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THE IMPLICATIONS OF THE UKRAINE CONFLICT FOR NATIONAL NUCLEAR SECURITY POLICY

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I. INTRODUCTION

The annexation of Crimea by Russia and the outbreak of conflict in the eastern part of Ukraine in 2014 have resulted in comprehensive changes in the approach of the Ukrainian Government to nuclear security policy.

Since 2014 Ukraine is facing increased threats of military and terrorist attacks on its cities and elements of its critical infrastructure. Moreover, the current crisis has increased the risks of terrorists using radioactive materials in an attack as well as the illicit trafficking of radioactive materials from Ukrainian facilities and through the country's territory. The Ukrainian National Progress Report, presented during the 2016 Nuclear Security Summit in Washington, DC, emphasized that 'Russian military aggression in eastern Ukraine and its illegal annexation of the Autonomous Republic of Crimea pose new threats to the national system of nuclear and radiation security and resulted in loss of regulatory control in those areas'.[1]

Ukraine has a well-developed physical protection system in place for its nuclear facilities, but it was not prepared for the outbreak of violent separatism and foreign intervention that the country has been facing recently. To counter this, the physical protection of nuclear power plants (NPPs) as well as tactical counterterrorist capabilities have been improved in the past few years. National military and police reforms, accompanied by the necessary legislative enhancements, have strengthened the nuclear security system in Ukraine and adapted it to emerging challenges. However, despite these improvements,

[1] Nuclear Security Summit, 'National Progress Report: Ukraine', Washington, DC, 31 Mar. 2016, <http://www.nss2016.org/document-center-docs/2016/3/31/national-progress-report-ukraine>.

SUMMARY

Since the annexation of Crimea by Russia and the outbreak of armed conflict in the eastern part of Ukraine, development of the Ukrainian Government's nuclear security policy has sought to strengthen the protection of civilian nuclear facilities, materials and sources inside the country from emerging threats arising from the changed security environment. Ukraine has a well-developed physical protection system for its nuclear facilities based on the assumption of territorial sovereignty, but was not prepared for the outbreak of violent separatism and foreign intervention that the country has been facing recently.

This paper reviews the nuclear security situation in Ukraine as influenced by the ongoing conflict. It looks at the current state of affairs in the Ukrainian nuclear industry through the prism of nuclear security conditions. Emerging threats are considered based on three main groups: (*a*) classic nuclear security threats; (*b*) threats from occupied/uncontrolled territories; and (*c*) 'hybrid war' threats. Successfully implemented measures aimed at improved nuclear security under such circumstances would ensure safe and secure operation of nuclear facilities and strengthen their resistance to attacks by terrorists and organized crime groups, as well as prevent illicit trafficking and malicious use of uncontrolled nuclear materials and sources.

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a number of real risks to the Ukrainian nuclear industry still remain due to the ongoing conflict as well as internal difficulties, such as political instability, corruption and so on.

Nuclear energy provides more than half of Ukraine's electricity supply. The constant and sustainable generation of electricity by NPPs is important for national energy security. This paper examines the main threats facing Ukrainian nuclear facilities, materials and radioactive sources after the start of hostilities, and how Ukraine is dealing with them through the enhancement of its nuclear security policy.

II. THE CURRENT STATUS OF THE CIVILIAN NUCLEAR FACILITIES, MATERIALS AND SOURCES IN UKRAINE

Due to the gas disputes with Russia, the interruption of the coal supply from the separatists occupied territories in the Donbas region and in order to ensure national energy security, Ukraine relies heavily on nuclear energy for electricity generation. In 2015 the nuclear industry supplied 55.7 per cent of national electricity production compared to approximately 45 per cent in 2014.[2] This increase in nuclear energy output was achieved without the construction of new power capacity, but instead utilized the existing potential of the nuclear sector in Ukraine and its high sustainability.

Electricity production by nuclear energy in Ukraine is based on the foundation of a massive and complex nuclear energy programme. The country has four NPPs with 15 power units, including 13 VVER-1000 and 2 VVER-440 reactors with a total installed capacity of 13 835 MW(e).[3] During the first quarter of 2016 the NPPs generated 22.8 billion kWh.[4] The amount of electricity generated by the NPPs in 2015 was 87.8 billion kWh.[5] The efficiency of the NPPs' installed capacity in the first quarter of 2016 was 75.6 per cent, compared to 72.3 percent in 2015.[6] The State Enterprise National Nuclear Energy Generating Company 'Energoatom' (Energoatom) is the operator of Ukraine's NPPs.

Some of the operational NPPs are located relatively close to the conflict zone in eastern Ukraine. The nearest one is the Zaporizhzhya NPP, located in the Zaporizhzhya region, near the town of Enerhodar and around 200 kilometres from the conflict border. The southern Ukrainian NPP, located near the city of Yuzhnoukrainsk in the Mykolaiv region, is about 600 km from the conflict zone. According to the Ukrainian Security Service, these two regions—Zaporizhzhya and Mykolaiv—are marked 'yellow' in terms of terrorism threats.[7] After red, yellow is the second highest threat level according to Ukrainian legislation.[8] Two other NPPs, the Rivne NPP (near the city of Varash in the Rivne region) and the Khmelnytska NPP (near the city of Netishyn in the Khmelnitsky region), are located around 1000 km from the conflict zone. According to the Ukrainian Security Service, these regions are assumed to face a lower terrorist threat—the third highest threat level on a scale of four (i.e. a possible threat).

Ukraine has robust research and development capabilities in the nuclear sphere. These include a light-water research reactor, VVR-M, with a nominal capacity of 10 MW at the Kyiv Nuclear Research Institute of the National Academy of Sciences of Ukraine.

Another research reactor, DR-100, with a nominal capacity of 200 kW is operated by the Sevastopol National University of Nuclear Energy and Industry and is located on the annexed Crimean Peninsula. Due to the absence of a licensee application to the Ukrainian regulatory body, the Sevastopol National University's licence for operating the research reactor was terminated in accordance with the established procedure on 16 July 2014 by the State Nuclear Regulatory Inspectorate (SNRIU).

According to the Ministry of Foreign Affairs of the Russian Federation, after the results of a referendum on the status of Crimea on 16 March 2014, Russia took full responsibility for the nuclear facilities located in

[2] Energoatom, [Results of Energoatom in 2015], Report 2015, <http://www.energoatom.kiev.ua/files/file/pidsumki_12_2015_utoch_(1).pdf> (in Ukrainian).

[3] Energoatom (note 2).

[4] Energoatom, [Results of 'Energoatom' in the first quarter of 2016], Report 2016, <http://www.energoatom.kiev.ua/files/file/pidsumki_03_2016_utoch.pdf> (in Ukrainian).

[5] Energoatom (note 2).

[6] Energoatom (note 4).

[7] Ukrainian Security Service, [Ukrainian Security Service established levels of terrorist threat to Ukraine's regions], 12 Aug. 2016, <https://ssu.gov.ua/ua/news/1/category/21/view/1614#sthash.D44cn1Y0.iG2fxcDw.dpbs> (in Ukrainian).

[8] Ukrainian Cabinet of Ministers, [Decree no. 92 On approval of the unified state system of prevention, response and suppress terrorist attacks and minimizing their consequences], 18 Feb. 2016, <http://zakon3.rada.gov.ua/laws/show/92-2016-%D0%BF> (in Ukrainian).

its new territories (Crimea and the city of Sevastopol).[9] This means that under the present circumstances, the research reactor DR-100 is under Russian control.

