ADVANCEMENT IN NUCLEAR TECHNOLOGY: A GLOBAL ENDEAVOR THAT REQUIRES UPDATED LEGISLATION

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I. INTRODUCTION

On December 2, 1942, scientists beneath the University of Chicago's athletic stadium catapulted the world into a nuclear age when they demonstrated the first ever self-sustaining nuclear reaction.[1] This moment was years in the making but changed the universe in the blink of an eye. Shortly after, global tension became extremely high as the rest of the globe raced to develop nuclear technology. The United States possessed the technology that the whole world wanted. However, this development came

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[1] Off. of Nuclear Energy, Sci and Tech., THE HISTORY OF NUCLEAR ENERGY, U.S. DEP'T OF ENERGY 6-7 (2011), https://www.energy.gov/sites/default/files/The%20History%20of%20Nuclear%20Energy_0.pdf.

with responsibility. Scientists recognized this responsibility and warned the U.S. government of the risk that came with the continued development of nuclear technology. Albert Einstein and Leo Szilard wrote a letter to the executive branch stressing the need for atomic power legislation.[2] They recognized that the United States would not have a nuclear monopoly for long and, at the time, foreign control over nuclear power threatened civilization.[3]

Geopolitics have significantly changed since 1942 and there have been significant safety advancements in nuclear technology.[4] Therefore, this Comment argues that legislation that Congress passed in the early years of the nuclear age is no longer entirely relevant in 2021. Furthermore, this Comment argues that Atomic Energy Act ("AEA") provisions are threatening U.S. national security by negatively impacting the United States's commercial industry, Nuclear Navy,[5] and geopolitical influence. Therefore, this Comment argues that the AEA should be amended by removing sections 103(d) and 104(d), which bar foreign ownership, control, or domination ("FOCD") of a U.S. nuclear reactor.

Part I of this Comment argues that sections 103(d) and 104(d) of the AEA negatively impact the U.S. commercial nuclear industry. Nuclear innovation is a global, rather than a purely domestic, endeavor.[6] The United States partners with allies to

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[2] Louise Lerner, *The First Nuclear Reactor, Explained,* UCHICAGO NEWS, https://news.uchicago.edu/explainer/first-nuclear-reactor-explained (last visited Mar. 19, 2022).

[3] Jessica Wang, *Scientists and the Problem of the Public in Cold War America, 1945-1960*, OSIRIS 323, 328 (2002).

[4] Off. of Nuclear Energy, Sci and Tech., *supra* note 1, at 13-21.

[5] "The Nuclear Navy is a term coined to describe vessels powered by nuclear reactors." *The Nuclear Navy*, NAVAL HISTORY AND HERITAGE COMMAND (Jul. 22, 2021), https://www.history.navy.mil/browse-by-topic/exploration-and-innovation/nuclear-navy.html.

[6] AMY ROMA, SUCHIN DESAI & ALEX GILBERT, U.S. NUCLEAR INNOVATION IN A GLOBAL ECONOMY: UPDATING AN OUTDATED NATIONAL SECURITY FRAMEWORK 4 (Nuclear Innovation Alliance, 2020) https://nuclearinnovationalliance.org/sites/default/files/2020-

develop, design, and fuel nuclear reactors.[7] When the United States enters a domestically located partnership with allies, the foreign investor is subject to the FOCD provisions. The FOCD provisions unrealistically expect all domestic nuclear projects to maintain a domestic investor. This causes the termination of expensive nuclear projects when United States investors back out of deals with foreign investors. Termination of these projects threatens the commercial nuclear industry and therefore threatens national security.[8] First, it threatens the commercial nuclear industry because the FOCD provisions are adding an additional statutory requirement to a highly regulated industry already struggling to maintain its strength.[9] This consequently compromises national security because nuclear power offers the nation a robust energy source that "keeps the grid online when disaster strikes" and a robust commercial industry that is imperative to America's role in influencing the world's nuclear practices and on which the Nuclear Navy relies.[10]

Part II of this Comment analyzes the FOCD's impact on the U.S. Nuclear Navy. As noted above, the Nuclear Navy relies on the strength of the U.S. commercial nuclear industry.[11] Further, the Department of Defense relies on the civilian electrical grid to power domestic military installations.[12] Ninety-nine percent of the electricity that powers domestic military installations is powered by the civilian power grid.[13] While Congress seemingly encourages the growth of the Nuclear Navy and the development of naval micro-reactors, an over regulated commercial industry is

07/NIA%20Updating%20an%20Outdated%20National%20Security%20Framework.pdf.

[7] *Id.* at 8-10.

[8] *Id.* at 10.

[9] *Id.* at 8.

[10] *National Security*, NUCLEAR ENERGY INST., https://www.neyi.org/advantages/national-security (last visited Dec. 5, 2021).

[11] *Id.*

[12] Richard B. Andres & Hanna L. Breetz, INST. FOR NAT'L STRATEGIC STUDIES, SMALL NUCLEAR REACTORS FOR MILITARY INSTALLATIONS: CAPABILITIES, COSTS, AND TECHNOLOGICAL IMPLICATIONS 2 (Feb. 2011), https://ndupress.ndu.edu/Portals/68/Documents/stratforum/SF-262.pdf.

