



# SAFEGUARDS BY DESIGN

Finnish & Belgian experiences  
on contributing to the peaceful  
use of nuclear material during  
the entire facility lifecycle

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## Finnish & Belgian experiences on contributing to the peaceful use of nuclear material during the entire facility lifecycle

### Conclusions of the Workshop on the Safeguards by Design concept and provisions in the legal and regulatory framework

#### Background

**Safeguards by Design (SBD)** *is commonly understood as an approach whereby early consideration of international safeguards is included in the (pre-)design process of a nuclear facility or of a change within an existing nuclear facility, or of wherever safeguards considerations have to be taken into account during the construction, the operation and also the decommissioning phases.* From a broader international point of view, SBD also means awareness within the nuclear community, including designers of components and installations, of the need to consider international safeguards as early as possible in the lifecycle of a nuclear project and understanding of the potential impacts design decisions might have on safeguards implementation. It is considered that SBD allows informed design choices that are the optimum confluence of economic, operational, safety and security factors, and of course of international safeguards.

The Finnish Radiation and Nuclear Safety Authority (STUK) and Belgium's Federal Agency for Nuclear Control (FANC) have gained extensive knowledge of safeguards implementation in nuclear newbuild, plant modification and decommissioning projects over the past decades. We have independently observed the issues related to the traditional implementation of safeguards and the benefits of the SBD approach. In this perspective, we have decided to jointly explore ways to improve the implementation of safeguards through raising awareness amongst the overall nuclear community and further developing the SBD approach.

STUK and FANC officially launched a collaboration on this matter by organizing a virtual workshop to exchange experiences on the implementation of safeguards and especially on SBD in April 2021. After encouraging feedback on the workshop, we laid a foundation for further international cooperation on SBD with the publication of a White Paper on "*Safeguards by*



*Design - Finnish & Belgian experiences on contributing to peaceful use of nuclear material during the entire facility lifecycle*” that was presented for the first time during a side event of the 65<sup>th</sup> General Conference of the IAEA. Since this date, STUK and FANC further spread the word by distributing the White Paper and by presenting STUK and FANC initiative in the European Safeguards Research and Development Association (ESARDA) meetings. On March 2023, STUK and FANC organised the first international workshop in the framework of this collaboration in Vienna. This workshop focused on the SBD concept and provisions in the legal and regulatory framework.

## Introduction to the workshop topic

In the White Paper, STUK and FANC presented five Reflection Points (RPs) to explore to further improve the SBD concept implementation worldwide. As expressed in the White Paper, further collaboration is directed to address these points while still aiming to contribute to the enhancement and the improvement of safeguards worldwide. The first Reflection Point (RP-1), *SBD concept and provisions in the legal and regulatory framework*, was identified by STUK and FANC to be the most logical starting point for a continued collaboration to spread knowledge of SBD in the nuclear community and to address, at least partially, the challenges and opportunities associated with this point.

One of the important SBD-relevant cases identified in the White Paper is the provision of initial design information of a facility to the IAEA. That is the de facto starting point of the international safeguards implementation in many countries. In the Subsidiary Arrangements of the Comprehensive Safeguards Agreements, the time limits for provision of preliminary and final design information are generally tied to the start of the construction of the facility and the reception of nuclear material, respectively. STUK and FANC have experienced that without separate national or regional legal requirements, and intervention by or guidance from the regulatory authorities, project management and short-term economic factors motivate the operator to provide the information in one consignment close to the deadline. At that point, safeguards solutions are not appropriately integrated to the facility design and project organization which may cause difficulties in the safeguards implementation, extra costs or even delays. Addressing RP-1 helps in exploring how national and regional nuclear legislation and regulation could offer a solid but practical foundation for the SBD concept and better facilitate the safeguards implementation in nuclear projects.



## Overview of the workshop

On 30 March 2023, STUK and FANC organized a workshop on the SBD concept and provisions in the legal and regulatory framework at the Embassy of Belgium in Vienna. The workshop was primarily directed at national safeguards authorities. The IAEA, Euratom and the national authorities from eleven countries, namely Canada, Norway, Switzerland, United Kingdom, and EU countries (Belgium, Czech Republic, Hungary, Slovakia, Sweden, Finland, France) were represented in this workshop. The objective during this day was to share and exchange on how the SBD concept and provisions in the legal and regulatory framework could contribute positively to the SBD in particular, and to effective and efficient safeguards in general.