Nevertheless, despite the fact that the practical operation of the research reactor is under Russian control and that Ukraine neither has regulatory control over the facility nor the ability to maintain inspection activities, Ukraine still sees this facility as falling within its jurisdiction. A corresponding statement was made by the Delegation of Ukraine on Agenda Item 87 of the 69th session of the United Nations General Assembly: 'Ukraine retains jurisdiction over all nuclear facilities and materials, including the research reactor DR-100 and other nuclear facilities of the Sevastopol National University of Nuclear Energy and Industry, which are the property of Ukraine and presently are located on the temporarily occupied territory'.[10]

Another nuclear research facility controlled by Ukraine (based at the Kharkov Institute of Physics and Technology) is called the Neutron Source, and includes a subcritical assembly driven by a linear electron accelerator. A test run of the facility took place on 23 March 2016.[11] This facility was constructed based on an agreement with the United States on technical and financial assistance to Ukraine, signed during the Nuclear Security Summit in Washington, DC, in April 2010. The USA made a $73 million investment in the realization of this project, in exchange for Ukraine's decision to dispose of its entire stockpile of highly enriched uranium. This provided Ukraine with two benefits. First, Ukraine strengthened its nuclear security. US President Barack Obama pointed out during the 2016 Nuclear Security Summit in Washington, DC, that 'successfully removing all of Ukraine's highly enriched uranium four years ago meant that a very difficult situation in Ukraine over the past two years was not made even more dangerous by the presence of these materials'.[12] Second, under the National Scientific Center's Kharkiv Institute of Physics and Technology (NSC KIPT), Ukraine was given the opportunity to build state-of-the-art technology in nuclear research that will contribute to 'solving problems of nuclear power industry and extending technical lifetime of nuclear power plants'.[13]

According to the Ukrainian regulatory body—the SNRIU—as of 2015, Ukraine is in possession of 24 582 radiation sources, including 9 654 radionuclide sources and 14 928 radiation generators.[14] The Deputy Chair of the SNRIU, Tetyana Kilochytska, has pointed out that as of 2015, because of the conflict in the Donbas region, Ukraine lost regulatory control over more than 1200 radioactive sources of category 1–5; 65 facilities using radioactive sources, including 8 institutions with high-activity sealed radioactive sources (HASS) with activities over 1000 Curie, the radioactive waste management enterprise 'Donetsk DSK', and the State Corporation 'UkrDO Radon'; and radioactive sources belonging to two Donbas mining enterprises, comprising 15 coal mines (142 sources).[15]

On 8 April 2015 the SNRIU sent a report to the International Atomic Energy Agency (IAEA) regarding the loss of control over nuclear materials that are in the temporarily occupied territory in the Donetsk and Luhansk regions.[16]

In addition to research reactor DR-100, Ukraine lost regulatory control over all nuclear and radioactive material in the Crimean Peninsula, including regulatory control over 277 radioactive sources and 53 items with radionuclide radiation sources. Ukraine also lost connection with the Crimean State Inspectorate for Nuclear and Radiation Safety.[17]

[9] Russian Ministry of Foreign Affairs, [Comment by the Information and Press Department of the Russian Foreign Ministry in connection with the statements of the Ukrainian Foreign Ministry on the issue of the legal status of nuclear facilities in the new Russian Federation: Republic of Crimea and Sevastopol], 16 Aug. 2014, <http://www.mid.ru/web/guest/kommentarii_predstavitelya/-/asset_publisher/MCZ7HQuMdqBY/content/id/674096> (in Russian).

[10] Statement by the Ukrainian Delegation on Agenda Item 87 of the 69th session of the United Nations General Assembly, 'Report of the International Atomic Energy Agency', 3 Nov. 2014, <http://mfa.gov.ua/en/press-center/news/29436-vistup-delegaciji-ukrajini-na-zasidanni-genasambleji-oon-shhodo-dopovidi-magate>.

[11] President of Ukraine, 'President at the meeting with nuclear physicist in Kharkiv: Ukraine launched the first nuclear facility of global significance developed by Ukrainian experts', 23 Mar. 2016, <http://www.president.gov.ua/en/news/v-ukrayini-zapushena-persha-yaderna-ustanovka-svitovogo-znac-36886>.

[12] Whitehouse, US President Barack Obama, POTUS Nuclear Security Summit Press Conference, Video, 1 Apr. 2016, <https://www.whitehouse.gov/photos-and-video/video/2016/04/01/potus-nuclear-security-summit-press-conference>.

[13] President of Ukraine (note 11).

[14] SNRIU, 'Report on nuclear and radiation safety in Ukraine for 2015', [n.d.], <http://www.snrc.gov.ua/nuclear/doccatalog/document?id=327019>.

[15] Seminar on topical issues of nuclear safety, on the occasion of the 15th anniversary of the establishment of an independent regulatory body (the State Nuclear Regulatory Inspectorate of Ukraine), Kyiv, 4 Dec. 2015.

[16] Information from the International Conference 'Nuclear Power: 30 Years after Chernobyl', 26 Apr. 2016, <http://mpe.kmu.gov.ua/minugol/control/uk/publish/article?art_id=245105878&cat_id=245070653>.

[17] Seminar on topical issues of nuclear safety (note 15).

The SNRIU informed the IAEA on 26 March 2014 about the loss of control over nuclear materials that are subject to Ukraine's safeguards agreement and located in the annexed Crimea.[18]

III. NATIONAL NUCLEAR SECURITY POLICY

Ukrainian nuclear security policy is derived from the overall objective of a nuclear security regime, defined in the IAEA Nuclear Security Series (NSS) no. 13. Its goal is 'to protect persons, property, society, and the environment from malicious acts involving nuclear material and other radioactive material'.[19]

Because of the armed conflict and associated threats, nuclear security policy has been substantively modified. Before 2014, the physical protection of nuclear facilities and radioactive material in Ukraine was organized within a framework of peace. Since then, however, it has been improved and expanded in order to ensure that the main objective will not be compromised.

Since its independence in 1991, Ukraine has shown its dedication to the physical protection of nuclear facilities and materials. The legacy of the Soviet Union left a large number of institutions, industrial enterprises and organizations that possess, among other things, a number of radioactive sources and radioisotope instruments. At that time, there was clearly an unstable socio-economic situation, and the legal framework that would regulate issues related to safety and security was also absent. Under such conditions in the early 1990s, illegal acts involving nuclear or radioactive materials in the Ukrainian territory increased significantly.[20] This issue was amplified by the risks of involvement in illegal activities related to nuclear weapons arsenals, which remained in Ukraine until 1996. Together, these issues and concerns necessitated the implementation of measures to reduce emerging risks. As a result, on 5 May 1993 Ukraine joined the Convention on the Physical Protection of Nuclear Material, with the respective resolution adopted by the Ukrainian Parliament (Verkhovna Rada).[21] This also included an amendment to the Convention in 2008.[22] On 28 December 1993 the Ukrainian President Leonid Kravchuk issued the decree 'On measures for the physical protection of nuclear material and nuclear facilities in Ukraine', which defined the responsibilities of the respective authorities in the sphere of physical protection.[23] Five years after the adoption of the core 'Law of Ukraine on nuclear energy use and radiation safety', the 'Law of Ukraine on physical protection of nuclear facilities, nuclear materials, radioactive waste and other sources of ionizing radiation' was finally adopted on 19 October 2000.[24] This law established a framework for the physical protection system, which is defined as a 'set of organizational, legal and technical measures undertaken to create the conditions to minimize the possibility of committing sabotage, theft or any other misuse of radioactive materials and strengthening the nuclear nonproliferation regime'.

Together with supplementary legislation, international assistance and reliable technical arrangements, Ukraine created a robust and effective physical protection system. This was approved during a number of inspections by Ukrainian regulators and international experts from the IAEA. Ukraine had International Physical Protection Advisory Services (IPPAS) missions in 2001, with follow-ups in 2003. In 2004, an IPPAS mission went to the Chernobyl NPP Shelter Object and this was followed up in 2007. During this mission, the Ukrainian state physical protection regime and security systems for nuclear and other radioactive material were comprehensively checked and compared with international legal instruments and the IAEA NSS. After recommendations were taken

[18] Information from the International Conference 'Nuclear Power: 30 Years after Chernobyl' (note 16).

