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Nuclear Safety, Security and Safeguards in Ukraine

Report by the Director General

Summary

- The Board of Governors, in resolutions GOV/2022/17 and GOV/2022/58, requested that the Director General continue to closely monitor the situation regarding nuclear safety, security and safeguards in Ukraine and report formally to the Board on these matters. This report provides a summary of the situation in Ukraine regarding nuclear safety, security and safeguards of nuclear facilities, and activities involving radioactive sources in Ukraine. It covers the period from 6 September to 9 November 2022 and is based on verified information made available to the Agency during this period. This report covers progress made by the Agency in responding to Ukraine's requests to provide technical support and assistance in re-establishing, as appropriate, a sound nuclear safety and security regime at its nuclear facilities and in activities involving radioactive sources.
- This report also summarizes relevant aspects of the implementation of safeguards in Ukraine under the Agreement Between Ukraine and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons and the Protocol Additional thereto under the current circumstances.

Recommended Action

- It is recommended that the Board of Governors take note of this report.

Nuclear Safety, Security and Safeguards in Ukraine

Report by the Director General

A. Introduction

1. On 3 March, the Board of Governors adopted a resolution on the safety, security and safeguards implications of the situation in Ukraine, which “[d]eplore[d] the Russian Federation’s actions in Ukraine” and expressed “grave concern that the Russian Federation’s aggression is impeding the Agency from fully and safely conducting safeguards verification activities”.¹
2. On 28 April, the Director General issued a first Summary Report on Nuclear Safety, Security and Safeguards in Ukraine², in which he provided an overview of the situation in Ukraine covering the period 24 February to 28 April and including initial findings of the Agency’s expert missions led by the Director General to Ukraine in March and April 2022.
3. At the Board of Governors meeting in June, the Director General presented an oral report on the nuclear safety, security and safeguards implications of the situation in Ukraine as well as on the Agency mission to Ukraine’s Chornobyl nuclear power plant (ChNPP) site and the Exclusion Zone carried out from 30 May to 4 June. The Director General informed the Board about the establishment of a comprehensive programme of assistance including remote technical assistance, on-the-ground technical assistance, delivery of equipment and the Agency’s readiness to rapidly deploy assistance if needed. He also underlined a detailed list of Ukraine’s needs that had been shared with Member States.
4. On 5 September, the Director General issued a second Summary Report on Nuclear Safety, Security and Safeguards in Ukraine³, covering the period 28 April to 5 September. Following an analysis of the situation at the Zaporizhzhya nuclear power plant (ZNPP), the Director General emphasized the urgent need for an immediate establishment of a nuclear safety and security protection zone to prevent a nuclear accident arising from physical damage caused by the armed conflict. On the basis of the second Summary Report on Nuclear Safety, Security and Safeguards in Ukraine, in September, the Director General provided the Board of Governors with a detailed report⁴ on nuclear safety, security and safeguards in Ukraine covering the period from 24 February to 5 September. The report to the Board of Governors focused mainly on the events at the ZNPP site and the preliminary nuclear safety and security

¹ IAEA Board of Governors resolution GOV/2022/17, adopted on 3 March 2022.

² Available at <https://www.iaea.org/sites/default/files/22/04/ukraine-report.pdf>

³ Available at https://www.iaea.org/sites/default/files/22/09/ukraine-2ndsummaryreport_sept2022.pdf

⁴ IAEA Board of Governors document GOV/2022/52.

findings from the IAEA Support and Assistance Mission to Zaporizhzhya (ISAMZ) from 29 August to 3 September, as well as the findings from the second Agency mission to the ChNPP site and the Exclusion Zone from 30 May to 4 June.

5. On 15 September, the Board of Governors adopted a resolution on the safety, security and safeguards implications of the situation in Ukraine, which “[d]eplore[d] the Russian Federation’s persistent violent actions against nuclear facilities in Ukraine” and expressed “grave concern that the Russian Federation has not heeded the call of the Board to immediately cease all actions against and at nuclear facilities in Ukraine”.⁵

6. At the 66th regular session, the IAEA General Conference, considered the nuclear safety, security and safeguards situation in Ukraine. Both the nuclear and radiation safety resolution (GC(66)/RES/6) and the nuclear security resolution (GC(66)/RES/7) adopted by the General Conference address, inter alia, the need for all Member States “to be mindful of the importance of nuclear safety and security regarding peaceful nuclear facilities and materials in all circumstances”. The safeguards resolution (GC(66)/RES/10), inter alia, urged all Member States “to refrain from attacks or threats of attacks on, against or in the vicinity of nuclear facilities devoted to peaceful purposes in order to ensure that the Agency is able to conduct safeguards activities in accordance with relevant safeguards agreements”.

7. On 24 October, a letter to the United Nations Secretary General and the President of the Security Council from the Permanent Representative of the Russian Federation indicated a potential use of radioactive material for a radiological dispersal device (also known as a ‘dirty bomb’) at two nuclear locations in Ukraine. These allegations raised concerns among the international community, the public and the media. At the invitation of Ukraine, the IAEA sent teams to perform inspections (see Section C).

8. This report has been produced in response to resolution GOV/2022/17, in which the Board of Governors requested the Director General and the Secretariat to “continue to closely monitor the situation [in Ukraine], with a special focus on the safety and security of Ukraine’s nuclear facilities and report to the Board on these elements, as required”, and to resolution GOV/2022/58, in which the Board of Governors requested the Director General to “continue to closely monitor the situation and report formally to the Board on these matters as long as required.” This report of the Director General to the Board of Governors provides a summary of the situation in Ukraine regarding nuclear safety, security and safeguards of nuclear facilities, and activities involving radioactive sources in Ukraine from 6 September to 9 November. It also includes progress made by the Agency in providing technical support and assistance in nuclear safety and security to Ukraine and in the establishment of the nuclear safety and security protection zone around the ZNPP.

B. Nuclear Safety and Security in Ukraine

B.1. ISAMZ and other Agency Missions to Ukraine

9. Between the start of the armed conflict in Ukraine and 5 September, the Agency implemented four support and assistance missions to Ukraine: to the South Ukraine NPP (SUNPP) from 29 to 31 March, to the ChNPP site and the Exclusion Zone from 25 to 28 April and from 30 May to 4 June, and to the

⁵ IAEA Board of Governors resolution GOV/2022/58, adopted on 15 September 2022.

ZNPP from 29 August to 3 September when the continued presence at the ZNPP site (ISAMZ) was established.

10. The primary objectives of these support and assistance missions were to assess the current nuclear safety, security and safeguards situation at nuclear facilities and activities involving radioactive sources in Ukraine; to agree on the scope of the technical support and assistance to Ukraine for nuclear safety and security; to initiate the implementation of the Agency's assistance aimed at reducing the risk of a major nuclear accident; and to help stabilize the current nuclear safety and security situation at the ZNPP site in particular, while closely monitoring and assessing the situation at the site.

11. The findings and outcomes of these missions were reported in the Director General's report to the Board of Governors in document GOV/2022/52⁶ in September.

