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THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY IN MAINTAINING NUCLEAR PEACE AND NON-PROLIFERATION REGIME IN THE 21ST CENTURY

ABSTRACT The article is an attempt to explain the IAEA's critical role in ensuring global nuclear safety and on the global nuclear governance system. The objective of the Agency's operation is promotion of the peaceful use of nuclear energy, including the use of energy to produce electricity, along with establishment of a system of safeguards to ensure that the countries do not use the peaceful assistance for military purposes.The aim of the article is to present the principles of the internationalsystem of nuclear safeguards and the role of the IAEA in maintaining nuclear peace and nuclear challenges of non-proliferation regime reform. The duality of nuclear technology (dual use) causes the need of strengthening the competence-control and institutional resources of the IAEA. It is necessary to oblige the Member States to cooperate with the Agency's inspectors. The Agency should also develop a procedure to standardize the rules, structure, and legal restrictions. In addition the UN Security Council should react faster in the case of non-compliance detection. A separate issue is the internationalization of the fuel cycle.

Key words: global nuclear safety, global nuclear governance, IAEA

In the twenty-first century, the issue of proliferation of nuclear technology is more and more connected with the transfer of engineering knowledge and with control of access to sensitive equipment instead of delivery of weapons systems. Civilian nuclear programs require extensive knowledge of radioactive materials properties, fuel production processes and functioning of reactors and their control systems. This reinforces the belief that countries possessing civilian nuclear facilities and expertise may have suffi-

cient capabilities to develop a program leading to the construction of nuclear weapons. The aim of this article is to analyse the principles of the international system of nuclear safeguards and assess the role of the International Atomic Energy Agency (IAEA) in maintaining nuclear peace and identify major challenges of nuclear non-proliferation regime reform. This article attempts to answer question how to strengthen and reform the IAEA and to enhance its nuclear safeguards system.

The paper is divided into four related parts. The first section presents the principles of the IAEA functioning within the international non-proliferation regime. The second section discusses major aspects of the nuclear program control system ineffectiveness. Next section analyses the needs of the strengthening of IAEA's control capacity and its institutional competence. The final part reviews perspectives for the multilateralization of the nuclear fuel cycle. As it will be argued below in order to maintain the effectiveness of the NPT regime, the reform covering expansion of the IAEA autonomy should follow into two directions: to strengthen the Agency's control and institutional capacities and through the internationalization of the fuel cycle.

The author has analysed the problem by a prism of the traditional realist approach in the framework of the regimes theory which is defined as *sets of implicit or explicit principles norms, rules, and decision – making procedures around which actors' expectations converge in a given area of international relations*.[1] Regimes set the framework for actors' actions and in a given problem area create a specific international order. However, *realists do not recognize the structure as a driving force that can shape political entities to operate in a specific way*.[2] This theoretical framework provides an explanation for the lack of significant cooperation on proliferation control, arguing that states are expecting to achieve relative benefits larger than other states and engage in cooperation only as long as this strengthens their position in the international environment and only to the point where relative benefits exceed their costs. From a realistic perspective, the effectiveness of the IAEA seems to be limited by the policy of national power and interests. In the perception of structural realism, states strive for a balance of power (Kenneth N. Waltz) and regimes (proliferation regimes) are treated as a 'product' of the existence and functioning of the hegemon state, which determines their strength and effectiveness.[3] A realist approach supports the non-proliferation argument only if it strengthens national interests.

In this article, the author applies research methodology of political sciences, combining desk research with empirical observations (personal visit and interviews in IAEA) and a comparative analysis of the states' non-proliferation policies and initiatives.

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1 J. Mearsheimer, *The Tragedy of Great Power Politics*, New York 2001; S.D. Krasner, *International Regimes*, Ithaca, NY 1983, p. 2.

2 K.N. Waltz, "Realist Thought and Neorealist Theory", *Journal of International Affairs*, vol. 44, no. 1 (1990), p. 34; S. Burchill et al., *Teorie stosunków międzynarodowych*, transl. by P. Frankowski, Warszawa 2006, p. 123.