[19] IAEA, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities*, IAEA Nuclear Security Series no. 13, INFCIRC/225/REVISION 5 (IAEA: Vienna, Jan. 2011).

[20] Kuzmyak, I. and Kravtsov, V. I., [The experience of the implementation of the fundamental principles of physical protection of nuclear facilities, nuclear and other radioactive materials], *Nuclear and Radiation Safety Journal*, no. 4(56) (2012), <http://www.nbuv.gov.ua/old_jrn/natural/Yarb/2012_4/4_56_15.pdf> (in Ukrainian).

[21] Parliament of Ukraine, [Decree no. 3182-XII On the participation of Ukraine in the 1980 Convention on the Physical Protection of Nuclear Material], 5 May 1993, <http://zakon.rada.gov.ua/laws/show/3182-12> (in Ukrainian).

[22] [Law of Ukraine no. 356-VI (356-17) On the ratification of the Amendment to the Convention on the Physical Protection of Nuclear Material], 3 Sep. 2008, <http://zakon.rada.gov.ua/laws/show/951_013> (in Ukrainian).

[23] [Presidential Decree no. 608/93 On measures for the physical protection of nuclear material and nuclear facilities in Ukraine], 28 Dec. 1993, <http://zakon.rada.gov.ua/laws/show/608/93> (in Ukrainian).

[24] [Law of Ukraine no. 39/95-VR On the use of nuclear energy and radiation safety], 8 Feb. 1995, <http://zakon0.rada.gov.ua/rada/show/39/95-%D0%B2%D1%80> (in Ukrainian); and [Law of Ukraine no. 2064-III On physical protection of nuclear facilities, nuclear materials, radioactive waste and other sources of ionizing radiation] 19 Oct. 2000, <http://zakon5.rada.gov.ua/laws/show/2064-14/ed20001019> (in Ukrainian).

into account, the Ukrainian system was found to be in full compliance with internationally accepted best practices.

In response to the emerging threats and in order to 'prevent provocations, mass disorders, incidents with unpredictable consequences, illegal actions towards nuclear facilities, nuclear material, radioactive waste and other sources of ionizing radiation', in January 2014 Ukraine's state system of physical protection was switched to a high alert regime.[25]

The anti-terrorist operation in eastern Ukraine in 2014–16 prompted significant strengthening of the physical protection of nuclear and radiation facilities.[26] The president of Energoatom, Yuriy Nedashkovskiy, assured the public of the highest possible protection level for nuclear facilities by stating: 'Energoatom pays great attention to the strengthening of security and physical protection of nuclear power plants. This is especially important in the current context of increased real threat of sabotage or terrorist acts. Today all the protection systems operate in emergency mode'.[27]

Interestingly, these statements took place during different events in April 2016 commemorating the 30th anniversary of the Chernobyl disaster. Ukraine, having experienced the devastating consequences of a catastrophe at a NPP, which it struggled to overcome, made every effort to mitigate the newly emerging threats to its nuclear facilities. Therefore, despite an internationally recognized high level of physical protection in Ukraine, since 2014 Ukrainian nuclear security policy has aimed to significantly strengthen the protection of all NPPs, materials and radioactive sources together with associated facilities.

Nuclear security policy has also been influenced by changes in the national security architecture as part of addressing current challenges. The National Security Strategy of Ukraine, which was approved on 6 May 2015, and the new Military Doctrine, from 24 September 2015, have for the first time defined specific military threats to Ukraine.[28] Among them are military aggression; the increasing military capacity of Russia in the immediate neighbourhood of the state border of Ukraine, including the potential deployment of tactical nuclear weapons in the territory of the Autonomous Republic of Crimea; and the organization of armed groups in the eastern part of Ukraine, aimed at destabilizing the internal socio-political situation in Ukraine, intimidating the population, and the functional impairment of state and local authorities, major industrial facilities and infrastructure. In addition, in the Military Doctrine, terrorist acts within the territory of Ukraine or against the citizens of Ukraine—sabotage as well as bombings, kidnapping and hostage-taking—were identified as the main threats to Ukraine's military security.[29]

These threats and risks were incorporated into the revised Design-Basis Threat (DBT)—a stand-alone threat analysis report. On 27 August 2015 a new revision of the DBT for Nuclear Facilities, Nuclear Material, Radioactive Waste and Other Radiation Sources in Ukraine was approved by President's Decree no. 520/14t/2015. The revised version introduced all risks related to the ongoing situation in the Donbas region.[30]

Based on the revised national DBT and due to the peculiarities of the regions with NPPs, the corresponding facility DBTs have also been updated, with new facility interaction plans being implemented at all NPPs in case of sabotage.[31]

Moreover, vulnerability assessments of Ukraine's NPPs were completed and the respective reports were prepared with recommendations for making the physical protection system in compliance with the requirements of the current legislation.

In addition, Ukraine is actively using 'nuclear security diplomacy'. Ukrainian diplomats and officials are using the international stage in order to attract attention to the nuclear security-related issues in Ukraine.

[25] Nuclear Security Summit (note 1).

[26] Information from the International Conference 'Nuclear Power: 30 Years after Chernobyl' (note 16).

[27] Nedashkovskiy, Y., [Security issues for Energoatom have the highest priority], Video statement, 16 Mar. 2016, <http://www.energoatom.kiev.ua/ua/press/nngc/45052-pitannya_bezpeki_dlya_energoatoma_mayut_nayivischiyi_proritet__yuryi_nedashkovskiyi_vdeo/> (in Ukrainian).

[28] [Presidential Decree no. 287/2015 On the decision of the National Security and Defense Council of Ukraine on 6 May 2015 'On the Strategy of National Security of Ukraine'], 26 May 2015, <http://zakon3.rada.gov.ua/laws/show/287/2015> (in Ukrainian).

[29] [The Military Doctrine of Ukraine], 24 Sep.2015, <http://zakon2.rada.gov.ua/laws/show/555/2015/paran8#n8> (in Ukrainian).

[30] 'New potential threat to nuclear facilities identified due to Russian aggression', UNIAN Information Agency, 20 July 2015, <http://www.unian.info/politics/1102927-new-potential-threat-to-nuclear-facilities-identified-due-to-russian-aggression.html>.

[31] SNRIU, 'Report on nuclear and radiation safety in Ukraine for 2014', [n.d.], <http://www.snrc.gov.ua/nuclear/doccatalog/document?id=293323>.

Ukraine used the 2016 Nuclear Security Summit not only for delivering the results achieved by Ukraine in nuclear security in different domains, but also to raise concerns and to condemn the armed Russian aggression. (Russia refused to participate in the Summit.) Among a number of concerns, the following was raised as the most crucial: 'At present Ukraine cannot guarantee physical protection of the [Sevastopol] research reactor, nuclear material and sources of ionizing radiation on the territory of Crimea, city of Sevastopol and certain areas of Donetsk and Luhansk regions.'[32]

In order to tackle these challenges, in 2014 the SNRIU sent the IAEA management a package of proposals to consider on amending the existing international conventions, including the Convention on Physical Protection of Nuclear Material and Nuclear Facilities, and the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management. The SNRIU Chair, Sergiy Bozhko, described these amendments as being very simple and stated that Russia, as the occupying force, bears full responsibility for what takes place at the site, while Ukraine, as the legitimate owner of the nuclear facility, remains responsible for its physical protection and nuclear non-proliferation.[33]

Ukraine continually informs the IAEA and its member states about the security conditions of its nuclear facilities. Ambassador Ihor Prokopchuk, in his statement at the meeting of the IAEA Board of Governors on 5 March 2014, noted that 'the physical security, including reinforced physical protection of 15 power units in operation at 4 sites of Ukrainian NPPs can be potentially endangered' because of the Russian military aggression.[34]

Attention to nuclear security policy has also increased in the international cooperation domain. During The Hague Nuclear Security Summit in 2014, Norway and Sweden stated that they were going to initiate trilateral cooperation with Ukraine in the field of nuclear safety and security as a response to the new challenges faced not only by Ukraine but also by the world community.[35] Within the context of this cooperation the following will be conducted: an upgrade of the physical protection system and other NPP infrastructure; the enhancement of regulatory supervision and control of nuclear safety and security; the enhancement of inspection capabilities; and the improvement of legislation. Ukraine is also continuing its cooperation in the sphere of nuclear security with, among others, Germany, Japan, Norway, Sweden, the United Kingdom and the USA.