12. During the reporting period, the Agency and Ukraine, through its Ministry of Foreign Affairs, agreed on the formal framework for the Agency's continued presence at the ZNPP. Under this framework, the Agency's continued presence facilitates the monitoring of the actual situation at the ZNPP pertaining to nuclear safety and security, the conduct of regular field observations of key plant areas, and regular discussions with technical counterparts at the ZNPP and elsewhere in Ukraine; the establishment of a communication channel with the Agency for direct technical discussions; the identification of priority needs; and the provision of relevant technical advice. The Agency's nuclear safety and security experts do not change, or substitute for, the respective responsibilities of the operator and the regulator of Ukraine in relation to the safe and secure operation of the ZNPP. It is expected that the team of experts at the ZNPP will also provide support to the nuclear safety and security protection zone, once it is agreed, by reporting on compliance to the Director General with the commitments being made by concerned parties.



First ISAMZ team on its way to the ZNPP site on 1 September (Photo: IAEA)

13. The Agency's continued presence at the ZNPP is implemented through the rotation of its experts every three to four weeks. Since 29 August, three Agency teams have been deployed with the third shift of four experts arriving at the ZNPP on 3 November. The Agency experts have established regular meetings on the site with the technical counterparts of the Ukrainian operator of the ZNPP. The Agency experts are provided with Agency communication equipment as well as radiation monitoring and safeguards equipment at the site to perform their activities. Prior to their departure, the Agency staff who are going to be deployed to the ZNPP are briefed in Vienna on the current nuclear safety and security situation at the plant, their communication procedure with Agency Headquarters, as well as their safety and security.

⁶ Available at: https://govatom.iaea.org/GovAtom%20Documents/2022/GOV-2022-5220220909200725/New%20GOV-2022-52%20-%20Nuclear%20Safety%20Security%20and%20Safeguards%20in%20Ukraine_.pdf.



Second ISAMZ team departing from the ZNPP on 3 November (Photo: IAEA)

14. The Agency's Incident and Emergency Centre stays in very close contact with the Agency staff and receives information and data directly from them on a daily basis. This information provides the basis for the IAEA Director General's regular updates on Ukraine.

15. The Agency, in close cooperation with Ukrainian counterparts, implemented a mission to Kharkiv from 8 to 10 November and is preparing for a mission to the ChNPP site later in November. The mission to Kharkiv assessed the current nuclear safety and security situation at the Kharkiv Institute of Physics and Technology and the State Specialized Enterprise "Radon". The latter mission will focus on nuclear safety and security in the ChNPP site and Exclusion Zone facilities and activities.

16. The scope of these technical support and assistance missions is expected to include an assessment of the nuclear security status of all facilities outlined above, including a damage assessment of the infrastructure and supporting physical protection systems affected by the conflict to date, as well as material inventory checks, and verification of equipment needs related to security and contingency measures. Similarly, from a safety perspective, the team will assess upgrades to air monitoring systems, calibration and verification capabilities, and the workplace radiation monitoring programme, and will identify equipment required to support the ongoing decommissioning efforts of multiple radioactive waste streams.

B.2. Nuclear Safety and Security Protection Zone

17. In document GOV/2022/52, the Director General stated that shelling on the site of the ZNPP and in its vicinity should be stopped immediately to avoid any further damage to the plant and associated facilities, for the safety of the operating staff and to maintain the physical integrity to support safe and secure operation. In this context, he called for an agreement by all relevant parties for the establishment of a nuclear safety and security protection zone around the ZNPP. The Board underscored the Director General's call in resolution GOV/2022/58.

18. Discussions aimed at agreeing and implementing the nuclear safety and security protection zone around the ZNPP were intensified during the reporting period. The establishment of such a protection zone aims at preventing a nuclear accident from happening and envisages that no attack on, against, aimed at or from the ZNPP takes place that may have an impact on the implementation of nuclear safety and security measures.

19. At the United Nations General Assembly meeting in New York in September, the Director General held high level discussions with Ukrainian Foreign Minister Dmytro Kuleba and Russian Foreign Minister Sergei Lavrov as part of his commitment to initiate talks with all parties aimed at reaching an agreement on the establishment of the nuclear safety and security zone around the ZNPP. In addition, on 21 September, the Director General took part in and co-chaired a side event on the safety and security of civilian nuclear facilities in armed conflicts hosted by the French President Emmanuel Macron. During this event the Director General reported on the proposal for the establishment of the nuclear safety and security protection zone and received broad international support.



IAEA Director General Rafael Mariano Grossi attended an event in New York hosted by French President Emmanuel Macron to discuss the safety and security of civilian nuclear facilities in armed conflicts (Photo: IAEA)

20. The Director General held meetings with the Ukrainian President Volodymyr Zelensky in Kyiv on 6 October and the Russian President Vladimir Putin in St Petersburg on 11 October to discuss the situation at the ZNPP and the Agency's proposal to set up a nuclear safety and security protection zone around the facility. These meetings were followed by extensive technical dialogue and consultations with both parties. Progress was made in these consultations on the establishment and implementation of the nuclear safety and security protection zone; however, further efforts and commitment from all involved in these consultations is still needed before an agreement is reached.

21. On 27 October, the Director General provided an additional briefing to the United Nations Security Council (UNSC) on the nuclear safety, security and safeguards situation in Ukraine that followed the briefings given on 11 August and 6 September. The Director General highlighted again that the current situation was untenable and that, while the best action to ensure the safety and security of Ukraine's nuclear facilities and its people would be for the armed conflict to end, in the meantime the Agency's continued presence at the ZNPP and the immediate establishment of a nuclear safety and security protection zone around the ZNPP were critical to prevent a nuclear accident from happening.



*IAEA Director General
Rafael Mariano Grossi
after the UNSC meeting on
27 October (Photo: IAEA)*

22. The Director General continues his efforts towards the urgent establishment of the nuclear safety and security protection zone around the ZNPP.

B.3. Overview of the Situation at Nuclear Facilities in Ukraine

23. On 2 March, at a meeting of the Board of Governors, and subsequently in a press release issued on 4 March, the Director General outlined seven indispensable pillars for ensuring nuclear safety and security during an armed conflict (“Seven Pillars”) in relation to the situation in Ukraine that have since been used to assess the nuclear safety and security situation in Ukraine. The Seven Pillars are:

- The physical integrity of the facilities — whether it is the reactors, fuel ponds or radioactive waste stores — must be maintained;
- All safety and security systems and equipment must be fully functional at all times;
- The operating staff must be able to fulfil their safety and security duties and have the capacity to make decisions free of undue pressure;
- There must be secure off-site power supply from the grid for all nuclear sites;
- There must be uninterrupted logistical supply chains and transportation to and from the sites;
- There must be effective on-site and off-site radiation monitoring systems and emergency preparedness and response measures; and
- There must be reliable communications with the regulator and others.

24. These Seven Pillars specifically apply to these unprecedented circumstances in which military forces are near or on the site of a nuclear facility, in particular of an operational NPP. As such, they do not present additional principles, requirements or recommendations for nuclear safety and security. They derive from the Agency's safety standards and nuclear security guidance publications. Information on the ongoing review of the Agency's safety standards and nuclear security guidance in relation to ensuring nuclear safety and security in an armed conflict is given in Annex I.