[13] *Id.*; NUCLEAR ENERGY INST., *supra* note 10.

preventing such development.[14] Thus, as the commercial industry is fading, the development of the Nuclear Navy and advancements in nuclear technology is threatened. This is detrimental to U.S. national security because a capable Nuclear Navy and continued advancements in nuclear technology is critical to protect the nation.[15]

Part III of this Comment argues the FOCD provisions negatively impact the nation's geopolitical influence. When the FOCD provisions were first promulgated, only three nations (the United States, Soviet Union, and United Kingdom) had developed nuclear technology.[16] In 1954, safeguarding technology was essential in a way that is no longer necessary. Today, the United States partners with allies to develop, design, and fuel nuclear reactors, allowing the United States to dominate the global nuclear energy safety and security standards.[17] The Non-Proliferation Treaty ("NPT") reflects these standards.[18] However, the FOCD provisions' hindrance on nuclear advancement in the United States could destabilize the country's dominance over NPT standards. This is a national security threat because if the United States does not control the global safety and security standards, then a different country will.

Finally, this Comment recognizes that there are other ways to mitigate the threats the FOCD provisions were originally aimed to prevent. Specifically, (1) the Committee of Foreign Investment in the United States ("CFIUS") and (2) the Nuclear Regulatory Commission's ("NRC") "inimicality" review on foreign investments protect the commercial nuclear industry from national security threats when partnering with foreign countries by policing foreign involvement in the United States nuclear

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[14] NUCLEAR ENERGY INST., *supra* note 10; ANDRES & BREETZ, *supra* note 12, at 8.
[15] MICHAEL WALLACE, AMY ROMA & SUCHIN DESAI, CTR. FOR STRATEGIC AND INTERNATIONAL STUDIES, BACK FROM THE BRINK: A THREATENED NUCLEAR ENERGY INDUSTRY COMPROMISES NATIONAL SECURITY 15 (2018).
[16] *Factsheet on Nuclear Weapons: Who Has What,* ARMS CONTROL ASS'N, https://www.armscontrol.org/factsheets/Nuclearweaponswhohaswhat (last updated Jan. 2022).
[17] ROMA. DESAI & GILBERT, *supra* note 6, at 4.
[18] WALLACE, ROMA & DESAI, *supra* note 16, at 8-9.

industry.[19] Additionally, the Nuclear Navy does not rely on the FOCD provisions for security. The Nuclear Navy maintains its own set of standards, such as the process and procedures utilized by the Naval Nuclear Propulsion Program and the Strategic Arms Reduction Treaty ("START").[20]

This Comment concludes by finding that Congress should strike the FOCD provisions because it negatively impacts the United States's commercial nuclear industry, Nuclear Navy, and geopolitical influence. Which, in turn, threatens the national security of the United States.

II. BACKGROUND

After the United States used nuclear weapons to end World War II in 1945, the Soviet Union (1949), "United Kingdom (1952), France (1960), and China (1964)" all raced to successfully develop nuclear technology.[21] Nuclear technology is the most destructive munition and efficient energy source the world has ever seen. Nations were forced to find a balance between the two extraordinarily powerful extremes.

The United States immediately understood that legislation was necessary for the country to control nuclear technology. On August 1, 1946, President Harry Truman signed the Atomic Energy Act ("AEA").[22] The original purpose of the AEA was to

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[19] ROMA, DESAI & GILBERT, s*upra* note 6, at 2.

[20] "Presidential Executive Order 12344, 42 U.S.C. Sec 7158, Public Law 98-525 and 50 U.S.C. Sec. 2406, Public Law 106-65 set forth the total responsibility of Naval Reactors for all aspects of the Navy's nuclear propulsion . . . ." Nat'l Nuclear Sec. Admin., Powering the Navy, U.S. DEP'T OF ENERGY, https://www.energy.gov/nnsa/missions/powering-navy (last visited Dec. 5, 2021); *New START Treaty*, U.S. DEP'T OF STATE, https://www.state.gov/new-start/#:~:text=Treaty%20Duration%3A%20The%20treaty's%20original,force%20through%20February%204%2C%202026 (last visited Mar. 19, 2022).

[21] ARMS CONTROL ASS'N, *supra* note 16; *Soviet Atomic Program – 1946*, ATOMIC HERITAGE FOUND. (June 5, 2014), https://www.atomicheritage.org/history/soviet-atomic-program-1946#:~:text=The%20Soviets%20successfully%20tested%20their,Semipalatinsk%20on%20August%2029%2C%201949.

[22] *See generally* Atomic Energy Act of 1946, Pub. L. No. 79-585, 60 Stat. 755 (1946).

develop a system for the United States to control the nuclear technology industrialized in World War II.[23] The AEA fostered a program to assist private research and development of nuclear power.[24] Moreover, the AEA recognized that there were many "unknown factors" involved in the nuclear energy field at the time, and legislation would, therefore, "necessarily be subject to revision from time to time."[25] On January 20, 1953, President Truman left office, and President Eisenhower took his place.[26] The AEA was subsequently amended on August 30, 1954, to reflect the Eisenhower administration's Atoms for Peace program.[27] The 1954 amendment permitted privately run nuclear reactors, which meant nuclear power was no longer a government monopoly.[28]

Promulgating the privatization of nuclear reactors in 1942 required certain safety precautions. One precaution is in sections 103(d) and 104(d) of the 1954 amendment to the AEA, known as the restrictions of foreign ownership, control, or domination of U.S. nuclear reactor licensees ("FOCD").[29] Section 103(d) of the AEA states:

> No license may be issued to an alien or any corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. In any event, no license may be issued to any person within the United States if, in the opinion of the Commission, the issue of a license to such

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[23] RICHARD G. HEWLETT & OSCAR E. ANDERSON, JR., THE NEW WORLD, 1939/1946, A HISTORY OF THE UNITED
STATES ATOMIC ENERGY COMMISSION 2-3 (1962).
[24] Atomic Energy Act of 1946, Pub. L. No. 89-135, 79 Stat. 551, § 1(b)(1) (1965).
[25] *Id.* at § 1(a).
[26] U.S. Presidential Inaugurations: Dwight D. Eisenhower, LIBRARY OF CONGRESS, https://www.loc.gov/rr/program/bib/inaugurations/eisenhower/index.html.
[27] *The Enduring Effects of Atoms for Peace*, ARMS CONTROL ASS'N, https://www.armscontrol.org/act/2003_12/Lavoy#:~:text=The%20act%20made%20the%20entire,their%20release%20to%20the%20military (last visited Mar. 19, 2022).
[28] Oscar M. Ruebhausen & Robert B. von Mehren, *The Atomic Energy Act and the Private*
Production of Atomic Power, 66 HARV. L. REV. 1450, 1450-51 (1953).
[29] ROMA, DESAI & GILBERT, s*upra* note 6, at 1.

