” – which has represented the next milestone and assurance – going along and beyond comprehensive safeguards agreement (CSA) and AP. This was later, in 2010, expanded to all non-nuclear-weapon States of the EU with significant nuclear activities.³

In the last couple of years, IAEA has continued improving the development of “State-level safeguards approaches” (SLAs). Slovenia has been one out of 133 States, for which an SLA has been developed [1]. Broader IAEA conclusions, an optimized combination of safeguards measures and “impeccable records” of Slovenia have displayed no indication of any diversion of declared nuclear material from peaceful nuclear activities and no indication of undeclared nuclear material or activities.

2 INTERNATIONAL OBLIGATIONS AND DOMESTIC ACTIVITIES

2.1 Some Overarching International Obligations, International Supervision vs National Approaches and Fulfilments

Let us quickly look into one specific spot, namely the definition of nuclear material. IAEA, its Statute to be precise, defines nuclear material in Article XX, coupling source material and special fissionable material. Slightly different, the Treaty Establishing the European Atomic Energy Community (Euratom) includes in Article 197 certain ores amongst nuclear materials’ definition, too (the definition is referenced in the Commission Regulation (EURATOM) No. 302/2005) on the application of Euratom safeguards. In addition to this, a well-aged Regulation No 9 defining the concentrations in ores as provided for in Article 197 (4) of the Treaty establishing the European Atomic Energy Community (1960) has embraced those uranium-bearing and thorium-bearing ores that fall within the definition of nuclear material due to their concentrations. All of these international requirements are enveloped in the internal procedure of SNSA, No. ON 2.4.1 (Revision 5) on safeguards, titled in Slovenian

² NPT: Treaty on the Non-Proliferation of Nuclear Weapons

³ <https://www.iaea.org/newscenter/pressreleases/agreement-reached-integrated-safeguards-european-union>

as “*Posebni ukrepi varovanja jedrskega blaga (»safeguards«)*”.

This “disharmony” between IAEA and Euratom approaches to nuclear material – in our view – only increases the complexity and blurs the issue. Back in 2019, SNSA sent a letter to the European Commission (Euratom), presenting some questions on definitions of nuclear material and interpretation of requirements in practice, including (any) *de minimis* quantities. SNSA received a rather short response in 2020 which provided a fairly useful orientation for future reports and decision-making.

Nuclear material shall be properly accounted and reported to Euratom, and to SNSA – in parallel. ICR, PIL and MBR reports⁴ are the key periodic-type reports and declarations of the basic technical characteristics and their updates are a salient obligation of all holders of nuclear material. Over the years, and as it has been a case in most countries worldwide, smaller quantities of nuclear material have been found here and there. “Accidental gain” (GA) – as such “batches” are coded – could derive from a handful of discovered and transferred sources, nuclear material by definition, from recycling-related industry to thorough checks at other facilities. Every country should appropriately deal with such historical materials, stemming from past decades when legislation, supervision and awareness were less mature and sporadic. In practice, nuclear material may also be used, i.e. slowly consumed in the process (e.g. U-acetate in microscopy). For proper evidence and reporting, the so-called “Discards to the environment” (TE) type of code should be used (one such regular instance in Slovenia).

It is worthwhile to mention two decisions (Nos. K(2008)975 and K(2008)1019, respectively), issued back in 2008 by the European Commission, i.e. particular safeguards provisions⁵ for two largest nuclear facilities in Slovenia, the Krško Nuclear Power Plant and Research Reactor TRIGA Mark II, operated by the Jožef Stefan Institute.

Based upon INFCIRC/193 (Article 89), Slovenia as any other of the Contracting Parties of this top-down agreement, has the right to have IAEA’s inspectors accompanied at their inspections. This opportunity has been duly used, in particular after 2008, and the participation rate (of a representative from SNSA) has been more than 82% since then. This percentage includes those inspections that were conducted by the Euratom’s inspectors only. Figure 1 shows such an inspection from 2014, at the premises of a small holder of nuclear material.



Figure 1: Verification of a batch (depleted uranium) by Euratom (SNSA’s archive photo)

The number of international inspections in a given year could be – based upon statistical data and past experience – mostly between six and ten. Larger numbers are anticipated in those years that include outage-related activities at the Krško Nuclear Power Plant.