25. The Agency has been monitoring the nuclear safety and security situation at Ukraine's nuclear facilities, including the ZNPP, ChNPP, Khmelnytsky nuclear power plant (KhNPP), Rivne nuclear power plant (RNPP) and SUNPP, as well as other facilities and activities involving radioactive sources. An overview of the current status at these facilities and activities against the Seven Pillars and of the findings from ISAMZ, since 6 September, is presented below. A chronology of events at nuclear facilities in Ukraine during the period from 6 September to 9 November is given in Annex II.

B.3.1. Zaporizhzhya NPP

26. The ZNPP consists of six VVER-1000 reactors operated by Energoatom, the National Nuclear Energy Generating Company of Ukraine. As of 9 November, four reactor units are in cold shutdown two reactor units are in hot shutdown.

27. During the reporting period, the Agency was informed about frequent shelling at or near the ZNPP as well as landmine explosions close to the ZNPP site. As a result of the shelling, the ZNPP's connections to off-site power were affected on a number of occasions. The ZNPP faced, in total, four losses of off-site power in this period when the plant's emergency diesel generators were started to provide the required electricity, with the last one on 2 November. While the landmine explosions mostly did not have a direct impact on the nuclear safety and security of the plant, the mere presence of landmines around the ZNPP imposed a challenge and danger to the Ukrainian operating staff and delays in conducting maintenance work to repair the broken power lines. On these occasions, the Director General reiterated his deep concern that the situation continues to be increasingly dangerous, precarious and challenging, with potential impact on nuclear safety and security, underpinning the need for the urgent establishment of the nuclear safety and security protection zone around the ZNPP.

28. Following the Russian Federation's attempted illegal annexation of four regions of Ukraine on 4 October, the United Nations General Assembly adopted Resolution A/RES/ES -11/4⁷ declaring that it had no validity under international law, and the IAEA complies with this resolution. This affects the ZNPP site and the town of Enerhodar where most of the plant operating staff and their families live. Also in October, the Russian Federation took operational control of the ZNPP facility, including taking significant decisions, following the creation of a Russian state operating organization based in Moscow. Although Ukrainian staff continue to undertake day-to-day operations of the ZNPP facility, more Russian staff arrived at the ZNPP site during the reporting period.

29. These latest developments have significantly intensified the difficulties for personnel at the ZNPP, with staff facing demands to sign a new employment contract with the Russian State Atomic Energy Corporation "Rosatom" to keep their jobs, while being urged by Ukraine's National Nuclear Energy Generating Company "Energoatom" not to do so and instead follow its instructions. In addition, the developments exacerbated the situation by leading to confusion as to who is in charge due to the ambiguity about the command and control chain at the plant. The Director General repeatedly expressed the concern that the ZNPP staff were being subjected to unacceptable pressure while being forced to also make a hugely difficult decision for themselves and their families and carrying out their crucial work tasks under increasingly difficult conditions with potentially severe consequences for nuclear safety and security. In this context, the Director General called for the enormous pressure on the Ukrainian operating staff to stop.

"The plant's courageous staff deserve our sincere gratitude and respect for continuing to fulfil their vital tasks in unimaginably difficult conditions, with their workplace located in the middle of a war zone. There is a need for urgent action to make their jobs and lives easier, not the opposite."

IAEA Director General Rafael Mariano Grossi, 6 October.

30. As part of these developments, the ZNPP Director General, Ihor Murashov, the ZNPP Deputy Director General and another Ukrainian plant management staff member were detained by the Russian forces. Since learning about Mr Murashov's detention, the IAEA Director General remained in

⁷ United Nations General Assembly Resolution A/RES/ES -11/4, adopted on 12 October 2022: <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N22/630/66/PDF/N2263066.pdf?OpenElement>.

continuous contact with all relevant authorities to contribute to his release, likewise for the later detentions of other plant management staff. Such actions impose an immediate and serious impact on decision-making in ensuring the nuclear safety and security of the plant and have a very significant impact on at least two of the Seven Pillars that were outlined at the beginning of the conflict in Ukraine. While two of detained staff were released on 4 and 17 October, respectively one plant staff member is still in detention. The IAEA Director General made an appeal for the other staff member to be released as soon as possible.

31. All these events have had a continued and direct impact on all of the Seven Pillars the Director General outlined in March 2022 and have shown a lack of commitment to the fulfilment of the Agency's recommendations stipulated in the second Summary Report on Nuclear Safety, Security and Safeguards in Ukraine, published on 5 September, and outlined in the Director General's report to the IAEA Board of Governors in document GOV/2022/52.

Physical integrity

32. On 6 September, the ISAMZ team reported that shelling had caused damage at the site's switchyard, which required the Ukrainian NPP operating staff to proceed with an immediate repair. On 20 September, further shelling occurred at one of the site's spray cooling ponds, which form part of the plant's heat removal system. The resulting damage to pipework rendered the pond out of service.

33. On 28 September, three landmine explosions close to the ZNPP, most likely triggered by wildlife, caused no major damage but yet again underscored the potential risk to nuclear safety at the facility.

34. On 30 October, another landmine explosion cut the main power supply connection to one of the reactor units, once again underlining the fragile nuclear safety and security situation at the facility.



Broken pipe observed by ISAMZ at the ZNPP site due to shelling on 21 September (Photo: IAEA)

35. Near continuous military activity at and in the vicinity of the ZNPP during the reporting period has impacted the physical integrity of the facilities, whether they be reactors, fuel ponds, or radioactive waste storage facilities. This has included repeated shelling and detonation of ordnance including landmines, as observed by the ISAMZ team, clearly compromising Pillar 1. On several occasions shelling has damaged buildings at the site, specifically the area adjacent to the cooling ponds and the

dry spent fuel storage facility, as well as power supply lines at the site.

Nuclear safety and security systems and equipment

36. Shelling, not only on site but also in the vicinity of the ZNPP site, has resulted in safety systems and associated equipment being activated, for example the emergency diesel generators upon disconnection of external power supplies. Auxiliary buildings, such as the solid radioactive waste storage facility and the dry spent fuel storage facility, have been damaged due to shelling and landmine explosions. The subsequent repair of the damages was performed under extremely challenging conditions. This has impacted the safety system's defence-in-depth principle and increases the risk of a safety system failure compromising Pillar 2.

37. Regarding recent reports pertaining to the ZNPP dry spent fuel storage facility, the Agency was made aware on 14 October of construction works being carried out with the stated aim of upgrading the existing physical protection system. The IZAMS team was informed that this work includes repairing the fence, setting up surveillance cameras and similar activities. Continued access to the facility was permitted for safeguards activities, amongst other purposes.

Operating staff

38. With the creation of a Moscow based Russian state operating organization for the site, the Russian Federation announced it has taken control of the facility, including now taking significant operational decisions. More Russian technical staff are now working at the site. Ukrainian plant staff continue to operate what the IAEA – in line with General Assembly resolution ES-11/4 – continues to regard as a Ukrainian plant, under relentless levels of stress and pressure, especially given the additional burdens of resource gaps, the unclear chain of command and continued detentions placed upon them. Furthermore, pivotal senior leadership staff, such as the ZNPP Director General and the ZNPP Deputy Director General for Personnel, were detained by Russian Federation authorities.