> person would be inimical to the common defense and security or to the health and safety of the public.[30]

Additionally, section 104(d) states:

> Any person who is a citizen, national, or agent of a foreign country, or any corporation, or other entity which the Commission knows or has reason to believe is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government, shall be ineligible to apply for and obtain a license.[31]

The NRC has interpreted sections 103(d) and 104(d) of the AEA to prohibit 100% foreign ownership of a nuclear reactor.[32] However, the NRC has never approved any indirect ownership of a licensee by a foreign interest above 50%.[33] Ultimately, this means that a U.S. nuclear reactor must have a domestic investor.

To illustrate, the application of FOCD provisions resulted in the termination of several nuclear projects in the United States.[34] For example, in 2007, a French nuclear vendor and utility formed UniStar, a joint venture with a U.S. nuclear utility.[35] Subsequently, UniStar submitted an application to build a nuclear power plant in Maryland.[36] However, after five years, the U.S. nuclear utility backed out of the deal, and the French vendor acquired full ownership of the project.[37] Consequently, the NRC found the project violated the FOCD provisions and denied the UniStar license.[38] Another example of the FOCD provisions

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[30] Atomic Energy Act of 1954, Pub. L. 83-703, § 103(d), 68 Stat. 919, 937 (1954).
[31] *Id.* at § 104(d).
[32] Memorandum, Policy Issue from Mark A. Satorius, Exec. Dir. Of Operations Nuclear Regulatory Commission on Fresh Assessment of Foreign Ownership, Control, or Domination of Utilization Facilities (SECY-14089) to the Commissioners 6 (Aug. 20, 2014), https://www.nrc.gov/docs/ML1330/ML13301A684.pdf.
[33] *Id.*
[34] ROMA, DESAI & GILBERT, *supra* note 6, at 8-10.
[35] *Id.* at 8.
[36] *Id.*
[37] *Id.*
[38] *Id.*

preventing nuclear investment in the United States is when Toshiba, a Japanese company, and NRG Energy, a U.S. company, jointly built new reactors in Texas.[39] Toshiba had 10% interest in the project.[40] At one point, NRG Energy was hesitant to continue the project, but Toshiba was willing to fund the NRC licensing.[41] Toshiba took it upon itself to eliminate foreign control on all matters regarding nuclear safety, security, and reliability.[42] However, the NRC used the FOCD provisions to conclude that Toshiba was not permitted to hold a NRC reactor license simply because NRG Energy struggled financially.[43] Toshiba spent five years negotiating and litigating before the administrative licensing board reversed the NRC's decision.[44]

In addition to the AEA, the United States has other statutory and regulatory mechanisms to protect the nation's security when working with nuclear energy. Two examples include (1) CFIUS and (2) the NRC inimicality review on foreign investments.[45] Experts in the field recognize that CFIUS and NRC's inimicality process better protect the nation from national security threats than the FOCD provisions.[46]

CFIUS is an interagency committee that reviews certain foreign investments in U.S. businesses for national security matters.[47] CFIUS "has authority to negotiate 'mitigation agreements' to resolve identified national security threats presented by a transaction."[48]

[39] *Id.* at 9.
[40] ROMA, DESAI & GILBERT, *supra* note 6 at 9.
[41] *Id.*
[42] *Id.*
[43] *Id.*
[44] *Id.*
[45] *Id.* at 2.
[46] ROMA, DESAI & GILBERT, *supra* note 6, at 2-3.
[47] John M. Beahn, Robert S. LaRussa & Lisa S. Raisner, *CFIUS and Beyond Navigating the Complicated Universe of Regulatory and Other Constrains Related to U.S. National Security*, SHERMAN & STERLING 2, 4, 16 (2020).
[48] *Id.* at 4, 16.

Additionally, the NRC's "inimicality" review on foreign investments protects the United States from national security threats that may arise when giving a foreign corporation a reactor license.[49] The "inimicality" provision is found in the sentence immediately following the section 103(d) FOCD provision and states:

> [N]o license may be issued to any person within the United States if, in the opinion of the Commission, the issuance of a license to such person would be inimical to the common defense and security or to the health and safety of the public.[50]

In other words, the NRC may issue a reactor license based on an evaluation of the company's effect on the common defense, security, and health.

The nuclear power industry has drastically evolved since 1942.[51] Therefore, legislation passed over sixty years ago is no longer applicable to the modern political climate. Moreover, the legislation that once protected the nation is now threatening its security. This Comment recommends that Congress strikes the FOCD provisions and allow foreign investors the opportunity to have a greater stake in nuclear reactors in the United States.

