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**Станет ли Япония ядерной державой?****Горчакова Татьяна Евгеньевна<sup>1</sup>**<sup>1</sup> Институт Китая и современной Азии РАН

**Аннотация.** В последнее время активно обсуждается вопрос о возможности появления в Японии ядерного оружия. Некоторые ядерные страны обвиняют Японию не только в отходе от послевоенной политики пацифизма, пересмотре «мирной статьи» Конституции и «ремилитаризации», но и в намерении пересмотреть «три неядерных принципа» (Three Non-Nuclear Principles) – не владеть, не производить и не ввозить ядерное оружие. В настоящее время политика премьер-министра Такаити Санаэ хотя и нацелена на усиление обороноспособности страны, но также провозглашает задачу построения мира без ядерного оружия. Тем не менее, широкое обсуждение в средствах массовой информации России, Китая, КНДР и других стран возможности появления в Японии ядерного оружия формирует в общественном сознании представление о реалистичности такого варианта развития событий. Однако пацифистски настроенная японская общественность, которая хорошо знает трагическую историю американских ядерных бомбардировок 1945 г., выступает категорически против концепции ядерного сдерживания в применении к своей стране.

**Ключевые слова:** Япония, Россия, российско-японские отношения, безопасность, оборона, ядерное оружие, ядерное сдерживание, общественное мнение.

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**Will Japan become a nuclear power?****Gorchakova Tatiana E.<sup>1</sup>**<sup>1</sup> Institute of China and Contemporary Asia of the Russian Academy of Sciences

**Abstract.** The chances of Japan acquiring nuclear weapons has recently become a major talking point. Some nuclear-armed countries accuse Japan not only of abandoning its post-war policy of pacifism, revising the “peace clause” of the Constitution, and “remilitarization”, but also of intending to reconsider the Three Non-Nuclear Principles (not to possess, manufacture, or import nuclear weapons). Currently, the Japanese Prime Minister Takaichi Sanae's policy, while aimed at strengthening the country's defense capability, also proclaims the goal of building a world without nuclear weapons. Nevertheless, widespread media discussion

in Russia, China, North Korea, and other countries regarding the possibility of Japan acquiring nuclear weapons is shaping the public consciousness to believe that such a scenario is realistic. However, the pacifist-minded Japanese public – which is well aware of the tragic history of the 1945 US nuclear bombings – remains categorically opposed to the concept of nuclear deterrence as applied to their country.

**Keywords:** Japan, Russia, Russian-Japanese relations, security, defense, nuclear weapons, nuclear deterrence, public opinion.

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## Introduction

Following its defeat in World War II, Japan adopted a “peace” Constitution in 1947, which does not allow the presence of a full-fledged army or the conduct of any military operations outside the country. It is believed that the United States punished Japan for its militaristic past this way. However, in recent years, Japan has seen threats from the countries actively developing their military power, such as North Korea and China, forcing Tokyo to reconsider its pacifist policy, based on the current conflictual situation in the region [Kireeva, Nelidov 2018; Kazakov 2023; Streltsov 2023]. The rise of Donald Trump to the American political Olympus with his “America First” concept and slogan “Make America Great Again” has created another problem for Japan related to the reliability of the United States as a key defense partner. Thus, de facto Tokyo has been faced with the question of transforming the Self-Defense Forces into a full-fledged army that would provide protection against possible aggression from the DPRK and China, capable of resolving the country's security issues by relying not only on the United States, but primarily on itself and a wider circle of like-minded countries.

## Japan's position on nuclear weapons

On August 6, 2026, Japanese Prime Minister Takaichi Sanae gave a press conference<sup>1</sup>. Answering the NHK journalist's question, she stated: “The government firmly adheres to the Three Non-Nuclear Principles as a policy. At the same time, we consider it the mission of our country (the only country in the world to have survived the combat use of nuclear weapons) to lead the international community's efforts to build a world without nuclear weapons, which can bring immense suffering to humanity, so that they are never used again”<sup>2</sup>.

At the annual ceremony dedicated to the memory of the victims of the nuclear bombings of Hiroshima and Nagasaki, held on August 6 and 9, 2026 in Hiroshima, she also noted that Japan

<sup>1</sup> Prime Minister Takaichi spoke to the press regarding her attendance at the Nagasaki Peace Memorial Ceremony and related events. *Prime Minister's Office of Japan*, Aug 9, 2026. URL: <https://japan.kantei.go.jp/105/speech/202608/09kaiken.html> (accessed: Sep 11, 2026).