39. The continuation of such working conditions and pressure on operating staff lead to constant challenges to maintain nuclear safety and security, risk the safe operation of the plant and significantly compromises Pillar 3.

Off-site power supply

40. The off-site power supply was repeatedly reduced due to shelling of the ZNPP switchyard, or other off-site power lines and switchyards, which are important for the off-site high voltage power lines and the backup power line from the nearby thermal power plant. As a result of the shelling, the ZNPP lost all external power supply on four occasions between 6 September and 9 November. The loss of off-site power was replaced by either one operating unit providing power for the site, or the emergency diesel generators supplying power for limited periods before any repairs were completed to reconnect either a high voltage power line or the backup power line.

41. On 6 September renewed shelling damaged once again a back-up power line between the ZNPP and the nearby thermal power station.

42. On 10 September, the last operating reactor at ZNPP was shut down after the restoration of a 330 kilovolt (kV) power line allowed the plant to access off-site electricity from the grid instead of relying on the reactor itself for power.

43. In the period that followed, some improvements regarding the plant power supplies were made temporarily but the power status remained far from safe and secure.

44. Renewed shelling on 21 September damaged cables providing electricity to one of its six units, temporarily forcing this reactor to rely on emergency diesel generators for the power it needs for its

cooling and other essential safety functions. The shelling did not have an impact on the other five reactors that continued to receive power directly from the recently repaired off-site power line. A similar situation occurred on 6 October. On that occasion, the Director General emphasized that again the plant's courageous, skilled and experienced operators had found solutions to overcome the severe problems that keep occurring because of the conflict, questioning the sustainability of this way of working and calling for creation of a more stable environment for the plant and its staff.

45. On 12 October, the ZNPP lost all external power for the second time in less than a week. Yet again the site's emergency diesel generators automatically started operating. Energoatom confirmed shelling as the cause of the loss. Similar situation was faced on 17 October when the ZNPP once again lost connection to its last remaining operating 750 kilovolt (750 kV) external power supply. The cause at that time was the sub-voltage protection system which automatically took such action when the voltage dropped below prescribed limits.

46. In the period that followed, operating staff heated up the two reactors in Unit 5 and Unit 6 to provide steam to the plant's operations. However, with the total loss of off-site power that took place on 2 November when shelling led to the 750 kV and 330 kV back-up lines being disconnected and emergency backup diesel generators being started, Units 5 and 6 were transferred to a cold down mode. The four other reactors were already in cold shutdown. On November 5, the external power lines were repaired and re-connected to the ZNPP switchyard, resulting that the site was receiving off-site power and was stopping the emergency diesel generators. The provision of reliable and diverse power lines to support the safe and secure operation of the ZNPP is still challenged and continues to compromise Pillar 4.

Logistical supply chain

47. On 17 September, the national Ukrainian operator Energoatom delivered spare parts for the repair of the ZNPP's power lines as well as additional fuel supplies for the plant's emergency diesel generators that can be used as a backup power source. However, delivery of spare parts and diesel fuel to the site continues to be difficult and even more challenging after the attempted illegal annexation of 4 October and was made possible only on a case-by-case basis in an unpredictable manner based on personal arrangement. This compromises Pillar 5.

48. Diesel fuel deliveries since October have been arranged from both Ukrainian and Russian authorities to the ZNPP. This proved to be essential considering the repeated total loss of off-site power the plant underwent during the reporting period, highlighting the need for uninterrupted logistical supply chains and transportation to and from the site in line with Pillar 5.

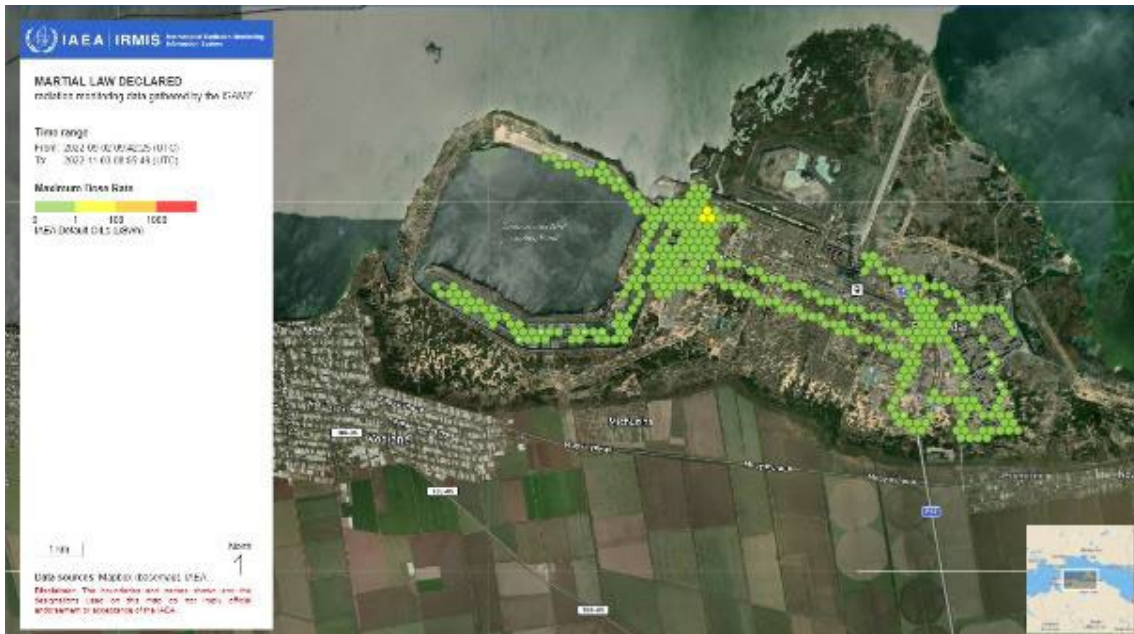
On-site and off-site radiation monitoring system and emergency preparedness and response

49. Access to the ZNPP's on-site crisis centre is still not possible. Since Russia's control of the facility including operational decision, the chain of command and responsibility for emergency response has been removed from Ukrainian authorities' control. Such a situation may be detrimental to the effectiveness of emergency response due to lack of clarity on the responsibility and authority to issue notification to off-site authorities and instructions to the public on protective actions to be taken in areas around the ZNPP site which may result in delays should a nuclear accident happen. This calls for reinforcement of sound emergency arrangements with clear lines of responsibility and authority in line with Pillar 6.