III. ARGUMENT: THE FOCD PROVISIONS HAVE A NEGATIVE IMPACT ON U.S. NATIONAL SECURITY

This Comment explores the FOCD provisions' negative effect on the U.S. commercial nuclear industry, the U.S. Nuclear Navy, U.S. geopolitical influence, and, subsequently, U.S. national security. This Comment further notes there are other laws and practices in place to protect the nation from nuclear threats absent the FOCD provisions. Although striking the FOCD provisions is not a "cure-all," and other measures may improve the nuclear industry, eliminating the FOCD provisions would help the nation address nuclear development with a global mindset instead of a purely domestic endeavor. Viewing nuclear

[49] Atomic Energy Act, 42 U.S.C. §§ 2133(d), 2134(d).
[50] *Id.*
[51] Off. of Nuclear Energy, Sci and Tech., *supra* note 1, at 13-21.

advancement this way is imperative to national security because it allows the United States to remain a leader in the global nuclear industry and fosters the development of foreign relations.

A. Part I: The Commercial Industry

Today, the world is collectively relying on nuclear power as an efficient low-carbon source of energy.[52] As of 2019, there were 443 operating reactors in thirty countries, which is a 9% increase in nuclear power since 2012.[53] This accounts for approximately 10% of the total electricity generated around the world and about one third of the total global low-carbon electricity production.[54] In 2020, thirteen countries used nuclear power to generate at least one quarter of their electricity.[55] The global nuclear power industry is anticipated to double by 2050.[56] However, most U.S. nuclear power plant licenses are set to expire by 2050.[57] Therefore, if there are no new or renewed licensed reactors in the United States before the year 2050, then it is possible that nearly all U.S. commercial nuclear power plants will shut down.[58] Experts observe that a mass shut down of reactors is a genuine concern:

> Even if some plants can renew their license and remain in operation past 2050, the loss of the other plants would make it harder for suppliers to stay in the nuclear business. The loss of key suppliers would make it harder for the current aging fleet to stay operating. A vicious cycle of shutdowns, followed by suppliers exiting the business, presents a real threat that

[52] *Nuclear Power in the World Today*, WORLD NUCLEAR ASS'N, https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx (last updated Mar. 2022).
[53] Marta M. Gospodarczyk & Marianne Nari Fisher, *IAEA Releases 2019 Data on Nuclear Power Plants Operating Experience*, Int'l Atomic Energy Agency (June 25, 2020), https://www.iaea.org/newscenter/news/iaea-releases-2019-data-on-nuclear-power-plants-operating-experience.
[54] *Id.*
[55] ROMA, DESAI & GILBERT, *supra* note 6, at 2-3.
[56] WALLACE, ROMA & DESAI, *supra* note 16, at 6.
[57] *Nuclear Regulatory Commission Resumes License Renewals for Nuclear Power Plants*, U.S. ENERGY INFO. ADMIN. (Oct. 29, 2014), https://www.eia.gov/todayinenergy/detail.php?id=18591.
[58] WALLACE, ROMA & DESAI , *supra* note 16, at 20.

> all currently operating nuclear plants in the United States will be shut down by 2050.[59]

The FOCD provisions create an unnecessary barrier for entities seeking licensed reactors in the United States. The entire globe recognizes the importance of nuclear power, whereas dated legislation prevents the United States from continuing to develop its commercial nuclear industry. Moreover, Congress should strike the FOCD provisions, so the United States can continue to protect the nation with nuclear power, which may be adequately regulated by realistic legislation already in place.

Unlike the CFIUS and inimicality provision review processes, the FOCD provisions fail to recognize the difference between a hypothetical partnership with treaty ally France and a hypothetical partnership with North Korea.[60] If either country (France or North Korea) wished to build a reactor in the United States, the FOCD provisions would forbid complete foreign ownership or control over the reactor, and likely deny a license if the foreign investment was over 50% interest in the project.[61] The FOCD provisions overlook the value of a long-term project with a trusted ally because it is blinded by a one-size-fits-all standard of review. However, the United States is not a one-size-fits all country, and in industries where there are high stakes, like the nuclear industry, there should be a case-by-case review.

The inimicality review provides a case-by-case system because it is not "country neutral," meaning, it treats North Korea differently than it treats France.[62] The inimicality test applies to both United States entities and foreign entities.[63] The test acts as

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[59] *Id.* at 3.
[60] ROMA, DESAI & GILBERT, *supra* note 6, at 1.
[61] *Id.* at 7.
[62] STEWART BAKER, STEPTOE & JOHNSON, Alternative Regulatory Regimes for FOCD/FOCI3 (2015), https://www.nrc.gov/reading-rm/doc-collections/commission/slides/2015/20150129/baker2-01-29-2015.pdf.
[63] Memorandum, Policy Issue from Victor M. McCree, Exec. Dir. of Operations Nuclear Regulatory Commission on Recommendations for a Process to Conduct Inimicality Reviews for the Licensing of Utilization Facilities (SECY-16-0056) to the Commissioners (Apr. 27, 2016),

a "backstop" to eliminate any problematic investment.[64] The NRC previously recognized the inimicality provision as sufficient to protect the United States from granting licenses that pose a threat to national security and the FOCD provisions as unfit for today's growing commercial nuclear industry.[65] Further, in 1999, the NRC presented Congress with a legislative proposal, which called for the FOCD provisions to be repealed.[66] The NRC expressed the inimicality provision "provide[s] ample authority for the NRC to refuse a license" that presents a threat or is inconsistent with national security matters.[67] Despite the NRC's encouragement and requests, Congress unfortunately never voted this proposal into law.[68]

Additionally, the CFIUS review process provides a case-by-case review because it "welcomes foreign direct investors" while analyzing national security threats.[69] Under the CFIUS review process, foreign investments are presumed to be on the same footing as domestic investments and as disputes arise, mitigation is preferred to obstructing deals.[70] Furthermore, CFIUS reviews foreign investments in nuclear reactors for security threats and analyzes those threats, vulnerabilities, and consequences of the investments.[71] CFIUS holds every investment (domestic and foreign) to the same standard when assessing threats, and offers a flexible review process while focusing on national security.[72]

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https://www.nrc.gov/docs/ML1532/ML15320A283.pdf; BAKER, *supra* note 62, at 3.