<sup>2</sup> 政策上の方針として堅持」非核三原則で高市首相 [PM Takaichi on the Three Non-Nuclear Principles: “To be upheld as a matter of policy”]. URL: <https://www.youtube.com/watch?v=BYPo7ebmUxU> (accessed: Sep 11, 2026). (In Japanese).

adheres to the Three Non-Nuclear Principles and sees its mission in continuing tireless efforts to build a world free of nuclear weapons<sup>3</sup>. As analysts note, it is significant that S. Takaichi refrained from making firm commitments to maintain these principles unchanged, as Japan prepares to revise its security strategy in the face of what Tokyo views as growing external threats.

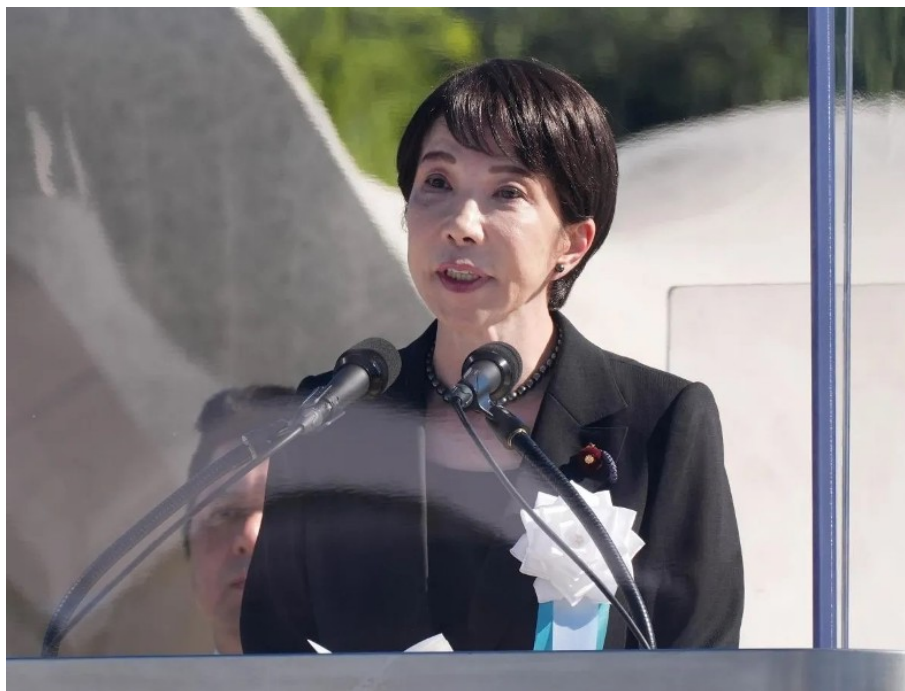


**Fig. 1.** Prime Minister Takaichi Sanae delivers a speech at the Hiroshima Peace Memorial Ceremony in Hiroshima on August 6, 2026 (Sankei/Yasushi Kawamura).

Source: Japan Forward, Aug 10, 2026. URL: <https://japan-forward.com/takaichi-speech-three-non-nuclear-principles-hiroshima-ceremony/> (accessed: Sep 11, 2026).

Thus, critics of Japan who accuse Tokyo of “remilitarization” still have room to maneuver. They are instilling the idea in the public consciousness, that if Takaichi Sanae doesn’t guarantee Japan’s future nuclear-free status today, the political leadership intends to change it. Obviously, in information warfare any omission can be exploited to create mistrust and suspicion in the public sphere.

However, at present Tokyo does not cross the “red lines” marked by the Three Non-Nuclear Principles and continues to reform its security, primarily based on the concept of its own defense with conventional weapons and with the help of partner countries [Kuzminkov 2026].