3 See K.N. Waltz, *Theory of International Politics*, Reading, Mass. 1979, pp. 117-118.

INTERNATIONAL NON-PROLIFERATION REGIME OF NUCLEAR MATERIALS AND TECHNOLOGIES

Nuclear technology is dual use in its essence. This means that it can be used for peaceful purposes but also is fundamental for inventing and producing nuclear weapons/warheads. It can be used both for production of medical isotopes, electricity and serve as a source of fissile material for nuclear weapons. The double nature of its usage causes that any form of civilian nuclear cooperation can increase the risk of the use of nuclear know-how for military purposes. Civil cooperation in the field of nuclear energy increases the risk of proliferation and militarization of nuclear installations and spent fuel.[4] Separated plutonium and HEU (highly enriched uranium) are the two dual-use nuclear materials of greatest proliferation significance. Both have a few non-military applications, most notably as fuel for energy reactors, but can also be used as source material for a nuclear weapon. Whether the plutonium contained in the spent fuel discharged from modern power reactors is suitable for weaponisation has been the subject of considerable debate (its isotopic composition is quite different from plutonium produced specifically for weapons).[5] Nonetheless, the IAEA treats almost all plutonium as weapon-usable.[6] The Agency considers twenty-five kilograms of uranium-235 in the form of HEU or eight kilograms of plutonium as the *the approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded*.[7] From the proliferation risk perspective, the most critical nuclear technologies are uranium enrichment and plutonium reprocessing because they can be used for production of weapon-grade materials. For this reason, in October 1956 the United Nations set up an autonomous and specialized entity – International Atomic Energy Agency (whose statute entered into force on 29 July 1957).

The International Atomic Energy Agency is an independent organisation forming a part of the United Nations' system that functions as an inter-governmental forum of cooperation with respect to the peaceful application of nuclear energy and control of the use of nuclear technologies. Originally, it was meant to be a specialist organisation supplying nuclear fuel for the member states, yet this encountered opposition on the part of the USSR. The Agency has become a centre of cooperation with respect to the safe use of nuclear energy for peaceful purposes. The objective of the Agency's operation is promotion of the peaceful use of nuclear energy, including its application to pro-

4 M. Fuhrmann, "Spreading Temptation. Proliferation and Peacful Nuclear Coopearation Agreements", *Quarterly Journal: International Security*, vol. 34, no. 1 (2009), p. 8; H. Sokolski, V. Gilinsky, "Serious Rules for Nuclear Power without Proliferation", in H. Sokolski (ed.), *Moving Beyond Pretense. Nuclear Power and Nonproliferation*, Carlisle Barracks, PA 2014, pp. 467-481; M. Kroenig, *Exporting the Bomb. Technology Transfer and the Spread of Nuclear Weapons*, Ithaca, NY 2010, p. 198.

5 E.D. Harris (ed.), *Governance of Dual-Use Technologies. Theory and Practice*, Cambridge, Mass. 2016, pp. 10-11.

6 Ibid.

7 Ibid.

duce electricity, along with establishment of a system of safeguards to ensure that the countries do not use the peaceful assistance for military purposes.[8]

The highest authority of the IAEA is the General Conference (consisting of representatives of all member states); it meets once a year (in September) for an ordinary session. The Conference reviews the operation of the IAEA and makes decisions on membership in the Agency, its structure, plans of activities and finances. The Agency is managed by a Board of Governors, which consists of one representative of every member state. The Board has 35 members; 13 are appointed among member states with most advanced peaceful nuclear programmes, whereas 22 are elected as part of two-year rotation from geographic groups. The Board holds four regular meetings a year and makes current programme and financial decisions determining the work of the Secretariat. Director General, supported by the Secretariat, manages on-going operation of the organisation.

The catalogue of the Agency's competences and tasks is extensive and, apart from overall control and verification of the use of nuclear materials and installations, it also encompasses establishment of safety standards of nuclear installations and management of radioactive waste, as well as exchange of scientific and technical information. The main areas of operation of the IAEA include: 1) *nuclear safety*: encompasses reactions to emergency situations, safeguarding and control of facilities; 2) *nuclear security*: includes physical protection of nuclear materials and activities aimed at safe trading and prevention of smuggling; 3) *nuclear safeguards and verification*: contains verification controls, ensuring supplies and internationalisation of the fuel cycle; 4) *promotion of peaceful use of nuclear energy*: refers to technical and scientific cooperation with respect to the use of nuclear energy.

A special instrument regulating peaceful use of nuclear energy which is the basis of the international legal system aimed at ensuring 'nuclear peace' is the *Treaty on the Non-Proliferation of Nuclear Weapons* (NPT), signed in Moscow and London on 1 July 1968, which entered into force on 5 March 1970 (in 1995, it was extended for an unlimited period of time).[9] The NPT divided the member state parties into two groups: nuclear weapon states, (NWS) and non-nuclear weapon states (NNWS). Member states that possess nuclear weapons and military application technologies became liable for non-proliferating them, whereas non-nuclear weapon states became liable for renouncing nuclear weapons and not seeking nuclear technologies in exchange for assis-

[8] In June 1972 IAEA published recommendations on the physical protection of nuclear materials (INFCIRC/225 updated multiple times) which define the security measures for power and experimental reactors (including protection against the theft of spent or fresh fuel), in: IAEA, *The Physical Protection of Nuclear Material*, INFCIRC/225, Vienna, September 1975, at <https://www.iaea.org/sites/default/files/publications/documents/infcircs/1975/infcirc225.pdf>, 20 April 2017.