The workshop began with a welcome and introduction from the Ambassadors and Permanent Representatives of Belgium and Finland, respectively H.E. Caroline Vermeulen and H.E. Pirkko Hämäläinen. After technical opening remarks by STUK, FANC and Euratom representatives, the IAEA and Euratom jointly presented their perspectives on SBD. Their words were followed by presentations and discussions on the status of SBD in the legal and regulatory framework in Finland, Belgium, Czech Republic, United Kingdom and Canada.



In the afternoon, the participants formed groups and discussed the role which current and potential provisions on SBD in the nuclear legislation and regulations play or could play in the future for more effective and efficient safeguards implementation. The findings of the group discussions and interactive polling questions sessions held during the workshop were used as focus areas for a panel discussion between invited expert panelists.

The workshop was followed by a reception at the Embassy of Belgium where the workshop participants continued to have productive discussions among themselves and with invited participants.

## Summary of discussions and polling questions

The workshop participants had a possibility to voice their views by answering eight polling questions throughout the workshop. The first session with four questions was held between the presentations by the national authorities while the second one was held before the panel discussion.

According to the answers, all early safeguards work, even without the involvement of the IAEA, benefits overall safeguards progress in projects. Project information should be provided to the national authorities even without prior involvement of the IAEA. It should not be limited to the contents of the design information questionnaire (DIQ) or, in Euratom countries, basic technical characteristics (BTC) whose delivery schedules do not facilitate an early launch of the SBD process in the initial stages. Following the vast majority of the participants, binding provisions on SBD should support and obligate the stakeholders and operators to start their safeguards-related work with both the authorities and the potential suppliers, designers and vendors well before the end of the pre-design phase. These provisions should clarify which important aspects are to be taken into account at the different steps of the project and what information should be provided to the authorities throughout the different phases. International cooperation and sharing of information are very much recommended, both for general awareness and for the sharing of best practices.

The afternoon session of the workshop was started with a group discussion on the current and potential provisions in the legislation and the regulation of the participants' countries. In general, few countries have direct and clear SBD provisions in the legislative and regulatory framework. Finland was the only represented country that had set concrete requirements related to the early provision of information. In Belgium, recommendations-level provisions exist for specific projects but binding general provisions are not yet included in the legislative and regulatory framework. Also, many countries are considering to introduce the SBD provisions either in their legislation, in their regulations or in safeguards-specific guidelines. Binding provisions in the legislation were seen to be more effective for the introduction and the support of the SBD concept and for influencing stakeholders. Due to the generic nature of



the nuclear energy legislation in many countries, binding provisions in the regulations, including in the guidelines, were considered to be better suited for defining practical and technical SBD requirements. However, the groups emphasized the need for flexibility when drafting SBD provisions in anticipation of new technologies and safeguards methods that will appear in the future, considering the rapidly changing nuclear landscape worldwide. In this regard, the need to tackle the challenges and opportunities associated to the emergence of small modular reactors (SMR) and advanced modular reactors (AMR) were briefly mentioned. Some trends, such as increasing remote monitoring and data transmission, are already visible.

The final part of the workshop was a panel discussion that reflected on and summarized the views presented during the day. The panel participants came from the IAEA, Euratom, STUK (Finland), FANC (Belgium), ONR (United Kingdom) and SUJB (Czech Republic). The panel stressed that SBD is not limited to the introduction of legal or regulatory requirements even though those are well recommended. Raising awareness, building relationships between the stakeholders, taking into account the safeguards needs from the (pre-)design phases onward and following up each declaration of information to authorities with necessary clarifications were considered at least equally essential for the SBD concept.

Safeguards provisions in the legal and regulatory framework should be drafted in a way that supports the aforementioned points. As long as safeguards needs do not play a strong role in design decisions in the nuclear industry, safeguards considerations will be rather only added onto the design than being also integrated to it. This will lead to less effective and efficient results. The success of safeguards work and follow-up in projects relies heavily on leadership by the national regulator and other national central stakeholders involved in the non-proliferation and safeguards. All these stakeholders should properly communicate together in order to have a comprehensive picture of the situation. The responsibilities and mandates regarding safeguards and especially in this regard SBD should be clear for everyone.