[64] BAKER, *supra* note 62, at 3.

[65] MATT BOWEN, COLUMBIA SIPA CTR. ON GLOB. ENERGY POL'Y, *Strengthening Nuclear Energy Cooperation Between the United States and Its Allies* 22 (July 28, 2020), https://www.energypolicy.columbia.edu/research/report/strengthening-nuclear-energy-cooperation-between-united-states-and-its-allies.

[66] *Id.*

[67] *Id.*

[68] *Id.* at 22-23.

[69] BAKER, *supra* note 62, at 4.

[70] *Id.* at 4, 7.

[71] *Id.* at 18.

[72] *Id.*

Experts recognize the systems demonstrated by the inimicality and CFIUS review processes are better suited than the FOCD provisions to oversee foreign ownership of nuclear reactors.[73] This is because the case-by-case system allows for reactor applications to be carefully considered rather than quickly denied solely because of the percentage of foreign investment. Especially as percentage of foreign investments has been shown to quickly shift in projects like UniStar and the Toshiba-NRG Energy partnership.[74] A case-by-case review would allow the United States to enter a long-term partnership with allies, such as the French, while protecting the United States from entering a partnership with countries who pose national security threats, like North Korea.

Without the FOCD provisions, projects like UniStar may prevail, and the nation would be adequately protected under the NRC's inimicality provision and the CFIUS review process. The inimicality provision and CFIUS review process likely would recognize the benefit of a United States-France nuclear project and permit UniStar to complete the nuclear utility. This is because those two safeguards are more capable than the FOCD provisions of efficiently protecting the nation, while recognizing that a nuclear energy partnership with France does not pose a substantial threat in the United States.

UniStar was a failed partnership with a French ally trusted by the United States.[75] Not only do the United States and France share parallel perspectives on many economic and political policies, but the United States currently works closely with France on national security matters including combating terrorism.[76] Denying UniStar a NRC license for a commercial reactor was counterproductive because it terminated the potential for a long

[73] ROMA, DESAI & GILBERT, *supra* note 6, at 8.
[74] *Id.* at 10-11.
[75] *Id.*
[76] *U.S. Relations With France*, U.S. DEP'T OF STATE (July 23, 2020), https://www.state.gov/u-s-relations-with-france/.

lasting relationship with a United States ally who holds similar values and global concerns.

The CFIUS review process and the inimicality provision provide the commercial industry with a case-by-case review process and can protect the United States absent the FOCD. In sum, the FOCD provisions are detrimental to the United States's already struggling commercial nuclear industry and present a national security threat. The United States houses fifty-six commercially operated nuclear power plants.[77] Nuclear power generates approximately 19% of power in the United States.[78] Maintaining these plants is a global endeavor.[79] The FOCD provisions prevent the United States from forming partnerships with allies and advancing technology. Inviting nations with similar values and global concerns into furthering a common goal of nuclear development and advancement is imperative so that the United States's nuclear interests are not outweighed by countries such as Russia and China.[80] Moreover, Russia and China are prioritizing nuclear investments and the United States must keep up.[81] The U.S. nuclear industry is struggling to survive, while the global nuclear industry is thriving.[82] It is important that the United States continues to maintain a commercial nuclear industry. Striking the FOCD provisions could help the United States to do so while fostering relationships and partnerships with foreign allies.

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[77] *How Many Nuclear Power Plants are in the United States, and Where are they Located?*, U.S. ENERGY INFO. ADMIN. (May 3, 2021), https://www.eia.gov/tools/faqs/faq.php?id=207&t=3.
[78] *Nuclear Power in the USA*, WORLD NUCLEAR ASS'N (Sept. 2021), https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power.aspx.
[79] ROMA, DESAI & GILBERT, *supra* note 6, at 5.
[80] *Id*.
[81] *Id*. *See generally*, Publication of a Report on the Effect of Imports of Uranium on the National Security: An Investigation Conducted Under Section 232 of the Trade Expansion Act of 1962, as Amended, 86 Fed. Reg. 145 (Aug. 2, 2021).
[82] WALLACE, ROMA & DESAI, *supra* note 16, at 6.

B. Part II: The Nuclear Navy

The FOCD provisions' negative effect on the U.S. commercial nuclear industry consequently has a negative effect on the U.S. Nuclear Navy because the strength of the Nuclear Navy relies on the strength of the U.S. commercial industry.[83] The Nuclear Navy "compromises the military and civilian personnel who design, build, operate, and manage the nuclear-powered ships and the many facilities that support the U.S. nuclear-powered naval fleet."[84] Moreover, over 45% of the Navy's warships are nuclear powered.[85] Military reactors rely on a nuclear supply chain that is heavily intertwined with the commercial nuclear industry. [86] Therefore, the shutdown of commercial nuclear power plants could directly destabilize the Nuclear Navy.[87] This directly affects national security because the U.S. military relies on the Nuclear Navy to protect the nation.[88] Accordingly, the FOCD provisions are preventing the military from maintaining national security by creating barriers for building nuclear reactors in the private commercial industry. Destabilization of the commercial industry means (1) less avenues for obtaining new technology and designs for naval reactors and (2) less job opportunities post-enlistment.