[9] The system of nuclear material control was strengthened after the adoption of the Convention on the Physical Protection of Nuclear Materials (entered into force on February 8, 1987), which was supplemented by an 'amendment' of May 8, 2016, extending the scope of the Convention among others through the obligation of physical protection of nuclear facilities and nuclear materials during use, storage and transportation.

tance in peaceful use of nuclear energy and technologies.[10] The inalienable right to the peaceful use of nuclear energy (Art. IV of NPT) has often been used as a cover-up for development of military programmes. Such activities were undertaken by North Korea, Iraq, Iran, Libya and Syria.[11] That is why Article III.2 of the Treaty requires the parties to ensure that IAEA safeguards are applied to exports to non-nuclear weapon states of (a) source or special fissionable material, or (b) equipment or material especially designed or prepared for the processing, use or production of special fissionable material. The following states remain outside of the treaty arrangements: India, Pakistan, Israel, North Korea (quit the treaty on 10 January 2003) and South Sudan. The treaty underlines the right of all parties to develop research, production and usage of nuclear energy exclusively for peaceful purposes, while maintaining international control procedures.

The Agency verifies the compliance of NNWS countries nuclear activities with their non-proliferation obligations, through prerogative to establish and apply safeguard agreements specified in the Non-Proliferation Treaty. IAEA safeguards, together with export control stipulated in article III NPT, export control guidelines of the Nuclear Suppliers Group (NSG), and export control guidelines of the Zangger Committee, are the core element of the non-proliferation regime and dual-use technology transfer control.[12]

The purpose of IAEA safeguards is to prevent the diversion of nuclear material from peaceful use by maximising the early detection and providing assurance that countries are in line with their treaty commitments to use nuclear materials and facilities exclusively for peaceful purposes. The purpose of the safeguard system is to verify that the declared activity or material is not used for the production of nuclear weapons. The agency therefore administers a security system that includes the verification of the use of fissile materials (plutonium, highly enriched uranium). Inspections are part of the verifications under 'safeguard measures' (Article XII of the Statute).[13] The inspections system relies on three elements:[14]

– material accountability – tracking all inward and outward transfers and the flow of materials in any nuclear facility,
– physical security – restricting access to nuclear materials at the site,

[10] The division criterion is the production and detonation of a nuclear weapon or other nuclear explosive device before 1 January 1967.

[11] The NPT guarantees open access to nuclear technology including a full fuel cycle based on Article IV, which provides that: *Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination... All the Parties to the Treaty undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy...*

[12] O. Meier, I. Hunger, *Between Control and Cooperation. Dual-Use, Technology Transfers and the Non-Proliferation of Weapons of Mass Destruction*, Osnabrück 2014, p. 9.

[13] IAEA, "The Statute of the IAEA", at <https://www.iaea.org/about/statute#a1-3>, 15 April 2017.

[14] "Safeguards to Prevent Nuclear Proliferation", World Nuclear Association, March 2017, at <http://www.world-nuclear.org/information-library/safety-and-security/non-proliferation/safeguards-to-prevent-nuclear-proliferation.aspx>, 25 April 2017.

– containment and surveillance – use of seals, automatic cameras and other instruments to detect unreported movement and spot checks on-site.

The control mechanism is based on 'material accountancy' during which inspectors take periodic inventories of declared nuclear materials, and verify declared transfers into and out of a facility.[15] In practice inspectors can provide only statistical but not absolute confidence in non-diversion.[16] By the end of 2015, safeguards agreements were in force with 182 states and Additional Protocols were in force with 127 states.[17]

The NPT regime introduced a legal obligation for the NNWS of the Treaty to include all their nuclear activities under the safeguards of the Agency. Every NNWS that is a party to the NPT is required (individually) to conclude bilateral Comprehensive Safeguards Agreements (CSA) with the Agency, making all nuclear materials held by it subject to the safeguards of IAEA.[18] As part of the concluded safeguards agreements, the member states provide information on the research and development activities pertaining to the nuclear fuel cycle, maintenance of nuclear installations, ore extraction, non-nuclear applications, as well as information on radioactive waste.

The Agency has the right to carry out a special inspection if it suspects that there are undeclared activities or facilities. In theory, there is no restriction on the right of the Agency to request such an inspection, but in practice the consent of the country concerned is required. This means that IAEA has been granted the authority to audit facilities and activities related to fissile materials, but only with the consent and with respect to the facilities designated by the State. The inspections are realized based on the Model Comprehensive Safeguards Agreement (INFCIRIC/153), which are focused on detecting the diversion of nuclear material (plutonium, enriched uranium, or uranium-233) from declared facilities.[19] States are required to submit comprehensive reports on their holdings of nuclear materials, which IAEA then verifies through material accountancy.[20] Although INFCIRC/153 requires states to safeguard *all* their nuclear activities, it does not provide the Agency with sufficient tools to do that.[21]

The IAEA member states may also conclude other specific types of safeguards agreements with the Agency: 1) limited ones (IAEA INFCIRC/66),[22] where the control only encompasses nuclear materials or activities within the range of nuclear energy specified in the state's agreement with IAEA; 2) Voluntary Offer Agreements (VOAs)

15 E.D. Harris (ed.), *Governance of Dual-Use Technologies*..., p. 17.

16 Ibid.

17 IAEA, *IAEA Annual Report 2015*, IAEA GC(60)/9, p. 97, at <https://www.iaea.org/About/Policy/GC/GC60/GC60Documents/English/gc60-9_en.pdf>.

