

Ensuring Nuclear and Radiation Safety during Pandemic in Slovenia

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ABSTRACT

The outbreak of COVID-19 pandemic in 2020 and the lockdowns caused the situation, which has not been witnessed before. The actions taken by the Slovenian Nuclear Safety Administration, to ensure nuclear and radiation safety are systematically described for each of the following areas: legal framework, management system, inspection, authorization, emergency preparedness and response, international cooperation, safeguards and nuclear security. In addition, interaction with the Krško NPP as the most prominent licensee in Slovenia is presented as a case study.

1 INTRODUCTION

At the onset of pandemic in January 2020 it was difficult to understand its impact and consequences. At the end of February 2020, the world faced an unprecedented situation which could not be compared with the experiences from the bird or the swine flu in the recent decades. Experiences from the Spanish flu could not be applied since it was a century ago, the records from that period were scarce and unreliable and, the most important, the world changed substantially. The travel and global economy were suddenly hit by the pandemic and the anti-pandemic measures changed the lifestyle and interactions between the people. This has profound effect also on ensuring nuclear and radiation safety. Response of the Slovenian Nuclear Safety Administration (SNSA), i.e. nuclear and radiation safety regulatory authority in Slovenia, to assure nuclear and radiation safety developed as the pandemic developed, e. g. smart working has been introduced.

The paper is structured into the thematic chapters. Each chapter describes the problem(s) and discusses the solutions to the problem caused by the pandemic. The emphasis is to highlight the measures, which were tested in practice and turned out to be efficient. Thematic areas comprise: legal framework, management system, inspection, authorization, emergency preparedness and response, international cooperation, safeguards and nuclear security.

2 LEGAL PROVISIONS FOR INTRODUCING ANTI-PANDEMIC MEASURES AND CHANGES OF LEGISLATION

During the pandemic the SNSA immediately provided on its website all information regarding its operation and the operation of nuclear facilities in pandemic. In order to prevent

the spread of the pandemic, it was also required that applicants for the authorization communicate any information via e-mail or telephone and applications were to be submitted via e-mail. In person communication was only in exceptional cases with prior invitation.

Pursuant to the *Act on Provisional Measures for Judicial, Administrative and Other Public Matters to Cope with the Spread of Infectious Disease SARS-CoV-2 (COVID-19)* [1] the time limits for the performance of procedural actions of the parties were put on hold and the validity of administrative acts (e. g. authorizations) that expired during the implementation of measures under this Act was automatically extended. They were to expire on the eighth day from the day of termination of measures, which was later determined by the Government of the Republic of Slovenia, but no later than 1 July 2020. At a correspondence session on 21 May 2020, the Government of the Republic of Slovenia adopted a decision terminating the interim measures of the above-mentioned act. From the point of view of administrative operations, it is important that from this day on, the *General Administrative Procedure Act*, as it applied before 29 March 2020, is fully applied again in all administrative matters. Table 1 gives lessons learned related to legal provisions.

Table 1: Legal provisions – Lessons Learned.

Positive	<ul style="list-style-type: none"> • Deadlines for procedural actions (applications, license expiration, etc.) were put on hold or extended • Licensees and registrants were promptly informed about these changes and access to the SNSA premises via the SNSA website
Negative	<ul style="list-style-type: none"> • Limited access to SNSA premises (in general, not many licensees, registrants or interested parties requested access to SNSA)

3 MANAGEMENT SYSTEM

The SNSA management system was running smoothly during the pandemic. The internal procedures of the SNSA management system were regularly reviewed and revised, if needed. A dedicated procedure dealing with teleworking was developed, as well as some procedures were updated by addressing virtual events. Virtual internal audits of four core processes were performed at the end of 2020, and corrective actions were proposed. The self-assessment of safety culture was successfully implemented, as well as customer and employee satisfaction survey. The regular annual management system review took place virtually in January 2021.

