INTERNATIONAL NUCLEAR LAW

DOI: 10.24833 / 0869-0049-2019-3-59-67

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Received 3 July 2019
Approved 11 September 2019

INTERNATIONAL LEGAL REGULATIONS OF FLOATING NUCLEAR POWER PLANTS: PROBLEMS AND PROSPECTS

INTRODUCTION. *The article is devoted to practical and legal aspects of floating nuclear power plants (FNPPs). The first ever FNPP "Academic Lomonosov" was built in 2019 in Russia. It is a unique transportable nuclear low-power unit intended for energy and heat supply of remote port cities, industrial enterprises, gas and oil platforms. "Lomonosov" and its successor generations will have a major impact on the global nuclear energy market. The question arises how FNPPs fit into the rules of International Law.*

MATERIALS AND METHODS. *The research was based on the analyses of international conventions on nuclear safety, security and civil liability, Treaty on the Non-Proliferation of Nuclear Weapons, IAEA documents on safeguards and standards, scholarly publications. General and special methods of legal research were used.*

RESEARCH RESULTS. *The authors determined that in the specific case of "Academic Lomonosov" which will operate on the Russian territory no collisions with the rules of International Law are expected. However, if future serial FNPPs go for export, it will be important to analyze their compatibility with international treaties.*

DISCUSSION AND CONCLUSIONS. *This paper concludes that FNPPs are largely compatible with the existing rules of International Law. However, there are some gaps and grey areas, especially in an export scenario. To mitigate those problems, bilateral intergovernmental agreements between the supplying and the importing states shall be concluded on their obli-*

gations in all legal and institutional issues prior to FNPP's international shipment. Safeguards arrangement with the IAEA should be envisaged as well.

KEYWORDS: *floating nuclear power plants, "Academic Lomonosov", nuclear safety and security, civil liability for nuclear damage, IAEA safeguards, nuclear nonproliferation*

FOR CITATION: Lysenko M., Bedenko V., Dalnoki-Veress F. Legal Regulations of Floating Nuclear Power Plants: problems and prospects. – *Moscow Journal of International Law.* 2019. No. 3. P. 59–67. DOI: 10.24833/0869-0049-2019-3-59-67

МЕЖДУНАРОДНОЕ ЯДЕРНОЕ ПРАВО

DOI: 10.24833 / 0869-0049-2019-3-59-67

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Поступила в редакцию: 03.07.2019
Принята к публикации: 11.09.2019

МЕЖДУНАРОДНО-ПРАВОВОЕ РЕГУЛИРОВАНИЕ ПЛАВУЧИХ АТОМНЫХ ЭЛЕКТРОСТАНЦИЙ: ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ

ВВЕДЕНИЕ. *Статья посвящена практическим и правовым аспектам эксплуатации плавучих атомных теплоэлектростанций (ПАТЭС). Первая в истории ПАТЭС «Академик Ломоносов» была построена в 2019 г. в России. Это уникальный мобильный атомный энергоблок малой мощности, предназначенный для поставок электричества и тепла в отдаленные портовые города, на промышленные предприятия, газовые и нефтяные платформы. «Ломоносов» и после-*

дующие поколения плавучих энергоблоков окажут серьезное влияние на мировой рынок атомной энергетики. Возникает вопрос: насколько ПАТЭС вписываются в нормы международного права?

МАТЕРИАЛЫ И МЕТОДЫ. *Исследование основано на анализе международных конвенций по ядерной безопасности, физической ядерной безопасности, гражданской ответственности за ущерб, Договора о нераспространении ядерного оружия, документов МАГАТЭ, а также на научных публикациях. Использовались общие методы и специальные методы юридического анализа.*

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ. *Авторы установили, что в конкретном случае с ПАТЭС «Академик Ломоносов», которая будет работать на территории России, коллизий с нормами международного права не предвидится. Однако в случае, если будущие серийные ПАТЭС пойдут на экспорт, важно будет проанализировать их совместимость с нормами действующих международных договоров.*

ОБСУЖДЕНИЕ И ВЫВОДЫ. *По итогам обсуждения авторы пришли к выводу о том, что ПАТЭС в значительной степени совместимы с действующими нормами международного права. Однако остаются некоторые пробелы и серые зоны, особенно в случае поставок ПАТЭС на экспорт. Эти проблемы могут быть урегулированы путем заключения до начала экспортных поставок ПАТЭС двусторонних межправительственных соглашений между государством-поставщиком и страной-импортером об их обоюдных обязательствах по всем юридическим и организационным вопросам. Потребуются также договоренности с МАГАТЭ о гарантиях ядерного нераспространения.*