First, the Nuclear Navy relies on the private sectors to maintain the publicly and privately shared nuclear supply chain.[89] For example, the Nuclear Navy needs tritium for efficient nuclear

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[83] *Id.* at 10.
[84] Nat'l Nuclear Sec. Admin., *supra* note 20.
[85] National Nuclear Security Program, United States Naval Nuclear Propulsion Program (Sept. 2017), https://www.energy.gov/sites/prod/files/migrated/nnsa/2018/01/f46/united_states_naval_nuclear_propulsion_program_operating_naval_nuclear_propulsion_plants_and_shipping_rail_naval_spent_fuel_safely_for_over_sixty_years.pdf.
[86] NUCLEAR ENERGY INST., *supra* note 10.
[87] WALLACE, ROMA & DESAI., *supra* note 16, at 11; Publication of a Report on the Effect of Imports of Uranium on the National Security: An Investigation Conducted Under Section 232 of the Trade Expansion Act of 1962, as Amended, 86 Fed. Reg. at 41541, 41564-66.
[88] NUCLEAR ENERGY INST., *supra* note 10.
[89] *Id*.

weapon function.[90] Tritium decays with a half-life of 12.3 years[91] and the United States has a limited ability to produce the quantity of tritium needed to maintain nuclear weapons.[92] Tritium can be produced using special rods that are placed in a reactor.[93] The United States uses this process to produce tritium in one domestic reactor run by Tennessee Valley Authority ("TVA").[94] When the TVA reactor is used for military purposes, it must be fueled by domestically sourced uranium.[95] However, as of 2018, the U.S. supply of uranium, which the TVA may use for military purposes, is expected to run out in about ten years.[96] This is extremely problematic because the United States has only one uranium enrichment facility, and the facility is financially unstable.[97] This supply chain is just one example that demonstrates the Nuclear Navy's reliance on the commercial industry. Private companies such as BWX Technologies, Westinghouse, and X-energy have been contracted by the government to design nuclear technology for the armed forces.[98] The nuclear commercial and military

[90] Robert E. Kelley, *Starve Nuclear Weapons to Death with a Tritium Freeze*, STOCKHOLM INT'L PEACE RSCH. INST. (Aug. 28, 2020), https://sipri.org/commentary/topical-backgrounder/2020/starve-nuclear-weapons-death-tritium-freeze.
[91] *Id*.
[92] WALLACE, ROMA & DESAI., *supra* note 16, at 15.
[93] *Watts Bar 2 to Start Weapons Tritium Production When Current Refueling Outage Wraps*, EXCH. MONITOR (Nov. 12, 2020), https://www.exchangemonitor.com/watts-bar-2-start-weapons-tritium-production-current-refueling-outage-wraps/?printmode=1; WALLACE, ROMA & DESAI, *supra* note 16, at 15.
[94] WALLACE, ROMA & DESAI, *supra* note 16, at 15.
[95] *Id.* at 10.
[96] *Id.* at 15.
[97] *US Nuclear Fuel Cycle,* WORLD NUCLEAR ASS'N (May 2021), https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-fuel-cycle.aspx; Matthew L. Wald, *Company Struggles to Keep U.S. in the Uranium Enrichment Game*, N.Y. TIMES, Jan. 28, 2014, at B1, https://www.nytimes.com/2014/01/28/business/energy-environment/company-struggles-to-keep-us-in-the-uranium-enrichment-game.html; Publication of a Report on the Effect of Imports of Uranium on the National Security: An Investigation Conducted Under Section 232 of the Trade Expansion Act of 1962, as Amended, 86 Fed. Reg. at 41553.
[98] Aaron Mehta, *Pentagon Awards Contracts to Design Mobile Nuclear Reactor*, DEF. NEWS (Mar. 9, 2020), https://www.defensenews.com/smr/nuclear-

industries have a shared supply chain and the survival of both industries is imperative to national security. This Comment is not suggesting the Navy allow foreign investment, but suggesting the lack of foreign involvement in the commercial industry hinders the development of the military industry.

Turning to the second point, many individuals choose to be a "Navy nuke"[99] when entering the military because they are cognizant of future opportunities in the nuclear private sector after their military contract is up.[100] The opportunities the private sector offers consist of high-paying engineers and scientists.[101] Because nuclear reactors may operate for eighty years and require educated engineers and scientists, the private sector has the potential to offer job security to Nuclear Navy veterans.[102] However, the FOCD provisions create unnecessary hurdles and shut down projects to build nuclear reactors.[103] The job market uncertainty disincentivizes those interested in a career in the Nuclear Navy.[104] However, if the FOCD provisions were to be eliminated, there would be potential for the commercial industry to grow, and therefore there would be a continued incentive for future generations to join the Nuclear Navy.

The Nuclear Navy will remain safe without the FOCD provisions because there are other rules and regulations in place to protect the nation. The Nuclear Navy does not rely on the FOCD provisions for safety and security because it sets its own standards, which ensure the safe operation of nuclear reactors in

arsenal/2020/03/09/pentagon-to-award-mobile-nuclear-reactor-contracts-this-week/.

[99] "'Navy nuke' is shorthand for someone who has supported reactor operations on a nuclear-powered submarine or ship." Paul Menser, *Old Ties Hodling Strong: 'Navy Nukes' Are Naturals For Operator Jobs at ATR, MFC*, IDAHO NAT'L LABS (Nov. 30, 2021), https://inl.gov/article/old-ties-holding-strong/.

[100] *See* WALLACE, ROMA & DESAI, *supra* note 16, at 15.

[101] *See id*.

[102] *See* Off. of Nuclear Energy, *What's the Lifespan for a Nuclear Reactor? Much Longer Than You Might Think*, U.S. DEP'T OF ENERGY (Apr. 16, 2020), https://www.energy.gov/ne/articles/whats-lifespan-nuclear-reactor-much-longer-you-might-think.

[103] *See* ROMA, DESAI & GILBERT, *supra* note 6, at 8-9.