IV. NUCLEAR SECURITY CONDITIONS

According to the IAEA definition, 'nuclear security' means 'the prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities'.[36]

There are two legally binding international conventions that stand for the protection of persons, property, society and the environment from malicious acts involving nuclear material and other radioactive material.

1. The 1980 Convention on the Physical Protection of Nuclear Material (CPPNM) and the 2005 Amendment to the CPPNM. The CPPNM is a legally binding instrument with provisions for prevention, detection and response to offences relating to nuclear material used for peaceful purposes and of nuclear facilities used for peaceful purposes through an effective physical protection system.[37]

2. The 2005 International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). ICSANT is wide ranging, including nuclear and radiological materials, as well as facilities used for military and civil purposes. It foresees the criminalization of all activities relating to nuclear terrorism.[38]

[32] Nuclear Security Summit (note 1).

[33] Ua-energy, [Ukraine asks the IAEA to help solving the liability issues for nuclear facilities in the Crimea], 25 Dec. 2014, <http://ua-energy.org/post/49747> (in Ukrainian).

[34] Statement by the Delegation of Ukraine at the IAEA Board of Governors, 5 Mar. 2014, <http://vienna.mfa.gov.ua/mediafiles/sites/vienna/files/Statement_Ukraine_at_the_Board_FINAL_05032014.doc>.

[35] SNRIU (note 31).

[36] IAEA, *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection*, 2007 Edition (IAEA: Vienna, June 2007).

[37] Unofficial consolidated text of the Convention on the Physical Protection of Nuclear Material, as amended on 8 July 2005, <http://ola.iaea.org/ola/documents/ACPPNM/Unofficial-consolidated-text-English.pdf>.

[38] International Convention for the Suppression of Acts of Nuclear Terrorism, opened for signature 14 Sep. 2005, entered into force 7 July 2007, <www.un.org/en/sc/ctc/docs/conventions/Conv13.pdf>.

In addition, there are the following United Nations Security Council Resolutions (UNSCRs) that deal with nuclear security issues.

1. UNSCR 1373 (2001), which focuses on general counterterrorism mechanisms.
2. UNSCR 1540 (2004), which directly addresses the weapons of mass destruction (WMD) terrorist threat and calls on states to adopt and enforce appropriate effective laws which prohibit any non-state actor from manufacturing, acquiring, possessing, developing, transporting, transferring or using nuclear, chemical or biological weapons.

There are also recommendations and requirements developed by the IAEA. The IAEA NSS no. 13, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities* (INFCIRC/225/Revision 5), is widely recognized as the non-binding international standard for the physical protection of nuclear material, including its physical protection during transport, and of nuclear facilities against malicious acts.[39] This document identifies three types of risk related to the protection of nuclear material and nuclear facilities.

1. The risk of the unauthorized removal of nuclear material with the intent to construct a nuclear explosive device.
2. The risk of the unauthorized removal of nuclear or other radioactive material that could lead to subsequent dispersal.
3. The risk of sabotage of a nuclear installation.[40]

These types of risk cover general scenarios possible in nuclear facilities or with nuclear materials within a normal security environment—referring to countries not involved in armed conflict or frozen conflict or not bordering an armed conflict zone.

However, if countries are involved in such circumstances, they should be ready to stand up to the emerging threats. The Amendment to the CPPNM states that 'the responsibility for the establishment, implementation and maintenance of a physical protection regime within a State Party rests entirely with that State'.[41] In general, physical protection systems are not designed to protect against an attack, but they are designed to detect and delay the attackers until a response force arrives. In this context, in terms of NPP protection, nuclear security measures should be supported by strong military forces.

The Amendment to the CPPNM clearly distinguishes nuclear security measures and the use of military forces. It emphasizes that 'the activities of armed forces during an armed conflict . . . are not governed by this Convention, and the activities undertaken by the military forces of a State in the exercise of their official duties, inasmuch as they are governed by other rules of international law, are not governed by this Convention'.[42] The same division is presented in ICSANT. It emphasizes that 'the activities of military forces of States are governed by rules of international law outside of the framework of this Convention and that the exclusion of certain actions from the coverage of this Convention does not condone or make lawful otherwise unlawful acts, or preclude prosecution under other laws'.[43] This paper only deals with nuclear security measures, therefore it only considers those threats that can be prevented or delayed with the help of physical protection systems.

The armed conflict in eastern Ukraine and its related threats are dramatically influencing the nuclear security conditions in the country. The 2016 Nuclear Threat Initiative (NTI) Nuclear Security Index, for the first time, considered the probability of sabotage in its ranking. More specifically, the NTI Index looked at a number of indicators determining the conditions for the protection of nuclear facilities against sabotage. These indicators include political stability, effective governance, the pervasiveness of corruption and the presence of groups interested in illicitly acquiring nuclear materials.[44]

For Ukraine, the 2016 NTI Index clearly shows that factors relating to sabotage should be improved. Overall, Ukraine scored 65 points out of 100 in the sabotage ranking, where 100 is the most favourable nuclear security conditions for nuclear facilities. Its lowest score was in the 'risk environment' section, where it scored only 36 points.[45] This is explained by

[39] IAEA (note 19).
[40] IAEA (note 19).
[41] IAEA, Amendment to the Convention on the Physical Protection of Nuclear Material, INFCIR/274/Rev.1/Mod.1, 9 May 2016.
[42] IAEA (note 41).
[43] International Convention for the Suppression of Acts of Nuclear Terrorism (note 38).
[44] NTI, NTI Nuclear Security Index, 'Theft—Sabotage', Jan. 2016, <http://ntiindex.org/wp-content/uploads/2016/03/NTI_2016-Index-Report_MAR-25-2.pdf>.
[45] NTI (note 44).

the ongoing armed conflict in eastern Ukraine and the severe challenges emerging for nuclear facilities and materials in the region, as well as political instability. Ukraine scored only 10 points under the 'political stability' indicator in the 'risk environment' section.

In its assessment of the nuclear security conditions for materials, the 2016 NTI Index gave Ukraine a total score of 77.[46] Therefore, the conditions for the security of nuclear materials in Ukraine are generally favourable given the current security situation. In comparison to previous years, the current score has not changed dramatically. For example, before the conflict started in Ukraine, the 2012 NTI Index listed Ukraine's overall score as 76.[47] In the year that the armed conflict began, the 2014 NTI Index listed Ukraine's score as 79.[48] However, despite minor changes in the overall picture with regard to nuclear security conditions for materials, the 'risk environment' section of the NTI Index has changed drastically since 2012. While the 2012 NTI Index gave Ukraine 47 points (the section is entitled 'societal factors' in 2012), in 2014 the score dropped to 40 and in 2016 there was a further decline to 34, clearly demonstrating that the risk environment took a turn for the worse.[49] This is explained by the loss of regulatory control in the occupied and annexed territories, where a significant amount of nuclear and radioactive material remains.