КЛЮЧЕВЫЕ СЛОВА: *плавучие атомные электростанции, «Академик Ломоносов», ядерная безопасность, физическая ядерная безопасность, гражданская ответственность за ядерный ущерб, гарантии МАГАТЭ, нераспространение ядерного оружия*

ДЛЯ ЦИТИРОВАНИЯ: Лысенко М.Н., Беденко В.М., Дальноки-Вересс Ф. 2019. Международно-правовое регулирование плавучих атомных электростанций: проблемы и перспективы. – *Московский журнал международного права.* № 3. С. 59–67.
DOI: 10.24833/0869-0049-2019-3-59-67

1. Introduction

Floating nuclear power plants (FNPPs) concept, purpose and design. In 2019 Russia commenced a fundamentally new technological and engineering nuclear facility. The first ever floating nuclear low-power plant "Academic Lomonosov" was built, loaded with nuclear fuel and tested. It is intended for providing electrical power and heat to remote Arctic industrial enterprises, port cities, gas and oil platforms. [Merkulov 2018:8; Sarkisov et al. 2008:248].

"Lomonosov" was transported 5600 km along the Northern Sea Route in the Russian Arctic from Murmansk to the northernmost city of Russia, the port of Pevek of the Chukotka Autonomous Region. It will generate electricity and heat to replace the outgoing coal-fired Chaunskaya thermal power plant built in 1944 and Bilibino nuclear power plant built in 1976. This remote region which is rich in gold, coal, tin, copper, and mercury has a growing demand in power supplies but confronts logistical problems.

Technically, "Lomonosov" includes a floating nuclear power unit and a complex of onshore facilities. The FNPP is equipped with two KLT-40S reactor units, analogues of which are effectively used on atomic icebreakers and "have the experience of more than 250 reactor-years of failure-free operation" [Pedraza 2017:69]. It is capable of generating up to 70 megawatts of electricity and 50 gigacalories per hour of thermal energy. This is enough to ensure energy and heat consumption for a city with a population of 100 thousand people. (The entire population of the Chukotka Region is 50 thousand people.) Russian technical experts confirm that Russia has extensive experience in operating a civilian nuclear fleet [Zverev et al. 2019:359]. FNPPs could be also used for desalination purposes in regions of scarce water resources. The lifecycle of "Lomonosov" is 40 years with the possibility to extend it up to 50 years. After decommissioning, "Lomonosov" and its spent fuel will be towed to a special reprocessing and recycling facility in the mainland Russia. No spent nuclear fuel or radioactive waste will be

left in the Arctic. A new FNPP will be delivered for replacement[1].

Rosatom is already working on the next generation of FNPPs. The "Optimized Floating Power Units" will be smaller, but with more electrical capacity than "Lomonosov", generating up to 110 MWs. They will be built serially and will be available for export[2].

2. Research results

Technical vs. legal. FNPP "Academic Lomonosov" and its successors are expected to have a major impact on the global nuclear energy market. They will open a new era of practical use of transportable nuclear power reactors (TNPP). Norwegian experts have observed that "resurgent attention has been focused on the development and implementation of new nuclear power initiatives of which low capacity nuclear power plants, for both the provision of domestic and industrial power and heat in isolated areas and for marketing internationally, are a major part" [Dowdall, Standring 2008:6]. US researchers believe that one of the main advantages of FNPPs is their sea-based location. "Since almost 50% of Earth's population lives within 60 miles of the ocean and seacoasts, nuclear power plants should be built near the coast" [Buongiorno et al. 2016:2].

If FNPP's are produced serially the supplier would benefits from reduced costs because construction, transportation and commissioning of a mobile facility will be much faster and easier than the construction of a land based reactor. The host state would benefit as well. It will not need to manage the spent nuclear fuel produced by the reactors. The site for the floating facility is much easier selected than the land site. After FNPP's decommissioning no rehabilitation works are needed. (It takes up to 50 years or more to fully decommission a land based NPP.)