As soon as the pandemic was declared the SNSA staff went teleworking. Each employee had remote electronic access to documentation from home. The initial problem was signing the documents, but during the first months of pandemic all SNSA employees received e-signature. Only the on-duty team which consisted of representatives of all SNSA departments worked in the SNSA offices. The on-duty team consisted of about 20 % of all SNSA employees. The team rotated on a weekly basis. All previously in person meetings have moved to virtual environment. Some of these measures were introduced in the revisions of the SNSA Register of Risks for 2020 and 2021.

At the beginning of 2020, the Government of the Republic of Slovenia introduced budget cuts for all budget users due to ensure funds for combating the pandemic. SNSA lost some funds, which affected its planned outsourced projects including the employee trainings. However, the budget for 2021 was comparable to those of previous years. Table 2 gives lessons learned related to management system.

Table 2: Management System – Lessons Learned.

Positive	<ul style="list-style-type: none"> • Introduction of teleworking and enabling remote access to documentation including granting e-signature to all employees • Revision and development of procedures, internal audits, surveys and meetings were conducted smoothly
Negative	<ul style="list-style-type: none"> • Reduced SNSA budget due to “pandemic” budget cuts

4 AUTHORIZATION

The SNSA authorization processes were arranged and adapted to the pandemic situation quickly after its outbreak. Virtual communication platforms were used for meetings, hearings, presentations, etc. Operators (licensees and registrants) also adopted some changes, e.g. in order to obtain approvals for modifications for nuclear facilities, the delivery of the application files and license documentation were arranged via an internet connection or via secure internet connections for proprietary documentation.

Coordination of individual SNSA reviewers for a particular licensing or registrant case was a challenge when doing review and assessment remotely. With the establishment of the appropriate organization process and communication protocol the process worked well and without major delays. The remote meetings of the SNSA and authorized parties were organized on daily basis or on request. Technical meetings with larger number of involved parties from the different institutions were also a challenge.

There were no requests to extend duration of authorization. There were only a few cases when the NPP requested an extension of the deadlines for implementation of a particular modification due to non-delivery of a component.

During pandemic there were the following important activities related to nuclear facilities in Slovenia:

- Preparation and approval of the program for the third periodic safety review (PSR) for the Krško NPP. The program was prepared on time. All review and assessment steps by the SNSA were carried out within the deadlines.
- Start of the second periodic safety review program for research reactor TRIGA in Ljubljana. The review and assessment and final approval of the program by the SNSA was conducted without major problems.

Due to the appropriate organization of working process, there was no special need to change the review and assessment process. In general, the regulatory licensing processes were carried out smoothly and on time. Table 3 gives lessons learned related to authorization process.

Table 3: Authorization - Lessons Learned.

Positive	<ul style="list-style-type: none"> • Use of different virtual communication platforms for working process • The remote meetings can be very effective due to resource optimization
Negative	<ul style="list-style-type: none"> • Access of certain documentation and using databases remotely were more difficult due to limitations (data transfer, proprietary documents)

5 INSPECTION AND ENFORCEMENT

The SNSA inspection adapted to the pandemic to ensure effective and efficient inspection process. At the beginning of the pandemic three major actions have been taken:

- The SNSA Annual Inspection Plan was revised in the middle of 2020, i. e. priority was given to inspection of operators, which activities may pose higher risk to the

population and environment, e.g. operators using high activity sealed sources. This approach enabled the SNSA inspection almost full implementation of the Annual Inspection Plan in 2020. In preparation of the Annual Inspection Plan for 2021 such graded approach was utilized.

- During regular inspections influence of pandemic on operator's ability to safely operate was inspected. Some NPP inspections were fully dedicated to this issue. Some inspections also identified impact of pandemic on technical support organizations and qualified experts.
- The inspectors worked from home whenever possible. In addition, they developed hybrid as well as virtual inspections as appropriate. As the pandemic evolved, more operators identified benefits of virtual inspections. By using foreign experience, the SNSA inspectors developed guides for conducting virtual inspections for inspectors as well as for the operators.

As the pandemic evolved several new measures were introduced:

- In conducting on-site inspections, the rules preventing the spread of virus were introduced, e. g. limited number of staff at inspection, use of masks and disinfectants, exchange of data of all involved to be notified in case of an infection.
- Inspectors who were considered to belong to one of the vulnerable groups conducted less on-site inspections.
- The SNSA provided FFP2 masks to the inspectors.