This situation has shown that the biggest problems in terms of the protection of nuclear facilities and materials, and the provision of favourable nuclear security conditions, lie in the challenges of the current political instability, the unsatisfactory socio-economic situation and the negative outcomes of the armed conflict in and annexation of Ukrainian territory.

These developments have led to a range of specific threats to Ukraine's nuclear security regime, which are part of the threats defined in the NSS no. 13. The following section focuses specifically on those risks that have increased as a result of the armed conflict.

V. INCREASED RISKS DUE TO THE ARMED CONFLICT

Considering the risks to Ukraine's nuclear facilities and materials as a result of the armed conflict, this paper looks at three main kinds of threat: (*a*) classic nuclear security threats; (*b*) threats from occupied/uncontrolled territories; and (*c*) 'hybrid war' threats. There has been an increase in the availability of illegal arms and ammunition during the armed conflict in eastern Ukraine. As a result, terrorist groups or other criminal organizations from the self-proclaimed Donetsk People's Republic (DPR) and Luhansk People's Republic (LPR) have been able to significantly bolster their power. Under such circumstances, the main concerns of non-state actor activities fall within these three kinds of threat.

Classic nuclear security threats

With regard to classic nuclear security threats—in addition to threats derived from the NSS no. 13 classification—a particular challenge is posed by insider threats.

The NSS no. 8, *Preventive and Protective Measures against Insider Threats*, describes an 'insider' as an adversary who could take advantage of their access rights, authority and knowledge of 'their' facility to bypass dedicated physical protection elements and other safety, material accountancy and control, and operating measures and procedures, in order to perform a malicious act.[50] Insiders can pursue different motivations, goals and means to achieve results. In the case of Ukraine, these aspects are defined by the ongoing conflict in the eastern part and have economic, social and political consequences.

In addition to the potential risks posed by Ukrainian citizens acting alone, there are risks posed by Ukrainian citizens working together with a foreign power involved in the conflict, in which case the insider might be provided with additional technical assistance, capabilities and support.

Russia's role in the conflict has raised concerns regarding the loyalty of some NPP personnel who have strong family relationships with Russia. Concerns have been especially linked to the idea of there being

[46] NTI, NTI Nuclear Security Index, Theft—Sabotage, Data & Results, 'Ukraine', Jan. 2016, <http://ntiindex.org/countries/ukraine/?index=theft>.

[47] NTI, NTI Nuclear Materials Security Index, Jan. 2012, <http://2016.ntiindex.org/wp-content/uploads/2013/11/2012-NTI-Index-Report.pdf>.

[48] NTI, NTI Nuclear Materials Security Index, Jan. 2014, <http://2016.ntiindex.org/wp-content/uploads/2014/01/2014-NTI-Index-Report1.pdf>.

[49] NTI, Jan. 2012 (note 47); NTI, Jan. 2014 (note 48); and NTI, NTI Nuclear Security Index (note 46).

[50] IAEA, *Preventive and Protective Measures Against Insider Threats*, IAEA Nuclear Security Series no. 8, Implementing Guide (IAEA: Vienna, Sep. 2008).

dissatisfied nuclear industry workers with low salaries. The 'insider threat' section of a Chatham House report on cybersecurity at civil nuclear facilities notes that this problem means 'workers [are] particularly vulnerable to recruitment by Russian agents, as does the fact that part of the population has loyalties to Russia'.[51]

Threats from occupied/uncontrolled territories

Nuclear terrorism threats from occupied/uncontrolled territories have also emerged as a result of the conflict and these are mostly dedicated to increasing the possibility of orphan source involvement in terrorist activities, because of the loss of regulatory control over occupied and annexed territories.[52]

The number of radioactive sources in eastern Ukraine outside of the proper control of the Ukrainian nuclear regulator was presented in the previous section. Usage by criminal or separatist groups from the DPR and the LPR is a real concern, although at the moment there is little evidence that such groups are planning to create a 'dirty bomb'. However, in 2015 the Ukrainian Security Service received information from competent sources regarding the creation of such a bomb in the occupied territories. This information was revealed by the Adviser to the Chair of the Security Service, Yuri Tandyt.[53]

In addition to threats of illicit trafficking of nuclear and radioactive materials from the east of Ukraine, there are also risks from unrecognized Transnistria. In 2014 the Counterintelligence Unit of the Ukrainian Security Service seized a source of ionizing radiation with a possible content of uranium-235 in the territory of Ukraine.[54] According to the results of a preliminary investigation, carried out by Chernovtsy region Sanitary Service experts, the exposure dose at a distance of 0.1 metres from the package with the radioactive source is 0.96 mSv/h, which is 5–7 times higher than the natural background, and at a distance of 1 metre it is 0.14 mSv/h.[55] The radioactive substance stored in the container was the result of 'cottage industry' production. According to the Ukrainian Security Service, nine persons were arrested and some of them were Russian citizens. Based on information from representatives of the Security Service, this material could be potentially used to create a 'dirty bomb' with the purpose of destabilizing the situation in the south-eastern regions of Ukraine.[56]

Political and social instability amplifies the motivation of criminal or terrorist groups or organizations for illegal business related to the distribution of radioactive materials that are out of regulatory control.

In addition to the loss of regulatory control over radioactive sources in the occupied territories, Ukraine has lost control over 400 km of the national border. Such circumstances pose real challenges for Ukrainian law enforcement agencies to combat illicit trafficking from the territories beyond national control. As a result, and as mentioned in the Ukrainian National Statement at the 2016 Nuclear Security Summit, there were two cases of illicit trafficking interception.[57] In March 2016 the Ukrainian Security Service intercepted three sources of ionized radiation in the Zaporizhzhya region, which allegedly arrived in Ukraine through the uncontrolled sections of the Ukrainian–Russian border. In July 2015 the Ukrainian Security Service discovered that Luhansk-based separatists had sold a number of sources of ionizing radiation from the occupied coal mine in the Luhansk region, which were recently found in the populated area of the Donetsk region.[58] The motivations of the end users are unknown: it

[51] Baylon, C., Brunt, R. and Livingstone, D., *Cyber Security at Civil Nuclear Facilities: Understanding the Risks*, Chatham House Report (Chatham House: London, Sep. 2015).

[52] An 'orphan source' is 'A radioactive source which is not under regulatory control, either because it has never been under regulatory control, or because it has been abandoned, lost, misplaced, stolen or otherwise transferred without proper authorization'. IAEA (note 36).

[53] [Ukrainian Security Service checks the information from competent sources on the creation of a 'dirty bomb' by armed groups], 112 Ukraine, 4 Aug. 2015, <http://ua.112.ua/golovni-novyni/sbu-pereviriaie-informatsiiu-vid-kompetentnoho-dzherela-pro-stvorennia-boiovykamy-brudnoi-bomby-249704.html> (in Ukrainian).

[54] [Ukrainian Security Service detained terrorists with composites for 'dirty' bomb], Obozrevatel, 5 May 2014, <http://ukr.obozrevatel.com/politics/17805-sbu-zatrimala-teroristiv-z-skladovim-brudnoi-bombi.htm> (in Ukrainian).

[55] SNRIU, 'On 30 Apr. 2014 the Security Service of Ukraine revealed a source of ionizing radiation in a vehicle close to the village of Strointsy, in the Novoselytsk district of the Chernovtsy region', 8 May 2014, <http://www.snrc.gov.ua/nuclear/en/publish/article/245551;jsessionid=9380AA11F327DE8A2BD6DA5468842D5B.app2>.

[56] Ukrainian National Police, [Information from the anti-terrorist centre at the Ukrainian Security Service], 5 May 2014, <https://www.npu.gov.ua/uk/publish/article/1042843> (in Ukrainian).