Many countries including Great Britain, France, and the USA have indicated interest in developing TNPPs including FNPPs. Currently, there are about 20 different innovative reactor concepts in small and medium sized categories at different stages of design and development worldwide[3]. Some schemes have already been used: in the 1960–70s, "a ship known as the *Sturgis* outfitted with a nuclear reactor was used to power the lock system of the Panama Canal"[4]. It was reported that China wants to start testing its first FNPP already in 2020 [Nguyen 2018:1]. According to Luo Qi, head of China Atomic Energy Institute, the floating nuclear power plant will not harm the environment and is intended for the supply of electricity to mining sites on the shelves, as well as to remote islands. The facility might be located off the coast of Shandong Province in the east of the country[5].

It should be noted that all breakthrough technologies require appropriate legal regulations. What are the gaps in international regulations regarding export, transport and operations of the FNPP technology? What about regulations to remain in good standing with the nuclear non-proliferation regime, and for the institution of IAEA safeguards?

Legal Regulations for "Lomonosov". In the specific case of "Academic Lomonosov" the legal picture is mostly clear. "Lomonosov" was transported along the Russian coasts within its territorial seas in the Arctic. The Northern Sea Route is widely used by the Russian nuclear powered icebreakers and its domestic legal regulations are quite advanced. "Lomonosov" final destination is the city of Pevek which is the territory of the Russian Federation. No collisions with the rules of International Law are expected. In the place, Russian national legislation and applicable international laws would govern "Lomonosov" operations. It would be advisable to adopt a Federal Law on the implementation of the 1963 Vienna Convention on Civil Liability for Nuclear Damage which Russia has ratified but has not created its implementation mechanism. As a result some important matters are left without legal regulation in Russia including "formats of the liability financial support, liability limits for the nuclear installation operator, state involvement in nuclear damage compensation, etc." [Supataeva 2012:232].

A noteworthy issue is the applicability of the IAEA safeguards to "Lomonosov". As defined in Ar-

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[1] NPPs under Construction. – *Official web-site of the Rosatom State Atomic Energy Corporation.* URL: http://rosatom.ru/en/press-centre/news/floating-nuclear-power-unit-lomonosov-has-arrived-in-murmansk-to-be-loaded-with-fuel-/?sphrase_id=688216 (accessed date: 15.06.2019).

[2] Floating Nuclear Power Plants of the New Generation Will Be Built by Rosatom in the Arctic. May 14, 2019. URL: http://www.atomic-energy.ru/news/2019/05/14/94588 (accessed date: 15.06.2019).

[3] Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. Vienna: International Atomic Energy Agency. 2013. P. 1.

[4] Reimann M. In the 1980s, a Power Company Almost Built a Floating Nuclear Power Plant off New Jersey. – *Timeline*. 2017. URL: https://timeline.com/floating-nuclear-power-plants-c808bfe707aa (accessed date: 12.06.2019).

[5] China Will Start to Construct Its First FNPP in 2019. URL: http://www.atomic-energy.ru/news/2019/03/21/93446 (accessed date: 20.06.2019).

ticle IX.3 of the Treaty on the Non-Proliferation of Nuclear Weapons, Russia as a nuclear weapon state (NWS) is not required to accept safeguards for its nuclear material or facilities. However, as a gesture of transparency Russia and other four NWS have voluntary concluded safeguards agreements with the IAEA (voluntary offer agreements) under which a NWS offers the IAEA a list of facilities from which the IAEA may select sites for the application of safeguards. Russia has included in such a list all of its nuclear power plants. In 2010 the International Uranium Enrichment Center in Angarsk was added to the list. The IAEA selected the Angarsk Center from the list and began to apply safeguards. In a similar manner it would be useful to include "Lomonosov" in the list as well. This gesture would build credibility and transparency for the new technology and encourage potential FNPP importers. It would help to test out in practice interactions with the IAEA for future export scenarios. An exercise could be done to test the protocol as for the export scenario.

3. Discussion

Export scenario and legal regulations. Russian officials have stated that "Lomonosov" is not intended for export sales. However, the next serial FNPP generations apparently will be offered for foreign customers. As Alexey Likhachev, the Rosatom head has stated, "Floating nuclear power plants are of interest not only for the grid-isolated Russian Arctic regions but also for a number of countries around the world"[6]. "We see great interest from all island nations where it is difficult, for various reasons, to set up a developed centralized power transmission infrastructure"[7].

If and when FNPPs go for export it will be important to analyze beforehand the applicability of International Law rules in such areas as nuclear safety, nuclear security, Law of the Sea, Environmental Law, nuclear liability, and IAEA safeguards.