[104] *See* WALLACE, ROMA & DESAI, *supra* note 16, at 15.

the military. Two examples of this can be seen in the Naval Nuclear Propulsion Program and the START.[105]

The Naval Nuclear Propulsion Program[106] ensures the safety, reliability, and operation of military nuclear propulsion plants.[107] The Naval Nuclear Propulsion Program codifies Executive Order 12344 issued by President Reagan to provide responsibilities of Naval Reactors.[108] The codification covers "all aspects of the Navy's nuclear propulsion including research, design, construction, testing, operation, maintenance, and ultimate disposition of naval nuclear propulsion plants. The Program's responsibility includes all related facilities, radiological controls, environmental safety, and health matters, as well as selection, training, and assignment of personnel."[109] Additionally, the START contributes to national security by limiting the number of strategic offensive arms (including nuclear warheads and ballistic missiles) in the United States and Soviet Union.[110] Both the Naval Nuclear Propulsion Program and the START provide security to the Nuclear Navy.[111] Furthermore, the FOCD provisions do not provide benefit to the military because it

105 "Presidential Executive Order 12344, 42 U.S.C. Sec 7158, Public Law 98-525 and 50 U.S.C. Sec. 2406, Public Law 106-65 set forth the total responsibility of Naval Reactors for all aspects of the Navy's nuclear propulsion. . . ." Nat'l Nuclear Sec. Admin., *supra* note 20; *see also New START Treaty*, *supra* note 20.
106 *See* 50 U.S.C. §§ 2406, 2511.
107 *See* Dep't of Energy & Dep't of the Navy, *The United States Naval Nuclear Propulsion Program* 1 (Nov. 2015), https://www.energy.gov/sites/prod/files/2017/08/f36/nuclear_propulsion_program_8-30-2016%5B1%5D.pdf.
108 *See id.*
109 *Id.*
110 *See generally* Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, U.S.-Russ., Apr. 8, 2010, T.I.A.S. No. 11-205 https://2009-2017.state.gov/documents/organization/140035.pdf.
111 "Presidential Executive Order 12344 , 42 U.S.C. Sec 7158, Public Law 98-525 and 50 U.S.C. Sec. 2406, Public Law 106-65 set forth the total responsibility of Naval Reactors for all aspects of the Navy's nuclear propulsion. . . ." Nat'l Nuclear Sec. Admin., *supra* note 20; *see generally New START Treaty*, *supra* note 20.

governs the licensure of civilian reactors.[112] If Congress were to strike the FOCD provisions, then the Nuclear Navy would maintain its strength. This is imperative to national security because the Nuclear Navy is essential to the United States' defense.

Experts in the field recognize that nuclear energy is a fundamental aspect to the military. One expert noted that:

> U.S. forces are becoming more vulnerable as other nations become more technologically and tactically sophisticated. Expanding America's nuclear navy is critical to staying a step ahead of the enemy. A nuclear ship has no exhaust stack, decreasing its visibility to enemy detection; it requires no fuel supply line, assuring its ability to maneuver over long distances; and it produces large amounts of electricity, allowing it to power massive radars and new hi-tech weaponry.[113]

Moreover, nuclear reactors are the only power source that can transport U.S. aircraft carriers across the oceans "at high speeds over long distances."[114] Nuclear power sources are physically small which "frees storage capacity for high value/high impact assets such as jet fuel, small craft, remote-operated and autonomous vehicles, and weapons."[115] Nuclear powered submarines can run for "twenty years without needing to refuel."[116] The limited food and supplies onboard the nuclear powered submarine limit the submarine's time at sea—not fuel.[117] Striking the FOCD provisions may allow the United States to maintain this advanced technology and fix vulnerabilities in the Nuclear Navy supply chain by enabling investment in the U.S. domestic nuclear industry. This will allow the country to provide

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[112] *See generally* Atomic Energy Act of 1954, Pub. L. No. 83-703, §§ 103(d), 104(d).

[113] Baker Spring & Jack Spencer, *The Advantage of Expanding the Nuclear Navy*, HERITAGE FOUND. (Nov. 5, 2007), https://www.heritage.org/homeland-security/report/the-advantages-expanding-the-nuclear-navy.

[114] WALLACE, ROMA & DESAI, *supra* note 16, at 9.

[115] Spring & Spencer, *supra* note 113.

[116] *Nuclear Submarines and Aircraft Carriers*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/radtown/nuclear-submarines-and-aircraft-carriers (last updated June 2, 2021).

[117] *Id.*

a competitive military and confront national security threats around the globe.

C. Part III: The United States Geopolitical Influence

Finally, the FOCD provisions negatively impact the United States's geopolitical influence. Maintaining the commercial nuclear industry demands global effort,[118] and striking the FOCD provisions may better promote that effort. It is geopolitically beneficial for the United States to have foreign investors in domestic nuclear power plants because it allows the nation to foster relationships and set nuclear safety standards abroad, which together helps keeps the nation safe.

First, foreign investors in the United States are beneficial to fostering foreign relations because of the long-lasting partnership that would stem from the investment. For example, if the UniStar project prevailed, then a French company would build a partnership with the United States that lives at least as long as the reactor's life. In many cases, that is sixty years.[119] Meanwhile the United States can be confident that the nation is secure because the foreign investor would be subject to extensive CFIUS and inimicality review.[120]

Additionally, the FOCD provisions' prevention of foreign investment in the United States is dangerous because the current strength of the United States commercial nuclear industry allows the nation to influence national nuclear operations and maintenance standards.[121] However, if the commercial industry in the United States loses its strength, then it will no longer have the capacity to influence global standards.

One example that demonstrates the United States's influence on the global nuclear industry can be seen in the NPT.