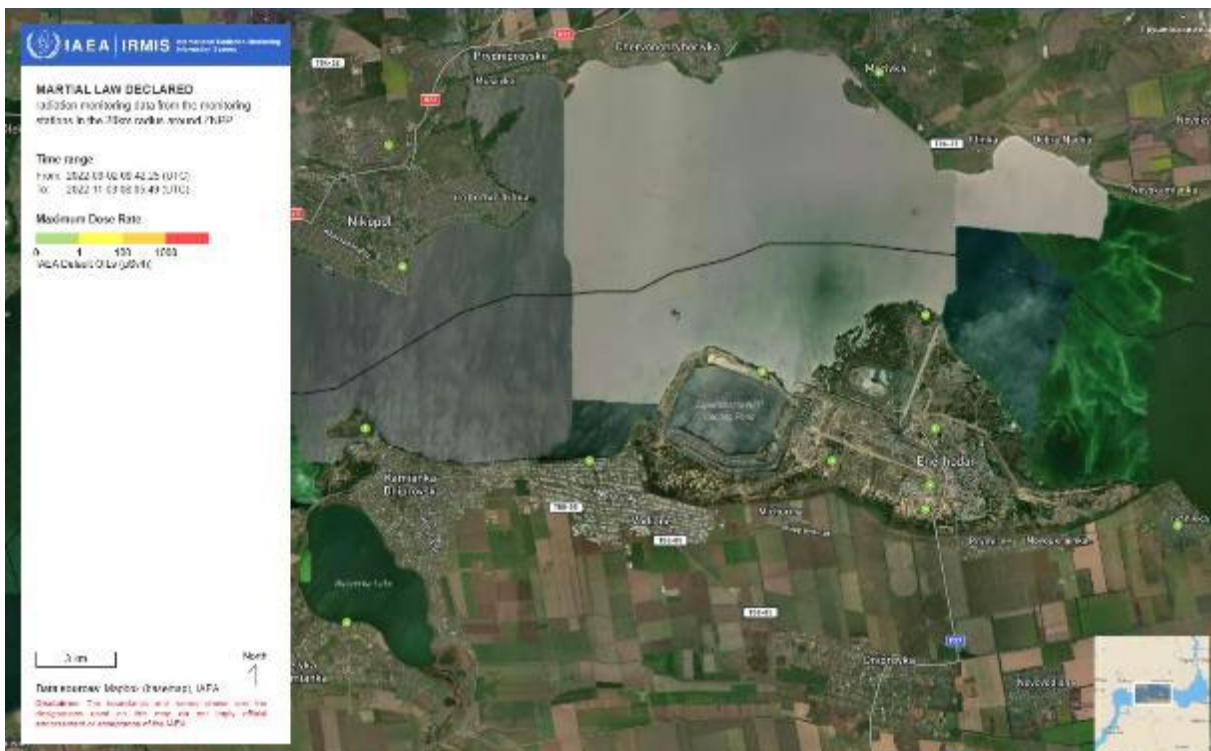
50. All on-site monitoring systems remained in operation during the reporting period. However, the off-site radiation monitoring network faced interruption in the power supply resulting in loss of some of the off-site monitoring points. However, gradually some of these monitoring points were reconnected to the power supply and became operational during the reporting period. The on-site and off-site

radiation levels reported in the International Radiation Monitoring Information System (IRMIS) and obtained from the ISAMZ team have been normal.

51.



Radiation monitoring data gathered in IRMIS by ISAMZ at the ZNPP site from 2 September to 3 November. Radiation levels are normal. (Photo: IAEA)



Radiation monitoring data from the monitoring stations in the 20 km radius around the ZNPP. Radiation levels are normal. (Photo: IAEA)

Communications

52. Communication between the ZNPP and the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) continue to be severely affected with many lines of communication either not functioning or unreliable. The internet connection at the site continues to be unreliable as witnessed by the ISAMZ team. This compromises Pillar 7.

53. The situation regarding communication between the plant and the SNRIU is worsening with the increase in Russian personnel at the site and announced changes in command. There have been no Ukrainian regulatory inspections of the facilities on site since 4 March.

B.3.2. South Ukraine NPP

54. SUNPP consists of three operational VVER-1000 reactors. On 19 September, an explosion took place around 300 metres from the SUNPP industrial site.

Off-site power supply

55. The explosion had an impact on some 150 kV backup power lines without impacting the normal operation of the three reactors. The three power lines were automatically reconnected after a short period of time. This situation compromised Pillar 4 regarding a secure off-site power supply. It is extremely important that external power supplies as designed remain available, and unplanned and unintended loss of external power supplies are minimized to ensure safe operation of the plant in all conditions.

56. When the ZNPP's main external 750 kilovolt (kV) power line was disconnected following shelling on 2 November, SUNPP also lost its connection to the same 750 kV line, one of three 750 kV lines used by this plant to provide power to the grid, prompting the site to reduce the power of one of its three operating reactors by 50%. The 750 kV power line was repaired on 4 November. On 8 November, the three operating reactors were at full power.

Operating staff

57. No staff of the SUNPP were injured as a result of the explosion. However, such a situation adds to the difficult conditions in which plant staff in Ukraine operate, which contravenes Pillar 3 regarding operating staff being able to work and make decisions free of undue pressure.

B.3.3 Other facilities and activities

58. No event affecting, or related to, on-site nuclear safety and security has been reported to the Agency for the other three NPPs in Ukraine (KhNPP, RNPP and ChNPP), the Kharkiv Institute of Physics and Technology, or the State Specialized Enterprise "Radon" facilities. It is the Agency's understanding that all these facilities have continued to operate safely and securely during the reporting period.

59. On invitation by Ukraine, the Agency conducted additional verification activities at three different sites in Ukraine in October and November 2022 (see para. 84, Section C).

60. Based on information provided by Ukraine to the Agency, there are approximately 5000 radioactive sources currently in use in Ukraine. Of the total inventory of radioactive sources, only a fraction are Category 1 or Category 2 radioactive sources, based on the Agency's categorization of radioactive sources denoting high-activity dangerous sources. This inventory includes radioisotope thermoelectric generators as well as radioactive sources used for medical, industrial, and research purposes that are located in regulated, private sector locations across Ukraine.

B.4. IAEA Technical Support and Assistance for Nuclear Safety and Security

61. Following the Director General's visit to SUNPP from 29 to 31 March, the Agency drew up and agreed with Ukrainian officials a concrete and detailed technical plan for nuclear safety and security assistance to Ukraine's nuclear facilities and activities involving radioactive sources. The technical support and assistance for nuclear safety and security, explained in detail in document GOV/2022/52, is focused on four areas: remote assistance, delivery of equipment, in-person assistance, and deploying rapid assistance.

62. The Agency and Ukrainian counterparts have continued to communicate closely to understand better and address the priority needs of Ukraine as efficiently as possible. In addition, the Agency has continued to work closely with a number of Member States and international organizations to ensure coordination in the provision of support to Ukraine and to secure the related necessary funding.

B.4.1 Remote assistance

63. During the reporting period, no activity was implemented on the territory of Ukraine pertaining specifically to radioactive sources. However, the Agency is ready and willing to provide, upon request, technical support and assistance for ensuring and, as needed, regaining control over any radioactive sources out of regulatory control. Such assistance could be begun remotely but would include on-the-ground efforts to address both safety and security aspects.

64. The scope of the national technical cooperation project UKR9040 entitled "Supporting Ukrainian Institutions in Addressing National Decommissioning, Radioactive Waste and Spent Nuclear Fuel Management, including Radio-Ecological Monitoring" has been enlarged to accommodate the needs identified for the ChNPP during the two missions carried out in April and June 2022. In September, a meeting was held with relevant counterparts in Ukraine to define the new work plan. Activities are ongoing to prepare the new work plan so that it matches the new needs in nuclear safety and radiation protection arising from the military conflict. Funding is being discussed with potential donors.