18 IAEA, "Safeguards Agreements", at <https://www.iaea.org/safeguards/safeguards-legal-framework/safeguards-agreements>, 20 April 2017.

19 IAEA, *The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, INFCIRC/153, Vienna, June 1972, at <https://www.iaea.org/sites/default/files/publications/documents/infcircs/1972/infcirc153.pdf>.

20 E.D. Harris (ed.), *Governance of Dual-Use Technologies*..., p. 21.

21 Ibid., p. 22.

22 IAEA, INFCIRC/66, Vienna, 28 September 1965.

that foresee the withdrawal of notified materials or facilities from control, with the exception of control of activities that may lead to the proliferation of nuclear materials. The member states – parties to the NPT conducting nuclear activities to a very limited degree supplemented their agreements with the so-called small quantities protocols (SQP), which greatly simplify the procedures foreseen in the CSA. A SQP excludes the majority of obligations from the comprehensive agreement, such as declarations and inspections, on the condition that the nuclear activity is conducted only on a certain small scale.[23] The IAEA verification and safeguards system is supplemented by domestic accounting and control standards (The State System of Accounting and Control, SSAC), which constitute a form of domestic control aimed at settling nuclear materials in a given state.

Recently safeguards were significantly expanded. In May 1997, based on the INFCIRC/540 procedure, NPT was extended to the Model Additional Protocol offering the IAEA a possibility of independent verification of nuclear materials.[24] The Protocol expands the obligations of the member states – if they previously concluded safeguards agreements – with respect to declaring and reporting, and it also offers an almost unlimited access on the spot to the activities carried out in the entire fuel cycle – from extraction to liquidation of nuclear waste (inspection notification 24 hours in advance). IAEA can deploy environmental sampling and remote monitoring techniques to detect illicit activities. The Additional Protocol allows the Agency to have a complete picture of a member state's activities in the area of nuclear power. The Additional Protocol agreement is not a separate treaty and does not constitute a protocol to NPT, but it is a model based on individual negotiations aimed at working out its 'tailored' version compliant with the expectations of a member state that has already concluded a safeguards agreement (the Protocol is an attachment to such agreement). Each Additional Protocol agreement is approved by the Board of Governors and signed and ratified by a given state. The greatest drawback of the Additional Protocol is the fact that it is voluntary, i.e. it is usually adopted by the countries that intend to comply with its requirements.[25]

The system of safeguards should result in timely issue of warning on any changes in the application of nuclear materials from peaceful purposes to military ones (e.g. construction of weapons) and discovery of potential irregularities, as well as prevention of activities against the NPT regime. Since 1981, IAEA has been filing annual reports of the member states' compliance with non-proliferation declarations to the UN Security Council. The IAEA's Board of Governors may summon a member state to remove the irregularities and notify such cases to the Security Council and the General Assembly.

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[23] T. Młynarski, "Reforma systemu zabezpieczeń i weryfikacji materiałów jądrowych jako warunek bezpieczeństwa nuklearnego w XXI w.", *Politeja*, no. 45 (2016), pp. 241-242.

[24] IAEA, *Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards*, INFCIRC/540, Vienna, September 1997, at <https://www.iaea.org/sites/default/files/infcirc540.pdf>.

[25] The most radical opponents of the security system are countries such as Cuba, Egypt, India, Iran, Pakistan, Syria, and Venezuela.

If a member state refuses the Agency's right to control selected facilities, the Agency reports to the UN Security Council that it was not capable of verifying whether nuclear materials were used for military purposes.

THE PROBLEM OF THE NUCLEAR PROGRAM CONTROL SYSTEM INEFFECTIVENESS

NPT has played an important role in delaying the international spread of nuclear weapons, although did not effectively rule it out because did not confine the transfer of sensitive nuclear technologies. The main weakness of NPT is that four countries with nuclear forces: India, Israel, Pakistan and North Korea are not its party. In addition, the crisis of the NPT regime is deepened by: the ineffectiveness of IAEA instruments in detecting illegal activities of the treaty Parties, inconsistent policy of the NSG states and the risk of militarization of nuclear installations and spent fuel.

IAEA is not able to detect early enough secret facilities or installations and has no authority to make control inspections at any time, at any installation without prior notice. The current power of the IAEA to conduct inspections is not sufficient to effectively prevent clandestine nuclear programs, which can be developed based on approved civil program. It is therefore necessary to implement better preventive political measures to reduce the risk of proliferation, which would include:[26] 1) expansion of IAEA's control and supervision powers; 2) closer and more responsible cooperation of NSG; 3) tightening of control mechanism over process of nuclear fuel enrichment.