AP to safeguards agreement has given an extra layer of assurance of the “correctness and

⁴ ICR – Inventory Change Report; PIL – Physical Inventory Listing; MBR – Material Balance Report

⁵ Note: The particular safeguard provisions (PSPs) contain a description of safeguards measures at the facility as well as detailed rules for nuclear material accountancy and reporting in respect of the facility.

completeness” – and the IAEA has conducted a number of inspections in Slovenia as well as in the countries that ratified this “current standard” of non-proliferation assurances [2]. On average, one such inspection per calendar year is held in Slovenia and the relevant article of the AP is clearly stipulated in the notification on a “complementary access”. The IAEA is empowered through the AP to carry out different activities, including collection of environmental samples.

Advance notices of access from IAEA are also defined, being relatively tight (at least 24 hours, at least two hours or even – in exceptional circumstances – less than two hours). In Slovenia, first two approaches have been applied and the last inspection under AP was held in June 2020 – and the notification “of two-hour timeframe” was delivered to the State (SNSA’s) representative at the end of a “usual” safeguards inspection. Without going into to many details, nearly all AP-related inspections rely very much on the past information, provided under Article 2.a.(iii) of AP – and selected buildings within a *site* are mostly checked, their use (of their rooms, activities there, as appropriate) – and any mismatch between the provided information and actual/present state is discussed and rectified, as appropriate, normally during the very next reporting under AP.



Figure 2: IAEA’s inspection under AP at the location of former U-mine (Žirovski vrh, 2010), SNSA’s archive photo

Reporting under AP is accomplished in (Slovenia is not one of the Side-Letter⁶ States) in three different manners: some declarations are prepared by the European Commission – and delivered to IAEA; other declarations are prepared by SNSA – and delivered to IAEA; a few declarations are prepared by SNSA, sent to the European Commission – and finally delivered to IAEA. Slovenia (SNSA) has had the most intense engagement (i.e. review, collation and interaction with the input-providers, looking through the lens of time and resources) with declaration under Articles 2.a.(i), 2.a.(iii) and 2.a.(x) of AP. SNSA has relied very much on the experienced site representatives (i.e. from the two largest domestic nuclear facilities).

2.2 National Legislation and Building Blocks in this Regard

The Ionising Radiation Protection and Nuclear Safety Act (“ZVISJV-1”; Off. Gaz. RS, no. 76/2017, 26/2019 and 172/2021) devotes the whole Chapter 7 to non-proliferation of nuclear weapons and the safeguards of nuclear goods. The stepping-stone is laid already in Article 4 of ZVISJV-1, through the principle of peaceful use, quoting here, that: “*Nuclear goods shall be used in such a way as to fulfil the obligations stated in international agreements on the*

⁶ Some (other) EU Member States are Side-Letter States, some of them briefly referenced in [3]. They have in addition asked the European Commission to collect data concerning dual-use goods, research and development activities and development plans for the nuclear fuel cycle and to transmit these to the IAEA on their behalf.

prevention of proliferation of nuclear weapons and to prevent unauthorized possession of nuclear goods, including spent fuel". Subsequently, the 2nd-tier Decree on safeguarding of nuclear materials (Off. Gaz. RS, no. 34/2008) sets off a connection to the implementation of the Commission Regulation (EURATOM) No. 302/2005 on the application of Euratom safeguards.

The Resolution on Nuclear and Radiation Safety in the Republic of Slovenia - for the period 2013-2023 (published in Off. Gaz. RS, no. 56/2013) addresses *inter alia* a number of goals – one being also the “amalgamation” of non-proliferation and nuclear security. Goal No. 6 envisages, quoting here: “*As Slovenia does not have any intention to pursue non-peaceful use of nuclear energy, it is firmly bound by the NPT and fully respects its obligations; Slovenia is entirely open to international inspection control of the nuclear material on its territory (“safeguards”). Slovenia has been co-operating with international organisations in the sphere of nuclear non-proliferation and dual-use items; Slovenia in particular tries to fulfil its obligations with regard to reporting, the export control of dual-use items, and – based on its financial capabilities – contributes to global efforts to prevent the proliferation of nuclear weapons.*” Year by year, the realisation of the goals is briefly captured in the Annual Report on Radiation and Nuclear Safety in the Republic of Slovenia, while underlining the overarching commitment and status of the national obligations regarding safeguards and international inspection control and global endeavours towards nuclear non-proliferation.