Beyond the statements of politicians, pacifist sentiments are extremely strong in Japan; they have taken shape throughout the post-war period, demonstrating the country’s successful development as a peaceful power. The tragic memory of the 1945 US nuclear bombings (on August 6 in Hiroshima, and on August 9 in Nagasaki) has become part of the Japanese cultural code [Kirichenko 2020; Kirichenko 2025; Kirichenko, Plevako 2026]. Moreover, according to many historians and experts, these bombings had no military purpose. They were rather political, aiming

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<sup>3</sup> Takaichi addresses Three Non-Nuclear Principles at Hiroshima Ceremony. *Japan Forward*, Aug 10, 2026. URL: <https://japan-forward.com/takaichi-speech-three-non-nuclear-principles-hiroshima-ceremony/> (accessed: Sep 11, 2026).

at intimidating the USSR. It is not surprising that the destruction of the civilian population of the cities of Hiroshima and Nagasaki is today often perceived in the public consciousness as a wartime crime, caused by the US desire to test nuclear weapons in the field at the end of World War II<sup>4</sup>. And after the appearance of nuclear weapons in the USSR<sup>5</sup>, an arms race has begun in the world, leading to the emergence of nuclear powers. It should be noted that currently nine countries officially possess nuclear weapons, which are Russia (with an estimated number of 5,420 nuclear warheads), the United States (5,042), China (620), France (370), the United Kingdom (225), India (190), Pakistan (170), Israel (90), and North Korea (60)<sup>6</sup>. It is also known that a number of other countries are discussing the possibility of acquiring nuclear weapons or are already developing them (Iran, Ukraine, etc.).

Distinctively the Russian media periodically raise the issue of Japan developing a nuclear bomb during World War II, although the activities of Japanese scientists did not produce any practical results<sup>7</sup>. Japan's major physical and chemical research institute RIKEN (理研) describes its involvement in the development of the nuclear bomb as follows:

"On December 8, 1941, Japan entered World War II with the attack on Pearl Harbor. In April of the same year, the Japanese army's air force had requested Masatoshi Okochi to begin a project to build an atomic bomb. Yoshio Nishina's lab, the Mecca of nuclear physics in Japan, was entrusted with the enrichment of uranium for the project. But American air raids in April 1945 destroyed two-thirds of RIKEN's buildings and facilities, including Nishina's apparatus for enriching uranium, putting an end to the project. On August 15, 1945, the war ended. In September 1945, the US forces started investigating Japan's atomic bomb program and decided to destroy the two cyclotrons Nishina had spent 10 years building and to dump them into Tokyo bay"<sup>8</sup>.

Yukawa Hideki, who later became the first Japanese to receive the Nobel Prize in Physics in 1949, is also credited with being a participant in the development of nuclear weapons in Japan<sup>9</sup>.

However, it is evident that there was no single "Japanese nuclear program" with centralized leadership that consolidated the country's scientific and financial resources. Only a handful of individuals were involved in separate nuclear weapons development projects, and there was no full-fledged experimental infrastructure that could compare to the ambitious Manhattan Project, which engaged the entire United States.

### Public criticism in Japan

The active role of Japanese public organizations uniting *hibakusha* (the nuclear bomb survivors who oppose nuclear weapons) in shaping Japan's peace mentality is noteworthy. For example, The Japan Confederation of A- and H-Bomb Sufferers Organizations

<sup>4</sup> The incredible story of "Little Boy": unsolved mysteries of the atomic bombings of Japanese cities. *Moskovskiy Komsomolets*, Aug 3, 2025. URL: <https://www.mk.ru/social/2025/08/03/neveroyatnaya-istoriya-malysha-neraskrytye-tayny-atomnykh-bombardirovok-yaponskikh-gorodov.html> (accessed: Sep 11, 2026). (In Russian).

<sup>5</sup> The first atomic bomb test in the USSR took place on August 29, 1949.

<sup>6</sup> Nuclear weapons by country 2026. *World Population Review*. URL: <https://worldpopulationreview.com/country-rankings/nuclear-weapons-by-country> (accessed: Sep 11, 2026).

<sup>7</sup> Sons of the Rising Sun. History of the Japanese Samurai. Part 3. *International Military-Historical Association*. URL: <https://imha.ru/1144546682-syny-voshodyaschego-solnca-istoriya-yaponskih-samuraev-ch-3.html> (accessed: Sep 11, 2026). (In Russian).

<sup>8</sup> The RIKEN story. *RIKEN*. URL: <https://www.riken.jp/en/about/history/story/> (accessed: Sep 11, 2026).

<sup>9</sup> A Hiroshima survivor spoke about Japan's work on developing atomic weapons. *RIA Novosti*, Aug 6, 2025. URL: <https://ria.ru/20250806/japonija-2033628401.html> (accessed: Sep 11, 2026). (In Russian).