IAEA, even though it is a specialist agency of the United Nations for safe and peaceful use of nuclear energy, does not have unlimited rights to perform control inspections at any time, at any facility and without notice (even if it acts on the basis of the comprehensive system of the IAEA safeguards contained in the so-called Additional Protocol); in relation to this, a member state that became liable for not processing or not enriching fuel cannot be efficiently verified if it shows no willingness to cooperate. The partial (random) verification in member states is never 100% effective, thence difficulties with disclosing modifications of the production process leading to military applications. The factors that testify to the fact that a member state may be pursuing a military nuclear programme include: delays in access of the IAEA inspectors to nuclear installations or failing to fully cooperate with the Agency; the member state performs enrichment or processing of fuel and failed to sign the Additional Protocol with the IAEA; the military establishment is directly or indirectly involved in development of the peaceful programme of nuclear energy and the country developed nuclear weapons'

[26] T. Młynarski, "The Need to Strengthen the NPT Regime and the Internationalization of the Fuel Cycle", *SGEM2016 Conference Proceedings*, Book 2, vol. 1, 2016, pp. 653-655, at <http://dx.doi.org/10.5593/SGEMSOCIAL2016/HB21/S01.082>, 2 November 2017.

programme in the past; or the member state has publicly threatened to withdraw from the NPT.[27]

In spite of its activities for the sake of non-proliferation, the IAEA failed to discover any significant irregularities in the nuclear programmes of India, Iraq, Iran and Libya included under the safeguards agreements and NPT. The test of Indian nuclear head on 18 May 1974 called the 'Smiling Buddha' showed a gap in the system of safeguards and resulted in the adoption of the safeguards agreement (INFCIRC/66) stating that no item included under the safeguards system could be used to build weapons, to serve other military purposes or to develop any nuclear explosive device.[28]

Discovery of the nuclear weapon construction programme in Iraq came as another shock, as illegal activities pursued upon the order of Iraqi authorities were discovered in locations right next to the regular visits of the Agency's inspectors. In consequence, the IAEA came to be perceived as ineffective, yet this mainly resulted from the restrictions contained in the Agency's statute and the practice of performing inspections stemming from it, designed primarily for advanced industrial countries open for cooperation. The system of safeguards was too weak to reveal the secret installations in a pent-up society. The main source of the Agency's failures was the fact that the inspectors focused exclusively on declared installations and nuclear materials. Experience gathered during work on destroying illegal Iraqi nuclear infrastructure in line with the recommendations of the UN Security Council has restored the credibility of the IAEA in the eyes of some critics. The UN Security Council also made the Iraqi authorities liable for cooperation and allowing access of the Agency's inspectors at any time and at any place to suspicious installations and materials. The Agency has also failed to detect for more than two decades Iran's illegal activities, the country seeking to militarize its nuclear program, despite that in 2006 the IAEA turned down Iranian requests for technical assistance for its heavy-water reactor and in 2007 suspended several other technical assistance projects (on 14 July 2015, the E3/EU+3 and Iran agreed on a Joint Comprehensive Plan of Action (JCPOA), stating that *the full implementation of this JCPOA will ensure the exclusively peaceful nature of Iran's nuclear programme* under which the IAEA received authority for monitoring, for the first time, to uranium mines and to the production and storage of centrifuge components).[29] The cases of Iraq, North Korea and Syria show that the current safeguard system is not fully effective. There is a need for an international 'coalition of willingness' to support these activities. Cases of Iraq, North Korea, Syria show that the current safeguard system is not fully effective and that the strong political willingness is required to get it improved.

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[27] Idem, *Energetyka jądrowa wobec globalnych wyzwań bezpieczeństwa energetycznego i reżimu nieproliferacji w erze zmian klimatu*, Kraków 2016, p. 222.

[28] T. Findlay, *Unleashing the Nuclear Watchdog. Strengthening and Reform of the IAEA*, Waterloo, Ont. 2012, p. 59.

[29] E.D. Harris (ed.), *Governance of Dual-Use Technologies*..., p. 26.

THE NEED OF STRENGTHENING IAEA'S CONTROL CAPACITY AND INSTITUTIONAL COMPETENCE

While the control of dual-use technologies is vital to prevent the proliferation of weapons of mass destruction (WMD), the importance of these technologies for economic and technological development has also grown.[30] Over the next few years, nuclear power technology will likely spread to new countries. This will require greater control, supervisory and security measures, and consequently increasing the IAEA budget and scope of authorizations.[31] The Agency predicts that by 2030 between 10 and 25 new countries will have access to nuclear power. Moreover, many countries consider launching their own civilian nuclear programs, among these are Jordan, Saudi Arabia, UAE which already received a promise of cooperation from at least one nuclear provider. Emerging economies such as Brazil, China, India and South Africa demand that that international cooperation in the peaceful application of dual-use technologies should be improved as part of the non-proliferation bargain.[32]