During pandemic the SNSA inspectors were tasked to inspect anti-pandemic measures as all the other inspectors in Slovenia. Specific training has been organised by the state administration and the SNSA inspectors conducted few tens of inspections dedicated to anti-pandemic measures. At each regular inspection some time was devoted to inspection of anti-pandemic measures. The SNSA inspectors had to adhere to anti-pandemic measures themselves (e. g. mobile application for tracking, testing and vaccinations). One of the inspectors had to be quarantined after a close contact to already infected person during inspection.

The SNSA inspections adapted to circumstances very well by applying hybrid and video inspections. In spite of pandemic all incidents were fully inspected in-person by the SNSA inspectors (reactive inspections). Table 4 gives lessons learned related to inspection process.

Table 4: Inspection – Lessons Learned.

Positive	<ul style="list-style-type: none"> • Setting new priorities for inspections reflected in the updated inspection plan • Change of inspection practices (hybrid and virtual inspections, less people involved), the guides were also developed
Negative	<ul style="list-style-type: none"> • Less inspectors available due to their age and vulnerability, exposure of inspectors to COVID-19 infections during site visits

6 INTERNATIONAL CO-OPERATION

The international cooperation is global and strongly relies on in-person meetings and international travel. In the first days after the declaration of pandemic, the travel routes were cut-off because the countries isolated themselves and banned all, but essential travel. Therefore, the onset of the pandemic will be remembered by massive cancellation and postponement of international meetings, courses, workshops, conferences, etc. Relatively quickly the organizing of virtual events became frequent practice as replacement for in-person meetings.

The virtual events proved themselves as a useful tool in pandemic situations, but the virtual world cannot supplement the physical contacts. One has to anticipate shortcomings of virtual events, such as:

- Keeping the attention of the audience, lack of feedback from the participants,
- In person engagement is not possible (fierce debate, body language and eye contact are missing),
- Absence of social life and informal contacts after the event or during the breaks.

Virtual events may also offer some advantages. Travel and all associated logistics (accommodation, visas, delayed or cancelled flights, weather) can be avoided in attending the virtual events. In case of events, which do not require so much interaction, as information meetings or when a meeting of international participants has to be organized in a short time period, the virtual meetings tools are the right solution.

When considering virtual events, one needs to consider the following limitations:

- Duration of an event (should not exceed few hours, running full day trainings is not advisable),
- Different time zones (for intercontinental meetings time difference can be more than 12 hours)
- Quality of internet connection (data bandwidth sometimes requires switching off the cameras, frequent connection interruptions, distorted voice, poor picture resolution),
- Confidentiality (difficult to control, who is actually on-line).

In spite of wide use of virtual platforms, the conventional means of communication such as e-mails and voice (telephone), as well as social networks, helped to maintain information flow between the stakeholders in the international arena.

The international co-operation proved useful in exchanging the experiences in combating the pandemic. This was in demand in the first months of pandemic. Almost all international fora asked for reports and data about the anti-pandemic measures (e. g. IAEA, WENRA, ENSREG, etc.). Although quite some information from different sources and countries were similar and did not provide something new, the usefulness of those was the confirmation that we are all in the same track.

In the area of assistance to third countries, we can praise the IAEA action of providing COVID-19 test kits to the interested countries. More than 100 countries requested these kits, which were aimed at providing or enhancing the countries' testing capabilities. At the first stage of pandemic the testing was critical. Even more developed countries were not sure that they have enough material needed to perform the requested scope of testing, not mentioning the countries lacking the expertise for performing testing. Table 5 gives lessons learned related to international cooperation.

Table 5: International Cooperation – Lessons Learned.