[57] Nuclear Security Summit, National Statement by Ukraine on the Threats Posed by the Aggression of the Russian Federation against Ukraine and Nuclear Militarization of Crimea to Safety and Security of Nuclear Sites and Material of Ukraine, Washington, DC, 1 Apr. 2016, <http://www.nss2016.org/document-center-docs/2016/4/1/national-statement-ukraine>.

[58] Nuclear Security Summit (note 57).

might be financial incentives due to the poor economy in the occupied territories, or it might be the desire to produce a 'dirty bomb' or other radiological dispersion device (RDD) in order to undermine stability in Ukraine. Regardless, the nuclear security conditions of radioactive sources have seriously deteriorated because of the conflict and this presents real a threat to national security.

'Hybrid war' threats

Based on the approaches used in the armed conflict in Ukraine, the conflict can be classified as a 'hybrid war'. During negotiations in 2016 with the North Atlantic Treaty Organization (NATO) Secretary General, Jens Stoltenberg, Ukrainian President Petro Poroshenko listed the following tools of undeclared war by Russia: 'Political pressure, outright propaganda, interference in the electoral process, economic coercion, covert sabotage and military operations, cyber-attacks, abuse of diplomatic measures . . .'[59] Therefore, within the 'hybrid war' threats for nuclear security, particular attention is given to the potential for cyber and armed attacks against Ukrainian NPPs.

On 23 December 2015 the Ukrainian energy sector suffered a cyberattack. The computer network of a Ukrainian power distributor, Prykarpattya Oblenergo, was shut down because of the BlackEnergy computer virus. This resulted in a blackout of 80 000 households in 103 towns.[60] The virus also paralysed the work of two other power distributors: Chernivtsi Oblenergo and Kyiv Oblenergo. According to the Ukrainian Ministry of Energy and Coal Industry, a break in the electricity supply ranging from 1 to 3.5 hours was attributed to the virus. The total loss was -73 MWh or 0.015 per cent of the daily consumption of Ukraine.[61] In the same statement, the ministry alleged that, based on information from one of the power distributors, intruders had accessed the computer network through Internet providers from Russia.[62] This case, in addition to the increased risk of insider threats, raises a real concern over possible cyberattacks on Ukrainian NPPs. President Poroshenko, in his statement at events in connection with the 30th anniversary of the Chernobyl disaster, noted that 'if the virus BlackEnergy was used for attacks on our power distributors, there is no guarantee that such technology will not threaten our nuclear plants'.[63]

In a Chatham House report on cybersecurity at nuclear facilities, a similar scenario is considered and it is noted that 'a cyberattack that took one or more nuclear facilities offline could, in a very short time, remove a significant base component to the grid, causing instability'.[64]

An attack by non-state actors with heavy weapons on a Ukrainian NPP in order to cause radiation dispersal.

Since heavy weapons have not been completely prohibited within the conflict in the eastern part of Ukraine, these risks, especially in the context of heavy armament usage, have been particularly high. According to the 2015 Minsk II agreement, conflict sides should withdraw all heavy weapons (including MLRS Tornado-S, Uragan, Smerch, and Tochka U tactical missile systems) to an equal distance in order to create a security zone of at least from 50 km to 140 km.[65] Unfortunately, this provision of the deal has not been implemented and so risks of MLRS Tornado-S or Smerch use against the Zaporizhzhya NPP remain. This is particularly relevant because of the incident on 17 July 2014, when a Russian-supplied Buk-M1 rocket system reportedly shot down Malaysia Airlines flight MH17, a civilian airliner flying in Ukrainian airspace.[66] With such weapons in the hands of poorly trained non-state actors, there is a real risk of a similar incident

[59] [Poroshenko met with NATO Secretary General in New York], ZN,UA, 21 Sep. 2016, <http://dt.ua/POLITICS/poroshenko-pospilkuvavsya-z-gensekom-nato-v-nyu-yorku-219530_.html> (in Ukrainian).

[60] Pagliery, J., 'Scary questions in Ukraine energy grid hack', CNN Money, 18 Jan. 2016, <http://money.cnn.com/2016/01/18/technology/ukraine-hack-russia/>.

[61] Ukrainian Ministry of Energy and Coal Industry, [Ministry of Energy and Coal Industry intends to form a group of representatives of all energy companies, managed by the ministry in order to explore the possibility to prevent unauthorized interference with the work of energy networks], 12 Feb. 2016, <http://mpe.kmu.gov.ua/minugol/control/uk/publish/article?art_id=245086886&cat_id=35109> (in Ukrainian).

[62] Ukrainian Ministry of Energy and Coal Industry (note 61).

[63] President of Ukraine, 'Statement by the President at events dedicated to the 30th anniversary of the Chernobyl disaster', 26 Apr. 2016, <http://www.president.gov.ua/news/vistup-prezidenta-pid-chas-zahodiv-u-zvyazku-z-30-mi-rokovin-37042>.

[64] Baylon, Brunt and Livingstone (note 51).

[65] The results of diplomatic efforts between France, Germany, Ukraine and Russia are two deals to establish a ceasefire: Minsk and Minsk II. Their main aims are to elaborate and agree on measures to solve the ongoing war in the Donbas region.

[66] Koshiw, J. V., *MH17: The Story of the Shooting Down of the Malaysian Airliner* (CreateSpace: 2015); and Romein, D. et al., *MH17: Potential Suspects and Witnesses from the 53rd Anti-aircraft Missile Brigade* (Bellingcat: 2016).

leading to an aircraft being brought down in close proximity to a NPP.

Expanded organized crime and separatist activities in the DPR and the LPR have raised the possibility of an armed attack on facilities with radioactive sources (including direct or indirect involvement of such facilities in armed hostilities).

President Poroshenko noted in April 2016 that in the past year activities of more than 300 sabotage groups had been uncovered by intelligence, military and law enforcement agencies.[67] Moreover, Poroshenko stated that representatives of these groups were trained on Russian territory, in Belgorod, Kursk and Rostov.

According to the SNRIU, there are no nuclear facilities in the DPR and the LPR, but there are small amounts of nuclear materials shielding containers for the transportation and storage of radiation sources and X-ray equipment in oncological clinics, as well as high-level radiation sources.[68] Intentional or accidental targeting of such facilities could still cause severe radioactive contamination and exposure of the local population and environment.

In 2015 it was reported by various media that a radioactive waste storage facility near Donetsk (not under Ukrainian control) could be potentially damaged as a result of a powerful explosion that occurred in the area of the Donetsk chemical plant.[69] This facility was close to the Donetsk airport, where military action was taking place at that time. Major-General Andriy Taran, Head of the Ukrainian side of the Joint Control and Coordination Center, noted that 'this situation is a cause for major concern to Ukraine because there is a possibility of radiation leak, which is very dangerous to the health and life of many civilians in the region'.[70]

There is no information regarding the current condition of this facility. However, this case shows the possible scenario where facilities with radioactive sources located within the battlefield during armed conflict can cause hazardous consequences, potentially even more dangerous than any attack from conventional armaments. This experience might also prompt separatists to use such scenarios within the ongoing conflict in order to destabilize the situation in the region even more.

VI. EFFORTS TO IMPROVE NUCLEAR SECURITY WITH REGARD TO THE CHALLENGES EMERGING FROM THE ARMED CONFLICT

As a result of the national security challenges related to the events in the eastern part of Ukraine, the Ukrainian National Security and Defence Council passed a Decision on taking urgent measures to ensure the national security, sovereignty and territorial integrity of Ukraine.[71] According to paragraph 6 of this Decision, the Ministry of Internal Affairs of Ukraine shall provide enhanced protection of NPPs and critical infrastructure. In particular, according to the Law of Ukraine on physical protection of nuclear facilities, nuclear materials, radioactive waste and other sources of ionizing radiation, the National Guard of Ukraine shall provide protection and defence for all Ukrainian NPPs, the Chernobyl NPP Shelter Object, the Nuclear Research Institute of the National Academy of Sciences, the NSC KIPT and more.