The strengthening of IAEA's authority has always been difficult since countries strongly defend their nuclear autonomy. IAEA tries to affect state behaviour in some areas of nuclear policy by providing rules and commands on non-proliferation.[33] But the IAEA rules and commands are often contested by states that challenge its specific findings on compliance. Many developing countries fear that most influential members may demand excessive safety and security requirements for the transfer of any peaceful nuclear technologies on grounds of proliferation risks. Therefore, some countries challenge the IAEA recommendations, focusing discussions on regulatory aspects, instead of expanding the mandate of the Agency aimed at ensuring the peaceful usage of nuclear energy. These countries argue that the non-proliferation regime is discriminating against their sovereign right to shape nuclear safety policies.[34]

Although nuclear safeguards system has been significantly strengthened in recent years, IAEA requires deep reforms to stop the risks associated with the dissemination of civilian nuclear technology. In a July 2011 speech, IAEA Deputy Director General for Safeguards Herman Nackaerts said that: *The* [*safeguards*] *system was manifestly failing in its primary objective, namely, to detect activities that did raise potential compliance issues and proliferation concerns – such as those undertaken, for instance, in Iraq, Libya, Syria and Iran*.[35]

Under the impact of failures with respect to verifying the member states' compliance with NPT, the Agency has implemented material reforms of the safeguards sys-

30 O. Meier, I. Hunger, *Between Control and Cooperation*..., p. 10.

31 P.S. Roberts, "How Well Will the International Atomic Energy Agency Be Able to Safeguard More Nuclear Materials in More States?", in H. Sokolski (ed.), *Moving Beyond Pretense*..., p. 266.

32 O. Meier, I. Hunger, *Between Control and Cooperation*..., p. 10.

33 R.L. Brown, *Nuclear Authority. The IAEA and the Absolute Weapon*, Washington 2015, p. 10.

34 Ibid.

35 See P.S. Roberts, "How Well Will...", p. 281.

tem. In the last decade, the Agency has started to be more active with respect to expanding verification activities by implementing a new type of inspection, the so-called 'unplanned' one, announced during a routine inspection. In parallel to legal reform several organizational changes have occurred. New approach to the IAEA safeguards system is based on the examination of *all nuclear material, nuclear installations and nuclear fuel cycle related activities* in a state suspected for undeclared activities.[36] The IAEA has also started to use open source information – the approach known as 'information-driven safeguards'. The Agency now also makes regular use of commercial satellite imagery and intelligence information supplied by member states.[37] In addition, the Agency's investigative inspectors are more independent and do not focus solely on the accounting of nuclear material, but have freedom to decide on the manner of inspections taking into account the results of previous controls.

The Agency has no police-type rights to verify a member state suspected of illegal activities. The procedure in case of a member state's withdrawal from the NPT and, in consequence, the safeguards agreement, is also problematic. A member state party may withdraw from the Treaty (Art. X of the NPT) in a fully legal manner after presenting a relevant notification (a three-month notice period). The weakness of the safeguards system is the fact that it does not allow for evaluating or discovering a state's true intentions (potential militarisation plans of nuclear materials). Additional external risk factors of the safeguards system include popularisation of civil nuclear energy and globalisation of nuclear trade, as well as 'political divisions' in the Agency (Board of Governors and the Director General are political bodies).

IAEA has proved to be an organisation capable of learning with respect to its dual mandate. It has improved and expanded the scope of its technical assistance program in order to meet the growing demand of its member states on technology sharing, and it also proved to be adaptable with respect to its non-proliferation mandate.[38] Cooperation and control on dual-use technology transfers are increasingly viewed as complementary and not conflicting elements of an effective non-proliferation strategy.[39] Nevertheless, the Agency still needs a reform encompassing its control competences. This means the IAEA should pay extra attention to achieve and maintain consensual support for its actions to avoid an institutional power struggle.[40] Furthermore, a precise definition of 'non-compliance' is necessary. Does it include all violations of the safeguards agreement, even slight ones, and does the lack of cooperation with the Agency constitute non-compliance?

The Board of Governors should adopt a clear standpoint that the obligation of ev-

36 E.D. Harris (ed.), *Governance of Dual-Use Technologies*..., pp. 22-23.

37 Ibid.

38 O. Meier (ed.), *Technology Transfers and Non-Proliferation. Between Control and Cooperation*, London–New York 2014, p. 252.