B.4.2 Delivery of equipment

Requests for assistance

65. In addition to the requests for assistance in the form of nuclear safety and security related equipment received on 22 and 29 April, 8 July and 9 August through the Unified System for Information Exchange in Incidents and Emergencies, the Agency's 24/7 secure communication channel, the Agency received a request for assistance on 3 October in the form of a list of equipment needed for the ZNPP. The request was made under the statutory functions of the Agency and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

66. As per Ukraine's request, the request for assistance was transmitted by the Agency to 31 of the 39 Assistance Convention States Parties that are registered in the Response and Assistance Network (RANET). The request addressed the needs of the ZNPP and comprises equipment necessary for maintaining nuclear safety and physical protection, as well as safety of the buildings (construction management), electrical equipment and other spare parts and consumables needed for safe operation. Despite the Agency's readiness to provide for these needs of the ZNPP, it is acknowledged that the provision of any equipment to the ZNPP will be particularly challenging from the logistics point of view and in terms of securing necessary funding following the attempted illegal annexation of 4 October.

Offers of assistance

67. In response to Ukraine's requests, by 9 November, 12 IAEA Member States registered under RANET had offered assistance in the form of equipment, with the last offer made on 13 July. The offered

equipment included personal protective equipment, radiation monitoring equipment, dosimeters, radiation counting systems, survey meters, computers, network servers and means for communication.

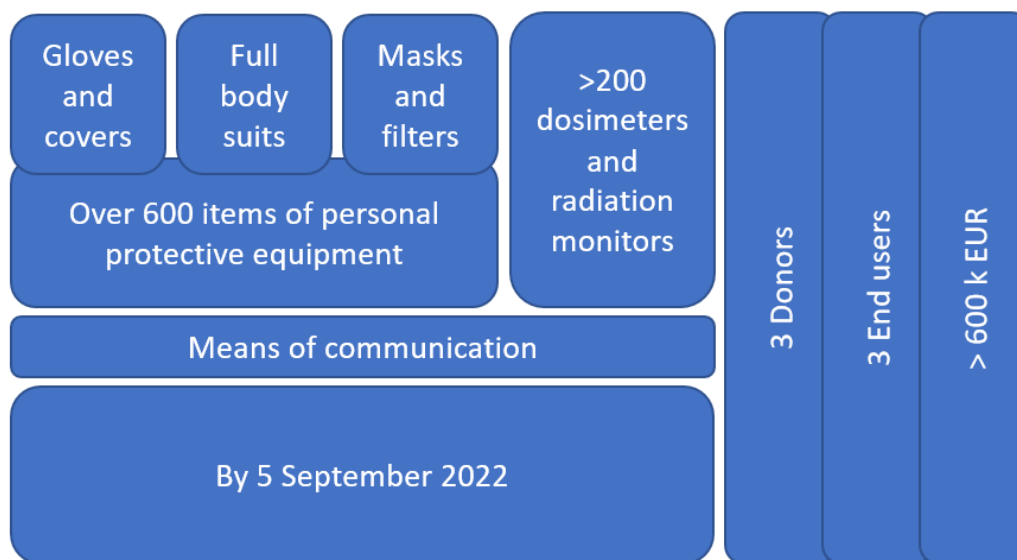
68. Eleven Member States and an international organization have offered extrabudgetary cash contributions to support Agency efforts in providing technical support and assistance to Ukraine in nuclear safety, security and safeguards. During the reporting period, seven Member States provided or expressed interest in providing new extrabudgetary cash contributions. Despite the generous contributions made by these donors, the needs of Ukraine remain large and the Agency continues its efforts in coordinating and collaborating with donors to secure further funding and assistance, which is of paramount importance for the Agency’s continued presence at the ZNPP in particular.

Provision of assistance

69. The Agency continued to deliver the equipment donated by Member States to the end-users in Ukraine. In addition, the number of items procured or in the process of procurement by the Agency for assistance to Ukraine has increased during the reporting period as a result of allocated funding.

70. To enable the above-mentioned deliveries, between 6 September and 9 November, an additional Assistance Action Plan (AAP) was prepared and signed by one Member State, the Agency and Ukraine. This is the eighth AAP of the same nature.

71. In addition, six Member States are preparing equipment for shipment. The Agency liaises closely with these Member States to facilitate timely delivery and to set up and sign respective AAPs. Through the Member States’ contributions and initiated procurements, approximately 45% of the items requested by Ukraine have been addressed to date. However, funds for the procurement of equipment identified by the Ukrainian counterparts as priority, with an initial estimate of €10 million, have been secured only partially.



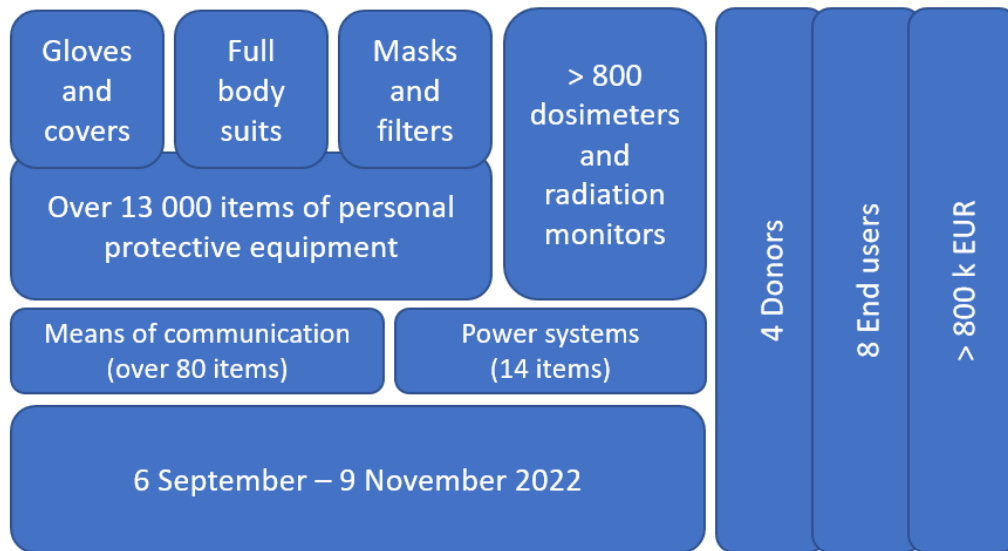
Overview of deliveries before 6 September

Delivery of equipment

72. During the Board of Governors meetings in September, the Director General announced that as part of continuing Agency-led support for nuclear safety and security in Ukraine, the second major assistance shipment had arrived in Ukraine, including radiation monitoring and personal protective equipment provided by Hungary, Romania and Spain. The second delivery to Ukraine’s Rivne and South

Ukraine NPPs, as well as the country’s regulator and its state emergency service, was organized through the Agency’s RANET.