Energoatom, the SNRIU and other responsible authorities are taking active measures in order to protect NPPs.

Energoatom has developed the 'Action plan of Energoatom on the realization concept of combating terrorism in NPPs for the period of 2014–2020'.[72] This plan consists of a set of measures aimed at revealing and mitigating terrorist threats, protecting the population and state against terrorism, concentrating main efforts towards anti-terrorist activities and strengthening communication with the respective national authorities.

Moreover, in order to mitigate the risks from air attack, the air defence system over the Zaporizhzhya NPP was strengthened. Officials from the SNRIU and Energoatom emphasized this fact during the SNRIU board meeting 'On the status of work on the extension

[67] [During the last year Ukraine caught more than 300 sabotage and reconnaissance groups: Poroshenko], Radiosvoboda, 22 Apr. 2016, <http://www.radiosvoboda.org/a/news/27690917.html> (in Ukrainian).

[68] SNRIU (note 31).

[69] [Burial of radioactive waste in Donetsk raised concern at the Joint Center for Coordination and Control], ZN,UA, 21 June 2014, <http://dt.ua/UKRAINE/mogilnik-radioaktivnih-vidhodiv-pid-doneckom-viklikaye-sturbovanist-u-sckk-176611_.html> (in Ukrainian).

[70] [Burial of radioactive waste in Donetsk raised concern at the Joint Center for Coordination and Control] (note 69).

[71] Ukrainian National Security and Defence Council, [Decision no. 189/2014 On urgent measures to ensure national security, sovereignty and territorial integrity of Ukraine], 3 Mar. 2014, <http://zakon3.rada.gov.ua/laws/show/n0001525-14> (in Ukrainian).

[72] The action plan was adopted by Decree no. 61 on 29 Jan. 2014.

of the operation unit number Zaporizhzhya NPP unit no. 1' in December 2015.[73]

From 2014–16, emergency training was conducted at all NPPs. The training objective was to exercise the actions of the Facility Interaction Plan for participants in case of sabotage in different situations, and to eliminate the possible consequences.[74] For example, on 31 May–2 June 2016, anti-sabotage and emergency exercises were conducted at the Khmelnytska NPP.[75] Moreover, the improvement and technical re-engineering of physical protection systems at all NPPs were implemented.[76]

Ukraine is addressing increased threats from insiders through on-site training and exercises

For example, a training course for NPP guards on the mitigation of 'insider threats' has just been completed at the southern Ukrainian NPP. The main aim of the training course was to improve the knowledge of military personnel in detecting and preventing threats from insiders.[77]

Ukraine is actively working on mitigation threats from cyberattacks on Ukrainian NPPs.

On 15 March 2016 the Ukrainian National Security and Defence Council's Resolution 'On the Cyber Security Strategy of Ukraine' was approved by a Ukrainian Presidential Decree. On 7 June 2016 Poroshenko signed a Decree on creating a national cybersecurity centre. However, these measures represent only a declared programme of necessary actions. Numerous changes to the Ukrainian legislation, serious investments and technical modernizations have still to take place.

In order to deal with illicit trafficking and the increased number of orphan sources Ukraine is strengthening its border controls.

As mentioned during the 2016 Nuclear Security Summit, for the past few years, Ukrainian Border Guard staff have been involved in more than a hundred topical training sessions on detecting radioactive (nuclear) materials on the state border. Moreover, the National Academy of Sciences of Ukraine has produced a draft 'Concept of the State Program of Development of Nuclear Forensics in Ukraine for 2014–20'.[78]

VII. POLICY RECOMMENDATIONS

The Ukrainian case has revealed a weak point in the nuclear security regime: the application of nuclear security measures during ongoing armed conflict. Existing nuclear energy facilities and materials were not designed with high levels of military danger as a result of armed conflict in mind. Nuclear safety and nuclear security systems were constructed based on a peaceful environment and territorial integrity. Therefore, the armed conflict in Ukraine and its associated threats have demonstrated a necessity to revise the current nuclear security architecture. In this regard, the Ukrainian experience can be of great use for the international community.

Despite the fact that nuclear security is exclusively a national responsibility, international cooperation in this area is very important as it contributes to the development of generally accepted standards, guidelines and regulations to improve security levels in the global context. The consolidation of the international community's efforts within Nuclear Security Summits has contributed to finding the best ways of solving current challenges. However, it is also crucial to continue this work in the post-Summit environment and to frame the long-term development of the nuclear security regime.

Thus, the main recommendations of this paper are aimed at the improvement of the nuclear security regime in general, and particularly taking into account nuclear security in states affected by armed conflict involving non-state actors.

[73] SNRIU, Facebook, Video, <https://www.facebook.com/171734492888296/videos/991130984281972/> (in Ukrainian).

[74] SNRIU (note 31).

[75] SNRIU, 'SNRIU participated in common emergency exercises at Khmelnitsky NPP', 6 June 2016, <http://www.snrc.gov.ua/nuclear/en/publish/article/325600;jsessionid=CC53039FE21456842450D8E6AB559725.app1>.

[76] Energoatom, [Presentation by the President of Energoatom, Yuri Nedashkovskiy, at the Conference of the Labor Collective of the Company], [n.d.], <http://www.slideshare.net/energoatom/ss-45889504> (in Ukrainian).

[77] Energoatom, [Southern Ukrainian NPP guards passed the training course on prevention of insider threats], 23 Aug. 2016, <http://www.energoatom.kiev.ua/ua/press/nngc/45763-yujnoukransk_gvardyitc_proyishli_navchalniyi_kurs__z_zapobgannya_zagrozi_vnutrshnogo_pravoporushnika/> (in Ukrainian).

[78] Nuclear Security Summit (note 1).

Create a fundamental legislative basis for further nuclear security development

As a next step after the Nuclear Security Summits, the further strengthening of nuclear security could be done through the creation of a global legislative platform, possibly in the form of a convention or resolution. This document should incorporate strategic understanding of nuclear security complexity, objectives and responsibilities, while at the same time it should not jeopardize national interests. The Nuclear Security Governance Experts Group has already started to work in this direction and issued a paper dedicated to the 'International Convention on Nuclear Security' in 2015.[79] This author fully agrees with the provisions of this document, but recommends considering nuclear security in states affected by armed conflict involving non-state actors.

In addition, if nuclear security experts and diplomats were to discuss such a document, the driving incentive should be the priority to strengthen global security. This document should not contradict the provisions of existing documents, such as the CPPNM, ICSANT, the IAEA NSS no. 13 or other nuclear security plans. Moreover, this document should gather all best practices, including the Ukrainian experience, and be a structural basis for the further development of the nuclear security regime.

Update existing nuclear security initiatives with provisions for nuclear security during armed conflict

Currently there are no legislative initiatives, legally binding or non-legally binding, which address the issue of nuclear security during armed conflict. The CPPNM, as well as its Amendment, does not refer to this issue at all. ICSANT only mentions that 'the activities of military forces of States are governed by rules of international law outside of the framework of this Convention and that the exclusion of certain actions from the coverage of this Convention does not condone or make lawful otherwise unlawful acts, or preclude prosecution under other laws'.[80]

Therefore, the IAEA should consider this recommendation and launch a discussion to work out the best way to address the issue at the earliest possible time, based on Ukrainian proposals.

It is worth noting that the 1960 Convention on Third Party Liability in the Field of Nuclear Energy and the 1963 Vienna Convention on Civil Liability for Nuclear Damage address some aspects of this issue. In particular, they refer to liability aspects: no liability shall attach to an operator for nuclear damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war or insurrection.