39 Ibid., p. 253.

40 See T. Coppen, "Developing IAEA Safeguards: An Institutional Perspective on the State-level Concept", *Journal of Conflict and Security Law*, vol. 20, no. 2 (2015), pp. 172-188, at <https://doi.org/10.1093/jcsl/krv004>.

ery member state of the IAEA is to testify the absence of non-compliance to the Agency and not vice versa. The Agency should also consider introduction of the following principles to reinforce the NPT regime: establishment of relevant legal restrictions preventing withdrawal from the NPT; on the other hand, the UN Security Council should ensure greater efficiency of sanctions against a member state violating the NPT rules.[41] A separate issue is extending the supervision and control competences, as well as verification techniques of undeclared facilities and materials on the part of the IAEA inspections. The Agency's inspectors should have unrestricted access to all stages of the fuel cycle, starting from uranium extraction and ending with the processing of nuclear waste. The IAEA rights regarding control of nuclear fuel enrichment facilities should be extended and enable on-going monitoring of such facilities.

Some reform proposals would require modification of the Agency's Statute and approval decisions from the Board of Governors or the General Conference. Moreover, the Secretariat requires reform including improvement of strategic planning and changing of inconsistent practices and quality control across departments, as well as betterment of personnel policies. Adoption of modern management tools is required, significant changes are needed to remove intra-agency barriers to communication and increase transparency and information sharing between the Agency has and its stakeholders (including the media, the general public, the nuclear industry.[42] A separate issue is an extension of equipment capacities including the Agency's infrastructure, technology (including IT) and human resources.[43] The Agency's underinvestment, coupled with significant increase of facilities encompassed by safeguards, result in the fact that the Agency's budget is insufficient for effective implementation of the safeguards.[44] Hence, strengthening the Agency will require additional financial resources. An efficiently functioning safeguards system requires preparation and implementation of new control principles based on multilateral approach and designation of global nuclear safeguard governance mechanisms, which primarily calls for political willingness of nuclear powers.

THE MULTILATERALISATION OF THE NUCLEAR FUEL CYCLE

A further strengthening of the NPT regime by prohibiting withdrawal from it and the internationalization of the nuclear fuel cycle would be necessary. The multilateralisation of the nuclear fuel cycle will establish mechanisms to prevent or at least limit the

41 T. Młynarski, *Energetyka jądrowa*..., p. 234.

42 T. Findlay, *Unleashing the Nuclear Watchdog*..., p. 104.

43 Ibid., pp. 104-105.

44 T. Findlay, *What Price Nuclear Governance? Funding the International Atomic Energy Agency*, Belfer Center for Science and International Affairs/Harvard Kennedy School, March 2016, p. 19, at <https://www.belfercenter.org/sites/default/files/legacy/files/WhatPriceNuclearGovernance-Web.pdf>, 2 November 2017.

increase in the number of countries with the capability to enrich uranium and/or reprocess nuclear fuel.[45] This internationalization of the nuclear fuel cycle could be done through establishment of international 'nuclear fuel banks' (international consortia with equal co-ownership and control of sensitive technology products). A precursor of a new approach is the creation at the end of August 2015 by the IAEA the world's first bank of low-enriched uranium (LEU) in Oskemen in the north-eastern Kazakhstan. It is a first centre of this kind under international auspices.[46] The aim of the project is to ensure stable supplies of nuclear fuel to IAEA Member States, discourage countries developing nuclear power programs from starting themselves construction of uranium enrichment facilities (later often used to produce nuclear weapons). The key principle of the IAEA LEU Bank is ensuring supplies in a crisis situation, i.e. when a member state of IAEA, being unable to receive the fuel from the commercial market, may request IAEA to supply the fuel from the bank. The uranium deposited in a bank in Kazakhstan will be enriched up to the maximum of 4.95% and will constitute typical fuel for a light-water reactor. The uranium may be used exclusively as fuel for an energy reactor and cannot be processed or re-exported without the approval of IAEA. The intention is to discourage member states from building facilities that might be used to enrich uranium for military purposes.

The IAEA LEU Bank is a part of global non-proliferation efforts and as an element of the fuel security mechanism, it strengthens the nuclear fuel cycle's nuclear non-proliferation resistance, what is a statutory task of the IAEA. The former US Senator and CEO of Nuclear Threat Initiative (NTI) Sam Nunn said that the IAEA LEU Bank *will enable and encourage peaceful uses of nuclear energy, while reducing the risks of proliferation and reducing the risks of catastrophic terrorism*.[47] Andrew Weber, principal advisor to the US secretary of defence for matters concerning nuclear, chemical, and biological defence programs estimated that, the new fuel bank reduces the possibility for countries to develop nuclear weapons because: *It gives them an international, neutral, reliable supply of low-enriched uranium for power reactors, so they don't have to develop their own enrichment capacity that could be misused to produce the fuel for nuclear weapons*.[48]

Subjecting nuclear installations to the international IAEA controls and inspections mitigates fears with respect to the use of nuclear technologies, yet it never fully excludes the risk of proliferation. Simultaneously, the countries that refuse to accept the safety measures such as the IAEA Additional Protocol of 1997 generate justified fears with respect to their intentions, even if they attempt to convince others about their

[45] See M. Álvarez-Verdugo, "Will Climate Change Alter the NPT Political Balance? New Challenges for the Non-proliferation Regime", *European Journal of International Law*, vol. 21, no. 1 (2010), pp. 208--216, at <https://doi.org/10.1093/ejil/chq013>.