Positive	<ul style="list-style-type: none"> • Transition to virtual events to avoid postponement or cancellation of events • Swift and adequate response of international organisations • International exchange of experiences about mitigation of the pandemic
Negative	<ul style="list-style-type: none"> • Inherent imitations of virtual events cannot make those events equivalent to in-person events • Postponement of international events • Repetition/duplication of exchanged information (too many organisations collected and circulated similar information)

7 EMERGENCY PREPAREDNESS AND RESPONSE

The pandemic did not leave nationwide emergency system for nuclear or radiological emergencies unaffected. On a national and on a regional level several exercises were postponed. Trainings were implemented remotely, via video conferences. In 2021, when the pandemic was already more under control, the exercises were no longer postponed, but were carried out with adjustments to the pandemic restrictions. Similarly, the implementation of regular trainings and exercises of the SNSA Emergency Response Team was re-established. Trainings were implemented in smaller groups, mostly individually and remotely via video conferences organized by SNSA Emergency Preparedness Division.

The SNSA prepared a detailed analysis, where the possibility of remote access of SNSA Emergency Response Team members to its information systems, services, applications, and programs was analysed in order adjust the SNSA response during pandemic. The analysis showed the inability of remote access to the local SNSA network and consequently to the necessary data and services. The remote communication via national emergency communication system is much slower than the personal communication used by the team when physically present in the Emergency Response Center. Working remotely the Emergency Response Team would almost certainly not be able to meet currently set time objectives for its tasks during an emergency.

In the event of a nuclear or radiological emergency in Slovenia or abroad with a potential radiological impact on the territory of Slovenia, the Emergency Response Team should be at least partially activated even in exceptional circumstances in accordance with applicable procedures, and, if necessary, in full scale and perform its work in the Emergency Response Center. For small-scale emergencies, where the work is limited only to informing the public and relevant organizations and not to the time-critical proposal of protective measures, it was suggested that the team should work remotely in accordance with applicable procedures. Table 6 gives lessons learned related to emergency preparedness.

Table 6: Emergency Preparedness – Lessons Learned.

Positive	<ul style="list-style-type: none"> • Training and exercises were organized virtually or respecting anti-pandemic measures • Adjustments were proposed to Emergency Response Center, such as less staff or the smaller scale events should be conducted remotely
Negative	<ul style="list-style-type: none"> • Remote communication is slower than in-person communication in the Emergency Response Center

8 SECURITY AND SAFEGUARDS (NUCLEAR NON-PROLIFERATION AND NUCLEAR SECURITY)

The number of “safeguards”- related inspections in Slovenia (including those, carried out under Additional Protocol) has remained practically unchanged in the period 2020 – 2021. Those inspections have been conducted smoothly, following basic healthy measures and preventive approaches.

The pandemic caused that the national Commission for the Control of Exports of Dual-Use Items has conducted correspondence sessions only for more than a year. However, the applications submitted by the exporters and licensing process ran unobstructed. Unfortunately, no outreach activities have been conducted to industry or academia/research and a lack of in-depth, in-person discussions and meetings has been evident.

During pandemic there were no reported cases of illicit trafficking of nuclear or other radioactive material. On the other hand, SNSA reported some events into the renowned Incident and Trafficking Database (ITDB), managed by IAEA. SNSA would really like to underpin the importance of the informal network of national stakeholders – also in the area of (preventing) illicit trafficking. The pandemic has brought up some postponements but also some extra interactions in the virtual environment and sometimes even some extra time for some additional queries, analyses and focusses.

In the international arena, the 10th NPT (Treaty on the Non-Proliferation of Nuclear Weapons) Review Conference was postponed to 2022. Another prominent conference the 2021 Conference of the Parties to the Amendment to the Convention on the Physical Protection of Nuclear Material (A/CPPNM) has shared the similar fate.

The Nuclear Suppliers Group (NSG) Plenary was carried out as a limited-scope meeting in June 2021. SNSA staff followed the discussion virtually.

In September 2020, Slovenia joined the international initiative on mitigating insider threats in the nuclear sector (“INFCIRC/908”). Several Slovene stakeholders, including SNSA, have been active since then and it seems that the pandemic has not hindered substantially any international activities within the initiative framework. Table 7 gives lessons learned related to security and safeguards.

Table 7: Security and Safeguards – Lessons Learned.