(日本原水爆被害者団体協議会), abbreviated as Nihon Hidankyo (日本被団協), received the Nobel Peace Prize in 2024 “for their efforts to achieve a nuclear-weapon-free world and demonstrating through testimony that nuclear weapons must never again be used”<sup>10</sup>. Nihon Hidankyo has gained popularity on the global stage and is actively promoting a nuclear-free world, enjoying widespread support in Japan. Notably, Nihon Hidankyo representatives take an uncompromising stance in response to reckless remarks by Japanese politicians.

Thus, on November 20, 2025, in response to S. Takaichi’s refusal to consider the inclusion of the Three Non-Nuclear Principles in Japanese legislation, Nihon Hidankyo called on the government to enshrine the three principles of nuclear renunciation in legislation, sign and ratify the Treaty on the Prohibition of Nuclear Weapons, pay compensation to the victims of the atomic bombings as a country that waged the war, and take a leading role in building a world free of nuclear weapons and wars<sup>11</sup>.



**Pic. 2.** Defense Minister Shinjiro Koizumi at a news conference on August 4, 2026 (Mizuki Sato).

Source: The Asahi Shimbun, Aug 5, 2026. URL: <https://www.asahi.com/ajw/articles/16786411> (accessed: Sep 11, 2026).

In July 2026, representatives of the Nihon Hidankyo criticized Japanese Defense Minister Koizumi Shinjiro's statement about the need to discuss nuclear issues “without any taboos” (Pic. 2). Specifically, Tanaka Shigemitsu, the leader of the Nagasaki Atomic Bomb Survivors' Council, said

<sup>10</sup> Nobel Peace Prize 2024. Press release. *Nobel Prize*, Oct 11, 2024. URL: <https://www.nobelprize.org/prizes/peace/2024/press-release/> (accessed: Sep 11, 2026).

<sup>11</sup> Nobel-winning A-bomb survivors slam Japan over non-nuke principle review. *Kyodo News*, Nov 20, 2025. URL: <https://english.kyodonews.net/articles/-/65265> (accessed: Sep 11, 2026).

on August 4, 2026: “Nuclear weapons and human beings cannot coexist... We categorically oppose Japan sharing nuclear weapons or allowing them to be brought into the country”<sup>12</sup>.

It should be noted that the *hibakusha*'s anti-nuclear position is consistent with Russia's interests, which is keen on Japan's nuclear-free status. However, there is no support for this organization's activities from the Russian officials.

### Criticism of Japan by opponents

Japan's nuclear-armed neighbors (Russia, China, and North Korea) have actively criticized Tokyo for its policy of “remilitarization” or “neomilitarism”, discussions of amending the “peace clause” of the Constitution, and nuclear debates. Meanwhile, these three countries appear to be coherent and aggressive in their anti-Japanese propaganda.

The question of Japan's readiness to independently produce nuclear weapons is at the forefront. A.A. Kobyakov, Advisor to the President of the Russian Federation, believes that Tokyo needs only a year to acquire its own nuclear weapons. He notes that ““The Prime Minister [Sanae] Takaichi's aggressive rhetoric demonstrates that the country's previous role in the comprehensive plans of American regional and global strategy has shifted significantly toward direct participation”<sup>13</sup>.

In turn, Chinese Ambassador in Moscow Zhang Hanhui stated in an article for TASS that among the signatories to the Treaty on the Non-Proliferation of Nuclear Weapons, Japan is the only non-nuclear state with spent nuclear fuel reprocessing technology and the ability to extract weapons-grade plutonium. As of the end of 2024, Japan had accumulated approximately 44.4 tons of plutonium separated from spent nuclear fuel – an amount sufficient to produce roughly 5,500 nuclear warheads. Furthermore, spent nuclear fuel storage facilities contain an additional 191 tons of unseparated plutonium<sup>14</sup>. Clearly, this information is part of China's official propaganda against Japan. Beijing claims that “Japan's pursuit of nuclear weapons has become a real, rather than a potential threat”<sup>15</sup>.

At the same time, Russian analysts point to the American policy of double standards. While the US and Israel carry out attacks on Tehran's nuclear facilities, Tokyo – a key American ally in Asia – possesses a full nuclear fuel cycle, enjoying the full support of Washington and raising no questions from the non-proliferation point of view<sup>16</sup>. Indeed, the US position on Japan has changed significantly since the post-war period. As one might expect, the US now views Japan not only as a location for its military forces, but also as a country that should largely resolve regional security issues independently.