Russian experts also note that "in determining the status of FNPPs designed for export it is important to take into account not only the legislation of the country of origin but also the national regulatory legal framework of the host country, as well as of interested third states" [Problemy… 2017:88].

A group of American experts claims that "IAEA, International Maritime Organization, and the UN should establish guidelines for platform construction, evaluate accident liability regimes, and establish transportation, security, and proliferation protocols for vendor and host nations" [Ford, Abdulla, Granger 2017:18].

In 2013 the IAEA published a comprehensive report "Legal and Institutional Issues of Transportable Nuclear Power Plants: a Preliminary Study" (hereinafter IAEA Study)[8]. It was released when neither "Lomonosov" nor any other transportable nuclear power plant was conceived. That is why authors of the IAEA Study analyzed mostly hypothetical TNPPs cases and applications. Still, most of their findings remain valid today and deserve special attention.

Taking into account the latest technological advances, let us consider how FNPPs fit into the framework of fundamental conventions of the International Nuclear Law.

Nuclear and radiation safety vs. FNNPs. The principal relevant instrument here is the *Convention on Nuclear Safety (CNS)*[9]. It obliges the States Parties to abide by certain safety regulations for site selection, design, construction and operation of nuclear facilities. But in terms of FNPP's applicability there is a legal gap. According to Article 3 the Convention "shall apply to the safety of nuclear installations". However pursuant to Article 2(i) the definition of a "nuclear installation" means only "land-based civil nuclear power plant". Still authors of the IAEA Study have concluded that "there may be room for arguments that could support, under certain circumstances, the inclusion of TNPPs in the scope of application of the CNS as set forth in Article 3, notably if and when a TNPP can be assimilated to a nuclear installation as covered by that Convention"[10].

Convention on Early Notification of a Nuclear Accident and its "sister" Convention on Assistance in the

[6] Communications Department of ROSATOM. ROSATOM Reports Power Start-up of the World's Only Floating Nuclear Power Unit. May 18, 2018. URL: http://rosatom.ru/en/press-centre/news/rosatom-reports-power-start-up-of-the-world-s-only-floating-nuclear-power-unit/?sphrase_id=688395 (accessed date: 20.06.2019).

[7] Press Service of Rusatom International Network. Floating Nuclear Power Unit Lomonosov Has Arrived in Murmansk to be Loaded with Fuel. December 6, 2018. URL: http://rosatom.ru/en/press-centre/news/floating-nuclear-power-unit-lomonosov-has-arrived-in-murmansk-to-be-loaded-with-fuel-/?sphrase_id=688395 (accessed date: 15.06.2019).

[8] See: Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. Vienna: International Atomic Energy Agency. 2013.

[9] Convention on Nuclear Safety, 1994. URL: https://www.iaea.org/sites/default/files/infcirc449.pdf (accessed date: 15.06.2019).

[10] Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. P. 66.

Case of a Nuclear Accident or Radiological Emergency establish mechanisms for cooperation to immediately notify member states and provide needed assistance in case of nuclear accidents with actual or potential transboundary effects[11]. We can agree with the IAEA Study that the broad scope of both conventions makes them applicable to TNPP supplier states and host states and to all related transport operations[12].

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management[13]. The IAEA Study claims that the Joint Convention applies mostly to the supplier state[14]. Indeed, in the most plausible FNPP export scenario all operations with the spent nuclear fuel and radioactive waste will be the entire responsibility of the supplier state.

Nuclear security vs. FNNPs. Principal relevant instruments here are the Convention on the Physical Protection of Nuclear Material and Nuclear facilities, as amended in 2005[15]; International Convention for the Suppression of Acts of Nuclear Terrorism[16]; non-legally binding IAEA periodicals on physical protection of nuclear material and nuclear facilities, INFCIRC/225 (currently it is Rev. 5). As the IAEA study remarks, "the transport of a reactor loaded with fuel is sufficiently novel. However, the existing legally binding norms and recommendations on nuclear security (physical protection) are of a generic nature, they have been carefully developed by the States Parties not to impede technological innovations of any kind". Therefore, the Study concludes, that "application of the existing legally binding and non-binding physical protection norms and recommendations remains valid to address the known concerns for transport of a TNPP with a factory fuelled and tested reactor"[17]. This conclusion seems to be quite plausible.