73. Further deliveries of equipment to Ukraine took place on 28 September, 10 October and 11 October comprising equipment donated by Sweden under RANET and items procured by the Agency with extrabudgetary support from France and the United States of America. As a result of the latest deliveries, five entities in the country — including the SNRIU and Energoatom — received radiation monitoring equipment, mobile phones, portable power systems and other items they have requested.



Overview of deliveries made between 6 September and 9 November



Spanish donation received at Rivne NPP on 9 September and Hungarian donation received by the SNRIU on 12 September (Photo: SNRIU)

74. It is expected that more nuclear safety- and security-related equipment will be transported to Ukraine in the coming months, either from in-kind contributions or procured by the Agency.



Overview of next deliveries to Ukraine

B.4.3 In-person assistance

75. On 19 October, a request was received from Ukraine’s Minister of Energy for the Agency to provide technical support and assistance in nuclear safety and security by considering deploying Agency missions to the South Ukraine, Khmelnytsky, Rivne and Chornobyl NPPs with the aim of providing “oversight and prompt guidance in the operation of the Ukrainian nuclear fleet”.

76. In response to this request, on 28 October, the Agency provided a concrete proposal for deployment of Agency missions in the field of nuclear safety and security to SUNPP, KhNPP, RNPP and ChNPP. This assistance can be provided in addition to the ongoing delivery of requested nuclear safety and security related equipment to these plants.

77. The scope of each of the proposed missions is expected to be agreed by the Minister of Energy and the Agency and may include the following topical areas, as appropriate:

- Assessment of buildings, systems and components that ensure nuclear safety;
- Verification of the performance of the physical protection systems and measures;
- Human and organizational factors as relevant to the nuclear safety and security at the sites;
- Radiation monitoring at the facilities and their vicinity; and
- On-site and off-site emergency preparedness and response arrangements.

78. Pending final agreement of the Agency’s proposal made in response to the Ukrainian Ministry of Energy’s request for technical assistance, the proposed missions are expected to take place in November and December if the safety and security situation in Ukraine allows.

Deploying rapid assistance

79. No nuclear or radiological emergency involving nuclear facilities or activities involving radioactive sources was declared during the reporting period and deployment of rapid assistance was not requested.

C. Implementation of Safeguards in Ukraine

80. Ukraine acceded to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) as a non-nuclear-weapon State in December 1994. Ukraine subsequently brought into force a comprehensive safeguards agreement (CSA) with the Agency in January 1998 and an additional protocol to its CSA in January 2006.

81. The Agency implements safeguards at 35 nuclear facilities and more than a dozen locations outside facilities (LOFs) in Ukraine. The safeguards implementation effort is concentrated at 4 nuclear power plant sites, which host 15 operational power reactors, and at the Chernobyl site, which hosts 3 shutdown reactors, the reactor damaged in the 1986 nuclear accident, and 2 spent fuel processing and storage facilities.

82. On 25 February, Ukraine submitted to the Agency a special report under Article 68 of its CSA informing the Agency that “as a result of the temporarily occupied territory of Chernobyl region, Ukraine has lost control over nuclear material” subject to safeguards on the Chernobyl site.⁸ Ukraine submitted two additional special reports, dated 4 March and 5 July, respectively, to the Agency regarding Ukraine’s loss of control over nuclear material at all facilities on the Zaporizhzhya site and at three LOFs in south-eastern parts of Ukraine.

83. Despite the very challenging circumstances, the Agency has continued to implement safeguards in Ukraine in accordance with the CSA and the AP and in line with the annual implementation plan established by the Agency for Ukraine for 2022. Over this reporting period, the Agency has conducted 8 safeguards missions to verify the declared nuclear material at facilities and LOFs and/or design information at facilities thereby bringing the total of 20 such missions since the conflict began. In addition, the Agency has successfully implemented six complementary accesses (CAs) in order to assure the absence of undeclared nuclear material and activities at the locations to which it had access. The total number of CAs since the conflict began is now nine.

84. On 28 October, the Permanent Mission of Ukraine to the International Organizations in Vienna informed the Agency⁹ of construction works of an unknown structure conducted by Russian nationals at the dry storage facility on the Zaporizhzhya site. In this letter, Ukraine notes that the construction of new structures is “contrary to the project of the dry storage facility for spent fuel, approved and implemented in accordance with the requirements of the legislation of Ukraine” and is a “gross violation of the terms of the license for operating the [Zaporizhzhya] NPP”. While the Agency inspector permanently present at the ZNPP was informed and provided with technical details about the work carried out with the stated aim to upgrade the physical protection of the facility, changes to the design of a safeguarded facility are to be notified to the Agency in advance and in the form of an update to the existing design information questionnaire. Based on the observations made in the field, the safeguards measures in place at the dry storage facility remain adequate in light of the changes made thus far.

85. Since the Director General’s previous report, the Agency has conducted three CAs at the request of Ukraine in order to assure the absence of undeclared nuclear activities and materials following the allegations made by the Russian Federation related to the development of radiological dispersal devices – or “dirty bombs” – at the Institute for Nuclear Research in Kyiv, the Eastern Mining and Processing Plant in Zhovti Kody, and the Production Association Pivdennyi Machine-Building Plant in Dnipro. Agency inspectors carried out all activities that the Agency had planned to conduct with particular attention to all hot cells and shielded containers capable of holding strong radioactive sources, and were

⁸ Ukraine has since regained control of the nuclear material at the Chernobyl site.

⁹ INFCIRC/1057 of 31 October 2022.

given unfettered access to the locations. Inspectors also collected environmental samples at these locations. Based on the evaluation of the results available and the information provided by Ukraine by the time of this report, the Agency did not find any indications of undeclared nuclear activities and materials at these locations. Environmental samples taken during the accesses have been sent to the Safeguards Analytical Laboratory (SAL) in Seibersdorf. The samples will then be analysed at SAL and at other laboratories within the Agency's Network of Analytical Laboratories (NWAL).

86. The Agency was also able to conduct in-field verification activities at the Kharkiv Institute of Physics and Technology which had not been possible earlier because of the security situation in the region.

87. The Agency has continued to rely on remotely transmitted data from its cameras, seals and unattended monitors to maintain continuity of knowledge over declared inventories of nuclear material. The transmission of all data from all of the sites has been possible during the reporting period. The Agency has maintained its continuous analyses of open source information and its acquisition and analyses of satellite imagery covering nuclear installations in Ukraine. This has proved to be essential for the preparation of in-field verification activities, in particular at the Zaporizhzhya site, which has been heavily affected by military activities. The Agency has been acquiring and analysing satellite imagery and continuously monitoring all available open source information to track developments and to assess the operational status of the plant, including the detection of damage caused by shelling at the site.

D. Summary

88. The situation at the ZNPP continues to be dangerous, precarious and challenging with the Seven Pillars being compromised at the site at all times. This situation underscores the need for the urgent establishment of a nuclear safety and security protection zone and the need for adherence to the Agency's recommendations stated in the last summary report on nuclear safety, security and safeguards in Ukraine, issued on 5 September.