<sup>12</sup> Koizumi's call for nuclear debate 'without taboos' triggers backlash. *The Asahi Shimbun*, Aug 5, 2026. URL: <https://www.asahi.com/ajw/articles/16786411> (accessed: Sep 11, 2026).

<sup>13</sup> Kobyakov believes that Japan is capable of assembling nuclear weapons in about a year. TASS, Aug 25, 2026. URL: <https://tass.ru/politika/28044349> (accessed: Sep 11, 2026). (In Russian).

<sup>14</sup> China has stated that Japan has stockpiled several dozen tons of plutonium. TASS, Aug 20, 2026. URL: <https://tass.ru/mezhdunarodnaya-panorama/28027281> (accessed: Sep 11, 2026). (In Russian).

<sup>15</sup> Japan's pursuit of nuclear weapons has become a real threat: Defense Spokesperson. *Ministry of National Defense of the People's Republic of China*, Jun 25, 2026. URL: <http://eng.mod.gov.cn/2025xb/P/16469719.html> (accessed: Sep 11, 2026).

<sup>16</sup> A Samurai at the Nuclear Club's door: why the US strikes Iran but remains silent on Japan. TASS, Aug 24, 2026. URL: <https://tass.ru/opinions/28039469> (accessed: Sep 11, 2026). (In Russian).

Meanwhile, in September 2026, S. Koizumi noted that Japan was not ruling out the possibility of acquiring nuclear submarines, even though the U.S. Navy representative had previously expressed a positive opinion of such a move. “Regarding nuclear submarines, we will continue to consider them as a possible option”, S. Koizumi stated at a regular press conference. Tokyo is exploring the acquisition of such submarines as part of a review of three key security documents, which is scheduled to be completed by the end of the year<sup>17</sup>.

Until recently, Russian experts held the opinion that the United States would not allow Japan to acquire nuclear weapons. However, there are many reasons why the American side might now lift the taboo on nuclear weapons in Japan. While Japan does possess the scientific, technological, and resource capabilities to develop nuclear weapons, making a corresponding political decision is virtually impossible in the near future due to the anti-nuclear stance of the overwhelming majority of the country's citizens.

### **Conclusion**

Contemporary Japan faces a difficult choice driven by the deteriorating international situation, particularly in the Asia-Pacific region. Tokyo sees threats from China, North Korea, and Russia, which is assisting them in their military buildup. This prompts Japan to enhance its defense capabilities by increasing its military budget and, taking into account the experience of recent conflicts worldwide, building modern Self-Defense Forces focused on deterring potential aggressors. In this context, Japan becomes hostage to the actions of other countries that pose potential threats to its security.

If we answer the question, raised in the title of the article, “Will Japan become a nuclear power?”, today the answer seems to be as follows: if tensions around Japan continue to escalate and nuclear powers intensify pressure on Tokyo, behave aggressively, and expand their arsenals, Japan may eventually abandon its post-war pacifism in favor of a pragmatic approach. This shift could manifest in the Japanese public's view that the possession of nuclear weapons would guarantee the country's security against possible external armed aggression. Certainly, this view has significant flaws from a security perspective, as an arms race is a path to escalation. However, it remains extremely difficult to offer alternatives to the concept of nuclear deterrence, and Japan's peace initiatives for complete nuclear disarmament have so far failed to yield any significant results.

### **БИБЛИОГРАФИЧЕСКИЙ СПИСОК**

- Казаков О.И.* К вопросу о появлении альтернативы «мягкой силе» Японии // Восточная Азия: факты и аналитика. 2023. № 2. С. 76–91. DOI 10.24412/2686-7702-2023-2-76-91
- Киреева А.А., Нелидов В.В.* Прошлое и настоящее Сил самообороны Японии: роль в государстве, обществе и на международной арене // Ежегодник Япония. 2018. Т. 47. С. 29–54. DOI 10.24411/0235-8182-2018-10002
- Кириченко М.А.* Атомные бомбардировки Хиросимы и Нагасаки: проблемы исторической интерпретации Японией и соседними странами // Гуманитарное сотрудничество стран АТР.