Positive	<ul style="list-style-type: none"> • Safeguards inspections were conducted smoothly in spite of pandemic • Limited scope meetings were introduced • Good relations from the times before pandemic enabled undisturbed work
Negative	<ul style="list-style-type: none"> • International conferences were postponed (see also Table 5)

9 CASE STUDY: MEASURES IMPOSED BY THE REGULATORY BODY TO THE KRŠKO NPP

At the outbreak of pandemic, the SNSA started collecting and analysing recommendations from international nuclear energy institutions concerning the relevant countermeasures applied by the foreign authorized parties, and in particular, in the NPPs. This enabled comparison of situation and countermeasures taken abroad with the situation in the Krško NPP, which also reported to the SNSA.

The SNSA required from the Krško NPP to conduct a comprehensive analysis of the impacts of the pandemic on the plant operation in April 2020. The Krško NPP analysis covered time interval when the pandemic was declared in Slovenia (13 March to 31 May 2020). The Krško NPP identified the following main threats:

- Interruption of operation – due to lack of healthy personnel at critical positions,
- Compromised plant physical security – due to lack of healthy security staff,
- Compromised supply of spare parts – due to unstable global situation,
- Adverse price movements - due to unstable global conditions.

Among the very first measures introduced by the Krško NPP were:

- All NPP staff, not needed for safe plant operation, were ordered to work from home,
- All construction sites in the NPP were closed down,
- Contractor workers were not allowed to enter the site,
- Personal distancing, disinfection and the wearing of the respiratory protection equipment, etc. were introduced.

In parallel the Krško NPP started to develop its internal *Epidemic or Pandemic Response Plan*, based on international standards and domestic experience. Its purpose was to provide guidelines for management of protective measures including the outage during pandemic. In the analysed period there were no COVID-19 cases among the plant staff. The SNSA independently analysed the Krško NPP response to pandemic. It was concluded that the Krško NPP actions were appropriate and similar to measures done by the other NPPs for which the SNSA had the information.

In autumn of 2020 there was a new rise of COVID-19 infections in Slovenia. The Krško NPP was preparing for April 2021 outage which was planned to be a full scope outage. The main potential hazards for outage carried out during the pandemic were identified:

- insufficient number of healthy personnel and workers on-site to carry out required activities,
- inability for external personnel/equipment to arrive at the NPP, and
- problems with procurement of spare parts.

Due to the above hazards, the SNSA and the Krško planned for a potential reduction of outage activities, if needed. The Krško NPP developed backup outage schedules which were made known to the SNSA in advance. The April 2021 the outage was performed in full scope, as it was planned. Due to comprehensive anti-pandemic measures at the NPP site there was a relatively small number (15) of recorded cases of COVID-19 infection among the NEK staff and contractors during the outage.

10 CONCLUSIONS

The response of the SNSA to pandemic was quick and demonstrated high level of flexibility of the SNSA staff to pandemic. In spite of the fact that effects of pandemic were mostly negative, the two categories of positive lessons learned can be identified:

- Those, which were useful and can be kept after the pandemic is over (also in non-pandemic situation),
- Those which would need to be repeated and applied in case of a new pandemic.

Among the most affected areas were inspection, international cooperation and emergency preparedness. These findings are in line with international experiences. The pandemic also showed resilience of the nuclear sector to pandemic as many similar actions can be identified in combating the pandemic. All the lessons learned, which may be repeated or kept in future pandemics, are summarized in the tables in the individual chapters. Those, which can be kept, are mostly related to use of electronic means and the virtual platforms. However, in considering the lessons learned, which of them should be kept, one needs to bear in mind the thin line between the practicality of the tools and the lack of physical interaction. The decision depends on the circumstances, which should be carefully analysed for each individual example.

REFERENCE

- [1] Zakon o začasnih ukrepih v zvezi s sodnimi, upravnimi in drugimi javnopravnimi zadevami za obvladovanje širjenja nalezljive bolezni SARS-CoV-2 (COVID-19) (Official Gazette of the Republic of Slovenia, 36/20 and 61/20) – in Slovenian