89. Discussions aimed at agreeing on and implementing the nuclear safety and security protection zone around the ZNPP, with the ultimate aim of preventing a nuclear accident, were intensified; however, efforts still need to be made with regard to reaching an agreement and commitment by concerned parties on its establishment as soon as possible.

90. The continued presence of Agency nuclear safety and security experts at the ZNPP has enabled progress in gradually improving and deepening the understanding of the situation and related nuclear safety and security issues at the site. Ever since its establishment, the Agency team present at the site has been able to share observations and report on the nuclear safety and security situation in an impartial and independent manner, which proved essential during the reporting period.

91. The operating staff at the ZNPP have continued to show endurance and resilience in keeping the facility safe and secure amid the armed conflict, despite continued detentions. The difficulties for personnel at the ZNPP significantly intensified during the reporting period, with their crucial work having to be carried out under increasingly difficult conditions, with potentially severe consequences for nuclear safety and security and for the personnel's well-being. The Director General repeatedly called for the concerned parties to end this enormous pressure on the Ukrainian operating staff.

92. At its 66th regular session, the General Conference addressed the importance of nuclear safety and security regarding civil nuclear facilities and materials in all circumstances, and urged all Member

States in the safeguards resolution (GC(66)/RES/10 “to refrain from attacks or threats of attacks on, against or in the vicinity of nuclear facilities devoted to peaceful purposes in order to ensure that the Agency is able to conduct safeguards activities in accordance with relevant safeguards agreements”.

93. The Agency continued to implement the provision of technical support and assistance to Ukraine in nuclear safety and security. Three deliveries of donated and procured equipment to different organizations were completed during the reporting period, with many more deliveries to be made in the coming months. Similarly, five new missions are being discussed with Ukraine to different facilities in Ukraine as part of continued Agency efforts to provide assistance.

94. The continued commitment of Member States and close cooperation with the Agency is essential to ensure nuclear safety and security in Ukraine under all circumstances and to provide assistance efficiently.

95. The Agency has continued to undertake a vital verification role to reach independent conclusions that nuclear material under safeguards remains in peaceful activities and that safeguarded facilities are not used for the undeclared production or processing of nuclear material. The Agency continues to implement safeguards in Ukraine, including in-field verification activities, in accordance with Ukraine’s CSA and AP. Based on the evaluation of all safeguards-relevant information available to the Agency to date, the Agency has not found any indication that would give rise to a proliferation concern.

96. The Agency has also taken prompt action following allegations made by the Russian Federation and the subsequent invitation by Ukraine to perform complementary accesses at the locations related to those allegations. Pending the results of the analysis of the environmental samples taken during the accesses, the Agency has not found any indications of undeclared nuclear activities or materials related to the development of radiological dispersal devices at the three specified locations referred to in Section C above.

Annex I: Agency Safety Standards and Nuclear Security Guidance: Challenges in their Application in Armed Conflicts

1. At the 52nd meeting of Commission on Safety Standards, held in October 2022, the Safety Standards Committees raised the issue of nuclear safety in Ukraine. The Nuclear Security Guidance Committee at its meeting also discussed the relevant nuclear security implications. At these meetings, Member States expressed their expectations that the Agency should look into the issue of maintaining nuclear safety and security during armed conflicts and should investigate whether there is a potential need for additional guidance within the Safety Standards Series and the Nuclear Security Series.
2. In light of these ongoing discussions, the Agency has begun an internal review of challenges in the application of Agency safety standards and nuclear security guidance in armed conflict situations. The review will cover nuclear safety and security considerations for all nuclear and radiation facilities and activities. It will identify publications addressing issues that might arise during an armed conflict and potential challenges in their application, and will propose changes to the guidance, if necessary.
3. The review of Agency safety standards and nuclear security guidance will be conducted in a systematic, balanced and harmonized way. The first phase of the review will cover the assessment of nuclear safety and security of nuclear power plants in armed conflicts, using as input the existing information on the situation in Ukraine. For the review, the relevant safety standards and nuclear security guidance publications will be prioritized, and the challenges in their application under selected conditions will be analysed. The first phase of the review is expected to be completed by the end of December 2022. The full-scope review is expected to be concluded by the end of 2023.

Annex II: Chronology of Events Since 6 September 2022

Events at the Zaporizhzhya Nuclear Power Plant

1. On 6 September, one of the backup power lines was damaged due to shelling, and the Zaporizhzhya nuclear power plant (ZNPP) switchyard was also damaged; their repair required the disconnection of the site from external power and all units needed to be shut down.
2. On 10 September, following the repair works, the backup power lines were reconnected to the ZNPP, and, on 11 September, the last operating unit — Unit 6 — was shut down.
3. On 16 September, one external high voltage power line was reconnected to the ZNPP.
4. On 21 September, there was shelling in the area of the spray cooling ponds for Units 5 and 6, which damaged one pipe and put the sprays out of service. Additionally, some shelling damaged the high voltage power line for Unit 6, which caused its diesel generators to start, before the unit was switched to a backup power line.
5. On 27, 28 and 29 September, there were mine explosions near Units 2 and 3, which caused only broken windows at the turbine hall of Unit 2, near the water intake channel and near the dry spent fuel storage facility.
6. On 30 September, the ZNPP Director General was detained by the Russian authorities; he was released on 3 October.
7. On 7 October, some backup power lines providing power to Unit 6 were damaged, which caused the unit's diesel generators to start before it was supplied with power from the other units.
8. On 8 October, the one external high voltage power line was damaged and the ZNPP lost once again its external high voltage power supply, causing the diesel generators of all units to start.
9. On 9 October, the repairs to the external high voltage power line were completed, and the external power supply was restored at the ZNPP.
10. On 11 October, the ZNPP Deputy Director General for Personnel was detained and was released on 17 October.
11. On 17 October, the external high voltage power line was disconnected due to a problem at a distant substation and was reconnected later that day.
12. On 19 October, the main backup power line was lost due to shelling at a switchyard of the thermal power plant.
13. On 30 October, a mine explosion damaged the high voltage power supply to Unit 4, and the unit was switched to backup power lines.
14. On November 2, shelling led to the 750 kV Dniprovskya and 330 kV Ferosplavna overhead lines being disconnected and emergency backup diesel generators being started. Units 5 and 6 were transferred to a cold shutdown mode.
15. On November 5, the external power lines were repaired and re-connected to the ZNPP switchyard, resulting that the site was receiving off-site power and was stopping the emergency diesel generators.

Events at the South Ukraine Nuclear Power Plant

16. On 19 September, an explosion took place around 300 metres from the South Ukraine nuclear power plant, affecting some 150 kV backup power lines.

17. When the ZNPP's main external 750 kV power line was disconnected following shelling on 2 November, SUNPP also lost its connection to the same 750 kV line, one of three 750 kV lines used by this plant to provide power to the grid, prompting the site to reduce the power of one of its three operating reactors by 50%. The 750 kV power line was repaired on 4 November. On 8 November, the three operating reactors were at full power.

Events at the Chornobyl, Rivne and Khmelnytskyy Nuclear Power Plants and at Other Facilities

18. No events took place during the reporting period affecting the nuclear safety and security at these facilities or in other facilities and activities with nuclear or radioactive material in use, storage or transport.