[46] "IAEA and Kazakhstan Agree to Create Nuclear Fuel Bank", World Nuclear News, 27 August 2015, at <http://www.world-nuclear-news.org/UF-IAEA-and-Kazakhstan-agree-to-create-nuclear-fuel-bank-27081501.html>, 15 March 2017.

[47] Ibid.

[48] Ibid.

peaceful intentions.[49] The former head of the IAEA, Muhammad el-Baradei said that if a member state controls the entire fuel cycle and, due to any reasons, violates the non-proliferation obligations, it may generate weapons in the course of several months.[50] Therefore, resigning from own fuel enrichment and processing facilities in exchange for nuclear assistance, even though it is definitely not a remedy for all challenges related to the availability of civil nuclear energy technologies, may however turn out to be an efficient manner to discourage the member states from building own enrichment facilities, which could be potentially used to purify uranium for military purposes.

CONCLUSIONS

The international safeguards system under IAEA control has since 1970 successfully prevented the diversion of fissile materials into weapons. The IAEA conducts regular on-site inspections of civil nuclear facilities and monitors the movement of nuclear materials. Despite of that there is a risk that the country receiving foreign assistance in the development of peaceful nuclear energy program could change it into a nuclear weapon program, especially if adverse changes occur in its geopolitical environment, affecting its subjective sense of security. The biggest concern of international community raises ability of nuclear fuel enriching as uranium enrichment and plutonium separation skills can be applied for military purposes. Therefore, an essential condition for development of nuclear power in the world will be to ensure its safety, both in terms of physical security of facilities but as well of safety of the technology – by guaranteeing its non-proliferation for other than peaceful purposes. The increase in the number of research and energy reactors in the world raises the need to strengthen the global non-proliferation verification system. The duality of nuclear technology applications requires working out effective mechanisms and institutional framework at the international level linking the aim of the development of civil nuclear power with control of proliferation and prevention of illegal transfers. This is provided by IAEA which has fulfilled the security and verification system with institutional framework, becoming a kind of 'guardian' to NPT provisions and having a critical role in maintaining 'nuclear peace'. The Agency has a very high degree of legitimacy among its member states because it is capable to balance the two fundamental demands of its member states: the promotion of peaceful uses of nuclear energy and the non-proliferation of nuclear weapons.

The condition of maintaining nuclear safety in the twenty-first century is to ensure a global system of nuclear materials safeguards. In practice, this means the need for a global system of verification of compliance with non-proliferation requirements

[49] M. Fuhrmann, "Preventive War and the Spread of Nuclear Programs", in H. Sokolski (ed.), *Moving Beyond Pretense...*, p. 105.

[50] M. Kroenig, "The Nuclear Renaissance, Sensitive Nuclear Assistance and Nuclear Weapons Proliferation", in A.N. Stulberg, M. Fuhrman (eds.), *The Nuclear Renaissance and International Security*, Stanford 2013, pp. 207-208.

equipped with mechanisms of international control, accounting and physical protection of nuclear materials and facilities. The nuclear non-proliferation regime is legally binding in nature and near universal – consequently its reforms are slow and difficult, since permission from many participants is required. Another problem is that despite of imperfect of IAEA safeguard system, the Agency in several cases (Syria, North Korea, Iran) was able to provide the international community warning of the proliferation risk. Unfortunately the response of UN Security Council was not effective. This leads to the conclusion that the biggest challenge facing the non-proliferation regime is not detecting violations but responding to them. So there is a need for the UN Security Council to react faster in case of non-compliance detection.

The paper has argued that IAEA's policy-oriented directions should include enhancing IAEA's audit function by extending surveillance and inspection effectiveness together with authorization to permanently monitor nuclear facilities and carry out inspections without earlier notice (at any time and any facility). Furthermore, also the implementation of effective instruments and tools (penalties and executions) and exerting pressure on the state in the event of anomalies detected by IAEA. Finally, the adoption in the UN Security Council of a legally binding resolution mechanism that would automatically be implemented in the event of detection of nonconformities to ensure greater effectiveness of sanctions against a country violating the NPT rules.

The increase of the Agency's control and supervision power requires further support of all IAEA member countries especially the newly emerging powers (Brazil, China, India and South Korea) which should play a greater role in governing, managing and supporting the Agency than they have in the past. In practice, this means that not only political support is needed, but also increased funding for the Agency and its human resources expansion. The Agency should develop a procedure to standardize the rules, structure, and terminology of reporting non-compliance, and promote the internationalization of the fuel cycle. The internationalization of nuclear fuel supplies by commercial fuel banks (trans-national consortia) that would be responsible for fuel deliveries and reprocessing of spent fuel, would weaken individual states efforts to gain control of the full nuclear fuel cycle in order to ensure adequate supplies of its nuclear power programs.

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