Update existing nuclear security non-legally binding initiatives with provisions for nuclear security during armed conflict

The existing IAEA information circular (INFCIRC/225) on 'Recommendations for the physical protection of nuclear material and nuclear facilities' provides guidelines for countries seeking to establish nuclear security systems, covering domestic and international use, storage and transport, defence in depth, security culture, and so forth.[81] However, despite full-scale national responsibilities for nuclear security, this information circular should introduce recommendations or issues to be considered for states with armed conflict on their territories.

The IAEA NSS no. 10, *Development, Use and Maintenance of the Design Basis Threat*, was developed in 2009 and does not provide practical recommendations on DBT strengthening during armed conflict or the threat of it.[82] Therefore, it should also be revised with a special focus on the ongoing conflict in the eastern part of Ukraine.

The IAEA should perhaps also consider developing a separate NSS dedicated to nuclear security in states affected by armed conflicts involving non-state actors. In this case, the European Union could earmark some of its contribution to the IAEA Nuclear Security Fund to support the production of such a document. However, considering the political difficulties that might appear within the IAEA, the aforementioned

[79] Nuclear Security Governance Experts Group, 'International Convention on Nuclear Security', Washington, DC, Mar. 2015, <http://www.nsgeg.org/resources.cfm?CatID=CF13FF02-9274-4995-BB9D-186411DD269D>.

[80] International Convention for the Suppression of Acts of Nuclear Terrorism (note 38).

[81] 'Defence in depth' is the combination of multiple layers of systems and measures that have to be overcome or circumvented before physical protection is compromised. IAEA (note 19).

[82] IAEA, *Development, Use and Maintenance of the Design Basis Threat*, IAEA Nuclear Security Series no. 10, Implementing Guide (IAEA: Vienna, May 2009).

document could also be created by the World Institute for Nuclear Security (WINS).

Create a legally binding document on the prohibition of all armed attacks against nuclear installations devoted to peaceful purposes

As mentioned earlier, there have been a number of cases of nuclear installations being attacked. Addressing the possibly devastating results and worldwide consequences in terms of radioactive contamination after one of these cases, in 1990 the IAEA General Conference passed Resolution GC(XXXIV)/RES/533 on the 'Prohibition of All Armed Attacks Against Nuclear Installations Devoted to Peaceful Purposes Whether Under Construction or in Operation'.

Another example of a similar concern was during a period of high tensions between Israel and Iran in the 2000s. Because of the Israeli threat to bomb Iranian nuclear facilities, the Iranian representative to the IAEA, Ali Asghar Soltanieh, made a new attempt to ban such attacks during the 2009 IAEA General Conference by stating that 'nuclear installations all over the world are increasing and any sort of threatening attacks . . . will have radiological consequences all over the world'.[83] As a result, the 53rd session of the General Conference unanimously adopted a decision (GC(53)/DEC/13) prohibiting any attack or threat of attack against nuclear installations under construction or in operation.[84] However, as of today there is no legally binding instrument that would make provisions for the protection of nuclear facilities against an armed attack.

Given the current situation in Ukraine, as well as other threats to global security, this issue needs to be resolved in the most effective manner. Within a legally binding document, all armed attacks against peaceful nuclear installations whether under construction or in operation should be strictly prohibited. And the delineation of peaceful and military installations should be addressed within the IAEA safeguards regime.

Another recommendation to be considered within this issue is that of using the Indo-Pakistani experience to establish a Non-Nuclear Aggression Agreement between Russia and Ukraine. The provision of such a document could be similar to the Indo-Pakistani agreement, which barred its signatories from carrying out a surprise attack (or assisting a foreign power in an attack) on each other's nuclear installations and facilities. The Indo-Pakistani agreement provides a confidence-building security measure environment and restrains each party from 'undertaking, encouraging, or participating in, directly or indirectly, any action aimed at causing destruction or damage to any nuclear installation or facility in each country'.[85]

[83] NTI, 'Iran urges IAEA members to ban attacks on nuclear sites', 13 Aug. 2009, <http://www.nti.org/gsn/article/iran-urges-iaea-members-to-ban-attacks-on-nuclear-sites/>.

[84] IAEA, 'Prohibition of armed attack or threat of attack against nuclear installations, during operation or under construction', General Conference Decision GC(53)/DEC/13, 18 Sep. 2009.

[85] 'India, Pakistan: Non-Nuclear Aggression Agreement', Decipher IAS, 29 Aug. 2015, <http://decipherias.com/currentaffairs/india-pakistan-issues/>.

ABBREVIATIONS

CPPNM	1980 Convention on the Physical Protection of Nuclear Material
DBT	Design-Basis Threat
DPR	Donetsk People's Republic
HASS	High-activity sealed radioactive sources
IAEA	International Atomic Energy Agency
ICSANT	2005 International Convention for the Suppression of Acts of Nuclear Terrorism
IPPAS	International Physical Protection Advisory Services
kWh	Kilowatt hour
LPR	Luhansk People's Republic
mSv/h	Millisieverts
MW(e)	Megawatt electric
NATO	North Atlantic Treaty Organization
NPP	Nuclear power plant
NSC KIPT	National Scientific Center's Kharkiv Institute of Physics and Technology
NSS	IAEA Nuclear Security Series
NTI	Nuclear Threat Initiative
RDD	Radiological dispersion device
SNRIU	State Nuclear Regulatory Inspectorate
UNSCR	United Nations Security Council Resolution
WINS	World Institute for Nuclear Security
WMD	Weapons of mass destruction

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A EUROPEAN NETWORK

In July 2010 the Council of the European Union decided to create a network bringing together foreign policy institutions and research centres from across the EU to encourage political and security-related dialogue and the long-term discussion of measures to combat the proliferation of weapons of mass destruction (WMD) and their delivery systems.

STRUCTURE

The EU Non-Proliferation Consortium is managed jointly by four institutes entrusted with the project, in close cooperation with the representative of the High Representative of the Union for Foreign Affairs and Security Policy. The four institutes are the Fondation pour la recherche stratégique (FRS) in Paris, the Peace Research Institute in Frankfurt (PRIF), the International Institute for Strategic Studies (IISS) in London, and Stockholm International Peace Research Institute (SIPRI). The Consortium began its work in January 2011 and forms the core of a wider network of European non-proliferation think tanks and research centres which will be closely associated with the activities of the Consortium.

MISSION

The main aim of the network of independent non-proliferation think tanks is to encourage discussion of measures to combat the proliferation of weapons of mass destruction and their delivery systems within civil society, particularly among experts, researchers and academics. The scope of activities shall also cover issues related to conventional weapons. The fruits of the network discussions can be submitted in the form of reports and recommendations to the responsible officials within the European Union.

It is expected that this network will support EU action to counter proliferation. To that end, the network can also establish cooperation with specialized institutions and research centres in third countries, in particular in those with which the EU is conducting specific non-proliferation dialogues.

http://www.nonproliferation.eu

EU NON-PROLIFERATION CONSORTIUM

The European network of independent non-proliferation think tanks

FONDATION pour la RECHERCHE STRATÉGIQUE

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PRIF Peace Research Institute Frankfurt — HSFK Hessische Stiftung Friedens- und Konfliktforschung

PEACE RESEARCH INSTITUTE IN FRANKFURT

PRIF is the largest as well as the oldest peace research institute in Germany. PRIF's work is directed towards carrying out research on peace and conflict, with a special emphasis on issues of arms control, non-proliferation and disarmament.
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IISS

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IISS is an independent centre for research, information and debate on the problems of conflict, however caused, that have, or potentially have, an important military content. It aims to provide the best possible analysis on strategic trends and to facilitate contacts.
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