According to the panel, currently safeguards awareness starts with the operator and their safeguards responsible staff but should spread to the safety and security experts, designers and vendors who are not safeguards experts. Internal trainings organized by operators with a direct outreach to vendors and designers are opportunities for spreading safeguards awareness and culture. Vendor design review processes, where designers must consider authority expectations on safeguards, and open international meetings with designers, vendors and suppliers are seen as good practices. In this perspective, there was a strong support from the participants on the idea that international associations such as the European Safeguards for Research and Development Association (ESARDA) and the Institute of Nuclear Materials Management (INMM) could play a role towards performing studies and proposing solutions regarding SBD in support to and at the demand of national, international and/or regional authorities. This could be done by working on and publishing best practices on, for example, the inclusion of provisions in the national legal and regulatory frameworks, and by reaching out and facilitating the contacts at the international level between all the stakeholders including the vendors and designers. The fact that these associations have members of different fields (in particular of regulatory bodies, universities and the industry) is seen as a strong asset in this



purpose. However, it was clearly underlined that any recommendations given in such publications would be considered purely voluntary. International training on SBD has rarely been offered as there has thus far not been a standard approach to SBD which could serve as the basis of such training.

Finally, the panel elaborated on the importance of developing and supporting a common understanding of the SBD concept in the nuclear industry, raising in this regard two important points. First, both the aspects of proliferation resistance and safeguardability should be clearly understood and taken into account by all the stakeholders, especially when new nuclear technologies and solutions are studied and proposed (e.g. for SMR and AMR). Addressing all proliferation resistance aspects, including the safeguardability, could significantly contribute to serve the goals associated with the non-proliferation commitments worldwide. However, even with highly developed proliferation resistance achieved as a result of other factors, challenges may arise in addressing the safeguards objectives afterwards if the safeguardability aspects have not specifically been included in the early considerations. Second, the question of when and how to introduce safeguards aspects into the projects can be understood differently from the operator's, the national regulator's and the international inspectorates' perspective. This can be alleviated with active discussions and follow-up. This is also applicable when dealing with plant modifications and decommissioning projects: understanding what kind of changes are safeguards-significant is difficult. As plant modifications are very frequent, raising awareness on safeguards requirements is the best way to ensure that those requirements are accounted for in a timely manner. The legislative and regulatory framework could support that, e.g. by developing provisions associated with the safeguards culture.



## Conclusions of the workshop and ways forward

Based on the findings of this workshop, the organizers can give the **following recommendations** regarding inclusion of Safeguards by Design in the legal and regulatory framework primarily to the attention of the regulatory bodies:

**Support early consideration of safeguards with SBD provisions, at least from the pre-design phase, in the legal and regulatory framework.** Provisions may range from principles on safeguardability and proliferation resistance of facilities to concrete requirements to allow necessary containment and surveillance methods. Strict and clear time limits for providing design information should be set.

**Set futureproof prescriptive provisions to account for new technologies and safeguards methods,** considering the rapidly changing nuclear landscape worldwide. In this regard, these provisions are needed to tackle the challenges and opportunities associated to the emergence of the SMR and AMR technologies.

**Supplement binding legal and regulatory provisions with national and/or international informative and non-binding guidelines** and clarify all these provisions with **authority expectations** to operators, vendors and designers to facilitate the SBD process.

**Follow up early safeguards reporting** with discussions and meetings to promote common understanding. Clarify leadership in the process, including in the legal and regulatory framework.

**Raise safeguards awareness and build relationships** between international inspectorates, national authorities, operators, vendors, designers and suppliers. In this perspective, provisions associated to the safeguards culture should be developed in the legal and regulatory framework.

STUK and FANC wish to thank the participants of the workshop and those that otherwise participated by expressing their interest and giving feedback on the collaboration. We think that the workshop was a suitable next step after the White Paper. Nuclear legislation and regulation are naturally a shared area of interest for the national and regional regulatory authorities who were the primary target group of this first workshop. Many of the participants had also been previously discussing and collaborating with STUK and FANC on the SBD development through ESARDA working groups, and other fora. The workshop gave encouraging results on the interest in the SBD approach and on the motivation of States to implement the concept in their nuclear legislation and regulation.

The first and already successful workshop on the Reflection Points of the White Paper opens new opportunities. STUK and FANC wish to keep promoting the SBD concept in the legal and regulatory frameworks with new regulator audiences and to expand the scope even more and





move on to the other four Reflection Points. Further collaboration that is considered by STUK and FANC include, for example, seminars on SBD best practices for operators and suppliers and further side events at international events to spread awareness of SBD in newcomer countries.

STUK and FANC are happy to welcome any interested parties to collaborate on the development of the SBD concept. We would like to invite everyone who could contribute directly or indirectly to safeguards and non-proliferation to share the White Paper, the present paper and in particular the recommendations given here to a broader audience. Finally, STUK and FANC invite all regulatory bodies to reflect on the interest of implementing these recommendations.