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<sup>17</sup> Koizumi says Japan not ruling out nuclear subs, days after US offers positive view. *The Japan Times*, Sep 11, 2026. URL: <https://www.japantimes.co.jp/news/2026/09/11/japan/koizumi-japan-us-nuclear-submarines/> (accessed: Sep 11, 2026).

Международная научная конференция. Москва, 23 апреля 2025 г.: тезисы докладов. М.: ИКСа РАН, 2025. С. 53–56. DOI 10.48647/ICCA.2025.25.35.014

Кириченко М.А. Лингва Хиросима – электронный каталог книг об атомной бомбардировке // Восточная Азия: факты и аналитика. 2020. № 4. С. 63–74. DOI 10.24411/2686-7702-2020-10025

Кириченко М.А., Плевако Е.С. 80-летие атомных бомбардировок Хиросимы и Нагасаки: средства мемориализации в Японии // Восточная Азия: факты и аналитика. 2026. Т. 8. № 1. С. 24–47. DOI 10.24412/2686-7702-2026-1-24-47

Кузьминков В.В. Роль Японии в укреплении безопасности в ЮВА (2010–2025 гг.) // Проблемы Дальнего Востока. 2026. № 3. С. 7–20. DOI 10.7868/S2712909826030017

Стрельцов Д.В. О новой концепции национальной безопасности Японии // Проблемы Дальнего Востока. 2023. № 2. С. 9–25. DOI 10.31857/S013128120025335-9

## REFERENCES

Kazakov O.I. (2023). K voprosu o poyavlenii al'ternativy «myagkoy sile» Yaponii [On the question of the emergence of an alternative to Japan's "soft power"]. *Vostochnaya Aziya: fakty i analitika* [East Asia: Facts and Analytics], 2: 76–91. (In Russian). DOI 10.24412/2686-7702-2023-2-76-91

Kireeva A.A., Nelidov V.V. (2018). Proshloye i nastoyashcheye Sil samooborony Yaponii: rol' v gosudarstve, obshchestve i na mezhdunarodnoy arene [The past and present of the Japan Self-Defense Forces: their role in the state, society and international arena]. *Ezhegodnik Yaponiya* [Yearbook Japan], 47: 29–54. (In Russian). DOI 10.24411/0235-8182-2018-10002

Kirichenko M.A. (2020). Lingva Khiosima – elektronnyy katalog knig ob atomnoy bombardirovke [Lingua Hiroshima – a database of books on atomic bombing]. *Vostochnaya Aziya: fakty i analitika* [East Asia: Facts and Analytics], 4: 63–74. (In Russian). DOI 10.24411/2686-7702-2020-10025

Kirichenko M.A. (2025). Atomnyye bombardirovki Khiosimy i Nagasaki: problemy istoricheskoy interpretatsii Yaponiyei i sosednimi stranami [Atomic bombings of Hiroshima and Nagasaki: problems of historical interpretation by Japan and neighboring countries]. *Gumanitarnoye sotrudnichestvo stran ATR. Mezhdunarodnaya nauchnaya konferentsiya. Moskva, 23 aprelya 2025 g.: tezis dokladov* [Abstracts. International scientific conference "Humanitarian cooperation of the Asia Pacific countries" (April 23, 2025)]: 53–56. Moscow: ICCA RAS. (In Russian). DOI 10.48647/ICCA.2025.25.35.014

Kirichenko M.A., Plevako E.S. (2026). 80-letie atomnykh bombardirovok Khiosimy i Nagasaki: sredstva memorializatsii v Yaponii [The 80th anniversary of the atomic bombings of Hiroshima and Nagasaki: the means of memorialization in Japan]. *Vostochnaya Aziya: fakty i analitika* [East Asia: Facts and Analytics], 8 (1): 24–47. (In Russian). DOI 10.24412/2686-7702-2026-1-24-47

Kuzminkov V.V. (2026). Rol' Yaponii v ukreplenii bezopasnosti v YUVA (2010–2025 gg.) [Japan's role in strengthening security in Southeast Asia (2010–2025)]. *Problemy Dal'nego Vostoka* [Far Eastern Affairs], 3: 7–20. (In Russian). DOI 10.7868/S2712909826030017

Streltsov D.V. (2023). O novoy kontseptsii natsional'noy bezopasnosti Yaponii [About the new concept of national security of Japan]. *Problemy Dal'nego Vostoka* [Far Eastern Affairs], 2: 9–25. (In Russian). DOI 10.31857/S013128120025335-9

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