SNSA has been actively engaged with the holders (users) of nuclear material in Slovenia. This does not include only participation during the international inspections but also supporting them through e.g. outreach activities (for example “Sevalne novice” – “Radiation News”)⁷ and answering as well as channelling specific questions. Figure 3 indicates all current, “active” holders of nuclear material, including three nuclear facilities and their reporting obligations in a nutshell.

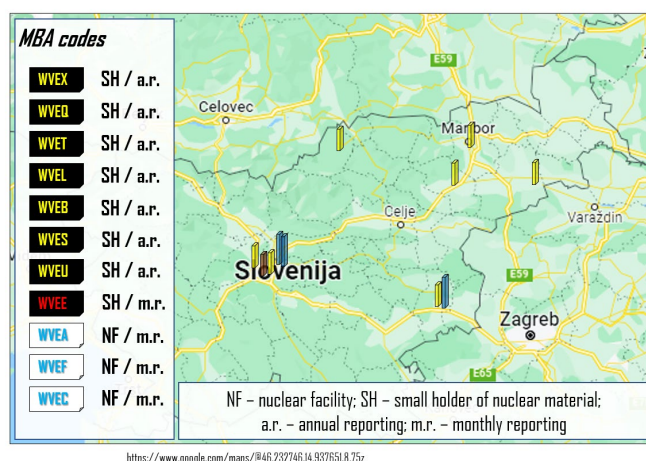


Figure 3: A schematic map with all holders of nuclear material

3 A SHORT OVERVIEW OF RELEVANT EUROPEAN BENCHMARK-LIKE ENDEAVOURS AND EXPERIENCE

Besides the renown (and well defined in various legislative texts or IAEA documents) “safety culture” and its younger complement, “security culture”, there are also other cultures

⁷ A dedicated, in-a-nutshell information on responsibilities of holders of nuclear material was presented in Issue No. 48 (January 2019; www.gov.si/assets/organi-v-sestavi/URSJV/Dokumenti/Sevalne-novice/sev-nov-48.pdf)

that have popped up in the wider nuclear sphere; one is, for example “export control culture”, the other “safeguards culture”. Some countries have significantly enhanced their efforts in this vein (e.g. Switzerland, by introducing the so-called Safeguards Indexing) [4].

The others have given a due importance to national audits, visits or inspections before the international ones are scheduled [5]. One of the drivers may also be a string of past inadequacies encountered in some places and put up the bar so as to prepare the holders of nuclear material before the eventual inspection as much as possible. At the international inspections there could be less time to discuss the issues of book-keeping, inventory lists, and reporting obligations (or even definitions and requirements). Such prior engagements and outreach activities are an important complement in ensuring compliance to regulations and international requirements.

It should be underpinned that also high level management should understand not only the importance of fulfilling safeguards-related obligations but have in mind the “ownership” of the process by appointing competent personnel. Safeguards-related activities should not be seen as an additional nuisance or burden. This is sometimes rather uneasy, e.g. if the over-bureaucracy and minor (paper) non-compliances entail undue amount of work and time. We have observed over the last two decades, that such culture varies in particular amongst small holders of nuclear material, i.e. micro companies where safeguards issues represent just a tiny fraction of duties of a single person. In practice, the SNSA has pursued “a soft approach” in many cases, while helping those organisations to communicate in a timely manner, including non-compliances or reporting issues.

Small holders of nuclear material are normally located at various places within a country. Their number may be below a dozen in some smaller European countries (also in Slovenia) or may be well over a hundred – as some open source information indicates [6] – for larger and more populous countries. Such locations may encompass e.g. industry, in particular industrial radiography-related organisations, high schools (faculties), scientific institutes, hospitals etc.

Some countries have indicated a number of LOFs (the so-called “location(s) outside facility”, aka “small holder(s) of nuclear material”). Most of them hold only depleted uranium. It is, somehow, really a bit odd to neatly count every gram of depleted uranium in shielding containers (e.g. mobile devices used in industrial radiography) when depleted uranium sometimes is dispersed all over the battlefields, on several continents, where anyone can pick it up [7]. It is not merely a single, personal point of view of a renown foreign expert, but it deserves more thorough collective contemplation, once in future, having in mind over-bureaucracy and proliferation “potential”.