Law of the Sea vs. FNNPs. In general, all relevant rules of the Law of the Sea will be applicable. It would be appropriate, for example, to refer to provisions of Article 23 of the UN Convention of the Law of the Sea, 1982 (UNCLOS) which postulates that "foreign nuclear-powered ships and ships carrying nuclear or other inherently dangerous or noxious substances shall, when exercising the right of innocent passage through territorial sea, carry documents and observe special precautionary measures established for such ships by international agreements"[18].

Specifically useful will be the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships. It was adopted by the International Maritime Organization (IMO) and became mandatory in 2001 by amendments adopted to chapter VII (Carriage of dangerous goods) of the International Convention for the Safety of Life at Sea, 1974 (SOLAS)[19].

Chapter VIII of SOLAS ("Nuclear ships") spells out basic requirements for nuclear-powered ships and is particularly concerned with radiation hazards. It refers to the detailed Code of Safety for Nuclear Merchant Ships adopted by the IMO in 1981[20].

As we can see, both UNCLOS and SOLAS refer to nuclear-powered ships whereas "Lomonosov" types FNPPs are non-self-propelled vessels. ("Lomonosov" is a barge towed by tug-boats.) However, it makes sense to tow a barge loaded with a nuclear reactor and nuclear fuel at short distances or close to your own sea ports and borders as is the case with

[11] Convention on Early Notification of a Nuclear Accident, 1986. URL: https://www.iaea.org/publications/documents/infcircs/convention-early-notification-nuclear-accident (accessed date: 15.06.2019); Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, 1986. URL: https://www.iaea.org/sites/default/files/infcirc336.pdf (accessed date: 15.06.2019).

[12] Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. P. 65–66.

[13] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 1997. URL: https://www.iaea.org/sites/default/files/infcirc546.pdf (accessed date: 15.06.2019).

[14] Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. P. 68.

[15] Convention on the Physical Protection of Nuclear Material and Nuclear facilities, as amended in 2005. URL: https://www.iaea.org/publications/documents/infcircs/convention-physical-protection-nuclear-material (accessed date: 15.06.2019)

[16] International Convention for the Suppression of Acts of Nuclear Terrorism, 2005. URL: https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XVIII-15&chapter=18&Temp=mtdsg3&clang=_en (accessed date: 15.06.2019).

[17] Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. P. 47.

[18] Convention on the Law of the Sea, 1982. URL: https://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm (accessed date: (15.06.2019).

[19] International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships, 2001. URL: http://www.imo.org/es/OurWork/Safety/Cargoes/Containers/Paginas/Default.aspx (accessed date: 15.06.2019).

[20] International Convention for the Safety of Life at Sea (SOLAS), 1974. URL: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx (accessed date: 15.06.2019).

"Lomonosov". Trans-ocean and long-distance transportation of FNPPs would require different technical options and different legal regulations.

Civil Liability vs. FNNPs. Agreements on civil liability for nuclear damage and fair financial compensations are key conditions prior to any FNPP deliberations. However, today it is quite difficult to make any legal recommendations. Much will depend on the supply arrangements. The picture is further complicated because the international civil liability regime is fragmentized. There is the Vienna Convention on Civil Liability for Nuclear Damage, 1963[21] and its new amended version of 1997[22]. The Organization for Economic Cooperation and Development adopted the exclusive (for its members only) Paris Convention on Third Party Liability in the Field of Nuclear Energy, 1960[23] with subsequent amendments. The USA is promoting Convention on Supplementary Compensation for Nuclear Damage, 1997[24] which still has a limited membership. In case of FNPPs export operations it would be imperative to come to proper understanding which regime will be applied. Moreover, at present most of the potential FNPP's host states among the developing countries are not parties to any of the relevant conventions. Jakub Handrlica expresses an opinion that "the entire liability regime of the Vienna Convention was adopted under the common understanding that transportable nuclear technologies require a special legal framework. Thus, this issue requires further clarification in the future and must also be addressed in the respective bilateral agreements between the home and host state" [Handrlica 2019:24].

A prudent option would be to fix liability rules in a bilateral intergovernmental agreement between the supplying state and the host states. Since the host state does not get any excess to the FNPP, its technology and nuclear fuel, the exporting state and the FNPP operator will shoulder the liability burden.