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118 ROMA, DESAI & GILBERT, *supra* note 6, at 1.
119 *How Does Nuclear Work?*, WORLD NUCLEAR ASS'N, https://www.world-nuclear.org/nuclear-essentials/how-does-a-nuclear-reactor-work.aspx (last visited Dec. 5, 2021).
120 ROMA, DESAI & GILBERT, s*upra* note 6, at 2.
121 WALLACE, ROMA & DESAI, *supra* note 16, at 8.

The NPT stops the distribution of nuclear weapons and nuclear weapon technology and encourages the cooperation in peaceful uses of nuclear energy.[122] Further, the NPT permits the United States to share its technology with the world and asks the world to adopt certain safety standards in return.[123] The United States can do this because of the current strength of its domestic nuclear industry. However, if the commercial industry were to lose strength and the United States did not have technology to share, then it is unlikely the world would cooperate with the United States safety standards. This threatens national security and leads the world down a slippery slope.

If the United States is not setting global safety standards, then other countries will. Although the peaceful use of nuclear energy can produce large amounts of low carbon electricity,[124] it must be in the right hands and abide by strict safety standards to be used safely. If the U.S. commercial industry is withering, it will not be able to influence the world's standards via the NPT. Other than the United States, the world's biggest nuclear energy producing countries are France, China, Japan, and Russia.[125] Moreover, China currently has the most nuclear reactors under construction.[126] China would present a huge threat if it began sharing technology in return for a voice in the way other countries maintain their nuclear reactors. The International Atomic Energy Agency concluded that China's management of nuclear safety raises several concerns, including failing to require security tests

[122] Off. for Disarmament Affairs, *Treaty on the Non-Proliferation of Nuclear Weapons*, UNITED NATIONS, https://www.un.org/disarmament/wmd/nuclear/npt/ (last visited Apr. 6, 2022).
[123] WALLACE, ROMA & DESAI, *supra* note 16, at 8.
[124] International Atomic Energy Agency, *supra* note 54.
[125] Hemanth Kumar, *The Top Ten Nuclear Energy-Producing Countries in 2021*, POWER TECH., https://www.power-technology.com/features/top-ten-nuclear-energy-producing-countries/ (last updated Nov. 23, 2021).
[126] Laura Gil, *How China has Become the World's Fastest Expanding Nuclear Power Producer*, INT'L ATOMIC ENERGY AGENCY (Oct. 25, 2017), https://www.iaea.org/newscenter/news/how-china-has-become-the-worlds-fastest-expanding-nuclear-power-producer.

at operating facilities.[127] China has an incoherent body of laws that regulate nuclear safety and has no clear legal basis for accident liability.[128] If China voiced its view and attempted to set standards with poor governance, this would pose an obvious safety risk. However, what is not as obvious is the threat that arises if China controls other nations' power.

If China were to share nuclear technology, the nation may have selfish motives. This is expected, after all, the United States shares its technology and in return influences global safety standards.[129] However, putting the world's energy in the hands of China could be fatal, and this is apparent in India.[130] In summer 2021, Chinese and Indian troops battled at their shared border.[131] Four months later, the power was turned off in Mumbai, affecting public transportation, the stock market, and hospitals during a global pandemic.[132] Although it is not entirely clear who is responsible for the outage, Indian officials claim the two events are linked, and that China is responsible.[133] If China were to have more leverage under the NPT, it could potentially turn the lights out all over the world.

It is imperative that the United States maintains a strong domestic commercial nuclear industry. If the FOCD provisions continue to create unnecessary hurdles and shut down projects before, during, and after they are completed, then there will be major national security implications. The United States may lose its geopolitical influence, leaving other countries to set global standards and threaten the world's safety. This would be

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127 Philip Andrews-Speed, *The Governance of Nuclear Power in China*, 13 J. OF WORLD ENERGY L. & BUS. 23, 38-39 (2020), https://academic.oup.com/jwelb/article/13/1/23/5818940.
128 *Id.* at 46.
129 WALLACE, ROMA & DESAI, *supra* note 16, at 8.
130 *See generally* David E. Sanger & Emily Schmall, *China Appears to Warn India: Push Too Hard and the Lights Could Go Out*, N.Y. TIMES (Sept. 27, 2021), https://www.nytimes.com/2021/02/28/us/politics/china-india-hacking-electricity.html.
131 *Id.*
132 *Id.*
133 *Id.*

problematic because nuclear technology can be extremely dangerous. If a country with different values and questionable motives sets global nuclear safety standards, then the world's safety and security will be threatened.

IV. CONCLUSION

The FOCD provisions are prohibiting the United States from expanding its commercial nuclear industry, and this has major national security implications. In the 1940s and 1950s, nuclear energy was introduced to the world as weaponry and foreign ownership of a nuclear reactor in the United States would present a detrimental risk to the nation's security.[134] However, the world has drastically transformed since the 1950s, and maintaining nuclear energy for commercial use is a global endeavor. Furthermore, if the United States continues to prevent foreign investors from the U.S. commercial nuclear industry national security will be severely impaired.

First, the commercial nuclear industry is struggling to survive and the FOCD provisions are intensifying the struggle by shutting down projects such as UniStar. Second, the Nuclear Navy is consequently fighting to survive because its strength relies on the strength of the commercial nuclear industry. Third, the United States's geopolitical influence is compromised because the FOCD provisions threaten the nation's ability to set global safety standards.

Today, the FOCD provisions present the United States with problems that the AEA sought to avoid. Moreover, part of the reason the University of Chicago scientists, Albert Einstein, and Leo Szilard stressed the need for legislation was the need for the United States to maintain international control of nuclear technology.[135] Today, the FOCD provisions create unnecessary hurdles and preventing the nation from developing nuclear

[134] Off. of Nuclear Energy, Sci and Tech., *supra* note 1, at 13-15.
[135] *See generally id.*

technology. This consequently threatens the United States from maintaining national security and geopolitical influence.