On the other hand, strong States’ Systems of Accountancy and Control (SSACs) are essential to fulfil needs for nuclear non-proliferation [8]. SNSA has extensively relied – for a number of years – on the experienced site representatives (larger nuclear facilities) or other holders’ representatives, being frequently at the same time radiation protection officers.

Last but not least, the covid-19 pandemic has touched upon safeguards-related activities. Upgrades of IAEA’s equipment (postponements), different requirements by different nuclear power plants in a single country, (additional) regional requirements, tele-working, significant efforts – sometimes – to prepare the conditions for smooth accesses to nuclear sites and various other issues have shaped some unique opportunities to “test” the resilience as well as on-the-ground approaches [9]. In Slovenia, on two occasions, SNSA has approached IAEA (by a letter) about the entry circumstances, regarding the Krško Nuclear Power Plant (2020 and 2021) – so as to enable a smooth access and conducts of inspections.

4 OTHER ENGAGEMENTS – STIMULATING PROGRESS

IAEA periodically organises the symposia on international safeguards (in Vienna). SNSA's staff have not participated there due to very limited manpower/resources. The same goes with ESARDA (European Safeguards Research and Development Association) – a transnational network, co-ordinating and harmonising safeguards-related research and development activities of the partners. However, SNSA tends to actively participate during the meetings organised by the European Commission, i.e. Euratom – Member States meetings on “Euratom Safeguards Implementation”, held about every 18 months [10]. The last such interaction was held in the virtual environment in 2021 but all these interactions have enabled a better understanding, exchange of news, specific issues to be tackled in the future etc.

In August 2021, the European Commission launched a consultation on the evaluation of the Commission Regulation (Euratom) No. 302/2005 on the application of Euratom safeguards. A dedicated questionnaire was prepared and distributed accordingly. The addressees were both nuclear regulators as well as users of nuclear material in EU Member States. This regulation has two accompanying recommendations (2006/40/Euratom and 2009/120/Euratom). The multi-faceted evaluation – some of us still remember the old regulation, i.e. no. 3227/76 – has been looking through the prism of (some) significant developments in nuclear and information technologies and the changing political environment of recent years. SNSA focused in its reply (sent in September 2021) on a few, rather intertwined issues. Namely, the importance of a graded approach, clear requirements in the regulation that do not require interpretation and a need to simplify certain obligations and reporting of small holders of nuclear material, avoiding excessive bureaucracy and burdens - bearing in mind, in particular, those quantities and materials (and uses) which have meant negligible proliferation concerns. At the moment of writing and concluding this article (August 2022), no official information has been received about the European Commission's conclusions from the inputs and processes touched above.

The opportunity is also being here to optimise our future endeavours, learning from the past, including during the covid-19 pandemic. Besides the usual activities, certain “*ad hoc*” questions about past activities and (sometimes timely distant) reporting may require a fair amount of extra checks, thorough reviews and in-depth searches. Fortunately, such deep dives have been rare, and the last such effort undertaken in the first quarter of 2021 while tele-working was still a compelling issue, re-considered some data about the yellow cake from the former uranium mine at Žirovski vrh.

5 CONCLUSIONS

This article has aimed at examining domestic approaches, good practices, benefits and challenges in the development and establishment of solid co-operation with different holders/users of nuclear material and international organisations. In a limited way, the approaches of a few other European nuclear regulators in this regard were also looked over. During the last twenty years, quite a few approaches (perspectives) have evolved due to several reasons – and the major pivot was back in 2004 when Slovenia joined the EU. SNSA has pro-actively worked – with its aim at shaping mutual understanding, avoiding non-compliances as well as self-complacency – and the co-ordinated dialogue has been carried out at different levels, pursuing multi-pronged efforts – that all these, safeguards-related activities imply.

It should be earmarked that the resilience and human resources at SNSA and broader in Slovenia should be considered in order to chart a sustainable path of safeguards-related matters,

determining priorities and a sound course for the future. Both needs and learnings of our workforce and domestic counterparts are important, framed with feedbacks from IAEA and Euratom, through official channels as well as through practical, technical interactions.

We are keen on following the process of future amendments – if so decided – of the Commission Regulation (Euratom) No. 302/2005 on the application of Euratom safeguards. Even though that its tectonic changes are highly unlikely, any step forward with a “graded approach”, smartly interwoven, would have a positive contribution, riveting our attention.

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