Safeguards vs. FNNPs. Another key issue will be the extension of IAEA nuclear non-proliferation safeguards to FNPPs especially when a FNPP is exported to a non-nuclear weapon state. "It becomes imperative to develop the necessary safeguards and nonproliferation standards addressing various aspects, vulnerabilities, and natural advantages of a sea-based nuclear reactor" [Prasad et al. 2015:108]. The IAEA Study recommends the supplying nuclear weapon state "to enter into an arrangement with the IAEA whereby the IAEA is able to verify the design information of the facility while it is under construction. Additionally, in the case when TNPPs are based on factory fuelled reactors designed for operation without on-site refueling, the IAEA may need to validate its ability to verify long life cores without access to fuel for re-measurement"[25].

Ownership and cooperation schemes vs. FNNPs (Build-Own-Operate-Transport-Return (BOOTR) option). In the on-going bilateral project of the Akkuyu Nuclear Power Plant Russia and Turkey have agreed to implement the Build-Own-Operate (BOO) cooperation model. Russia has instituted the Akkuyu Project Company which shall build, own and operate the NPP. The Turkish Electricity Trade and Contract Corporation has guaranteed to purchase the NPP's electrical power[26].

For FNPPs the best option seems to be the Build-Own-Operate-Transport-Return (BOOTR) model. It might be an arrangement when the supplying state builds, fuels, transports, installs, operates, maintains and owns an FNPP generating power on the territory of a host state. The responsibilities of the host state would only be to plug in electrical grids and pipes (in case of heating and/or desalination) as well as to guard the facility. To be more specific, it will be the so called "black box" scheme when the host state would have no access to the FNPP, its technology and nuclear fuel, which is important in terms of nuclear non-proliferation. When time comes for decommissioning, the FNPP including its reactor, spent nuclear fuel and radioactive waste will be returned to the supplying state. Such a model will provide a host state with additional benefits – there will be no need for costly and lengthy decommissioning and decontamination of the FNPP site. The old decommissioned FNPP might be replaced

[21] Vienna Convention on Civil Liability for Nuclear Damage. URL: https://www.iaea.org/topics/nuclear-liability-conventions/vienna-convention-on-civil-liability-for-nuclear-damage (accessed date: 15.06.2019).

[22] Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage. URL: https://www.iaea.org/publications/documents/infcircs/protocol-amend-vienna-convention-civil-liability-nuclear-damage (accessed date: 15.06.2019).

[23] Paris Convention on Nuclear Third Party Liability. URL: http://www.oecd-nea.org/law/paris-convention-ratification.html (accessed date: 15.06.2019).

[24] Convention on Supplementary Compensation for Nuclear Damage. URL: https://www.iaea.org/topics/nuclear-liability-conventions/convention-supplementary-compensation-nuclear-damage (accessed date: 15.06.2019).

[25] Legal and Institutional Issues of Transportable Nuclear Power Plants: A Preliminary Study. P. 59.

[26] "Welcome to the site of Akkuyu NPP JSC!". URL: akkunpp.com (accessed date: 15.06.2019).

by a new one on the same legal and operational conditions.

4. Conclusions

The analysis of the abovementioned international legal instruments demonstrates that FNPPs are largely compatible with the existing rules of International Law. However, there are certain gaps and "grey areas". Some international conventions cover only land-based nuclear power plants and nuclear-powered ships. There are no specific legal regulations addressing the transportation of a fuelled nuclear reactor.

In order to address such problems, the first and foremost condition for the international supply of FNPPs should be a bilateral intergovernmental agreement between a supplying state and an importing host state. It should be a framework agreement covering all necessary technical and legal requirements. The agreement should focus on such issues as obligations of both states and of operating companies; FNPP's type and delivery timeframe; duration of FNPP's operation; return schemes for the FNPP, its spent nuclear fuel and radioactive waste; civil liabilities; conditions for electricity supply; financial terms; guarding and security issues, etc. Specific subjects could be covered in separate agreements and contracts (site selection; types of electrical grids, etc).

If an FNPP is transported through third states, "international agreements on a bilateral or multilateral level regarding safety of the TNPP transport through international waters or land states should be concluded" [Zou et al. 2018].

As discussed above, safeguards arrangement with the IAEA both for "Lomonosov" and for export scenarios should be envisaged as well.

It would be necessary that host states become parties to the relevant international conventions.

When deciding on FNPPs international deliveries, it will be imperative to carefully weigh the political side of the matter. It should be taken into account, whether the importing country and the region as a whole are politically stable and how nuclear non-proliferation requirements are observed there.

When the first FNPP "Academic Lomonosov" gets practical experience it would be advisable to review the 2013 IAEA Preliminary Study on Legal and Institutional Issues of Transportable Nuclear Power Plants.

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