| **QM NEG V1 [ENERGY]** |
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**Carrollton negates, Contention One is Poland**

**Poland wants nukes BUT lacks capacity,**

**Naughtie 25,** Andrew Naughtie, 03/21/2025, “Could another European country develop its own nuclear weapons?” EuroNews, [https://www.euronews.com/2025/03/21/could-another-european-country-develop-its-own-nuclear-weapons]

Building up a nuclear deterrent from scratch is no easy feat, but with the US distancing itself from Europe, the idea has started to resurface. “**Poland must pursue** the most advanced capabilities, including **nuclear** and modern unconventional **weapons**,” Polish **P**rime **M**inister Donald **Tusk told** his country’s **parliament** earlier this month. “This is a serious race — a race for security, not for war.” Coming **as** the **Trump** administration signalled it **is** essentially **pulling back from** protecting **Europe**, Tusk's statement seemed to suggest a potential lurch toward nuclear weapons proliferation in Europe — something at odds with decades of European policy. While questions remain over the US' ongoing commitment to its role as Europe’s nuclear security guarantor, **China is expanding its** nuclear **arsenal**. And **Russia**, which maintains the world’s largest stockpile of warheads, **repeatedly invokes** the **threat** of using them to warn NATO and the EU against getting directly militarily involved in Ukraine. The overall picture raises two difficult questions. How can Europe maintain a continent-wide nuclear deterrent? And is there a possibility that other countries will join the nuclear club? Although some European states have some of the elements required to develop independent nuclear weapons capability, experts say the **chances of another European state going nuclear are slim**. Starting from scratch According to Fabian Rene Hoffmann, a research fellow at the Oslo Nuclear Project, even if one of Europe’s NATO powers were keen to develop its own nuclear weapons rather than simply hosting them, it would find itself at a standing start. “**The major issue** European countries are facing **is that they** either **don’t deploy** the civilian **nuclear infrastructure** to launch a nuclear weapons programme, or, if they have civilian nuclear infrastructure, that it is highly ‘proliferation-resistant’,” he told Euronews. “For example, Finland and Sweden only have light-water reactors, which are not suitable for the production of weapons-grade plutonium. In addition, neither of those countries have chemical reprocessing plants that are needed for separating wanted from unwanted isotopes in fissile material production."

**They’ve turned to American company Westinghouse,**

**Hayden 22,** Jones Hayden, 10/29/2022, “Poland picks Westinghouse to build its first nuclear plant,” POLITICO, [https://www.politico.eu/article/poland-picks-westinghouse-to-build-its-first-nuclear-power-plant/,]

**Poland awarded** a contract to build its first **nuclear** power **plant to a U.S. bid** as the country seeks to burn less coal **and** increase its energy independence. The government in Warsaw **chose Westinghouse** for the nuclear project, Prime Minister Mateusz Morawiecki said late Friday in a tweet praising the U.S. company’s “reliable, safe technology.” “A strong Poland-U.S. alliance guarantees the success of our joint initiatives,” Morawiecki said.

**America’s provided funding but only increased investment allows completion,**

**Brodacki 25,** Dominik Brodacki, 2025, “Nuclear Energy in Poland: Assessment of Readiness for the Construction of the First Nuclear Power Plant,” Baker McKenzie, [<https://www.bakermckenzie.com/-/media/files/locations/poland/nuclear-energy-in-poland/baker-mckenzie-polityka-insight-report-nuclear-energy-in-poland-2025_eng.pdf>,]

The above also makes it difficult to precisely determine the final cost of building NPP1 (despite the indicative amount of PLN 192 billion given by the Council of Ministers in its notification to the EC). This is because it depends, among other things, on the outcome of the power plant design process (which will determine the specific solutions to be applied), discussions with the EC and the detailed provisions of the EPC contract. As a result, it is not possible at this stage to make a final decision on the detailed method of financing the investment. **No**ne of the **nuclear projects** under construction **in Poland has full**y secured **financing**. The investment in NPP1 is the most advanced in this respect – as mentioned above, its implementation is to be supported by public funds, including in the form of a direct capital injection into the NPP of around PLN 60.2 billion. In February 2025, the Parliament adopted an amendment to the Special Nuclear Act, according to which state aid will be transferred to PEJ in the form of a capital increase by the State Treasury in exchange for shares in the company. Of this amount, PEJ is to receive for the preparation and implementation of the construction of NPP1 and accompanying investments, as well as its current operations: PLN 4.6 billion in 2025, PLN 11 billion in 2026, PLN 14 billion in 2027, PLN 13 billion in 2028, PLN 11 billion in 2029 and PLN 6.6 billion in 2030. It is known that their disbursement will be possible only after the EC approval following the notification of the support programme for the construction and operation of NPP1. Approximately 70% of the construction costs of NPP1 will be covered by external financing, of which two-thirds will be provided by export credit agencies and the rest by commercial financial institutions. PEJ has **secured** declarations (in the form of letters of intent) of financial **commitment** for approximately PLN 95 billion **from**, among others: **the** Export-Import Bank of the **U**nited **S**tates (EXIM), U.S. International Development Finance Corporation, Bpifrance Assurance Export, Sfil and Export Development Canada. Taking into account the aforementioned capital injection of around PLN 60.2 billion, **there are still** tens of **billions missing** to cover the estimated project budget (around PLN 192 billion).

**Empirically, US investment in Westinghouse got the project started,**

**Kraev 21,** Kamen Kraev, 9/24/2021, “Poland/US Wants To Speed Up Westinghouse AP1000 Study, Says Energy Secretary Granholm,” NucNet, https://www.nucnet.org/news/us-wants-to-speed-up-westinghouse-ap1000-study-says-energy-secretary-granholm-9-5-2021]

**The US gov**ernment wants to **accelerate** its **support for a** front-end engineering and design study for the deployment of US-made AP1000 **reactor** technology **in Poland**, US energy secretary Jennifer Granholm said. In July, US-based **Westinghouse** Electric Company and Bechtel Corporation **announced** the start of the study, which will provide Poland’s Polskie Elektrownie Jądrowe (PEJ) – the company responsible for managing the country’s first nuclear power project – with **layout plans** for the location of a first nuclear power station, together with a licensing plan, project schedule and cost estimate. **The** US Trade and Development Agency **[USTDA] has released a grant to fund** the study. “**US industry and gov**ernment **have come together at a critical juncture** in the development of Poland’s nuclear energy programme,” Ms Granholm said during a press conference in Warsaw.

**Competition decks prolif safeguards,**

**Gilinsky 20,** Victor Gilinsky, 05/15/2020, “Bad Business: Pushing US Nuclear Exports,” The American Interest – NPEC", Nonproliferation Policy Education Center, https://npolicy.org/bad-business-pushing-us-nuclear-exports-the-american-interest/]

**The** nuclear industry and the Department of Energy **(DOE) want to** raid our wallets…again. This time, it’s not to save the planet, but supposedly to give industry a **fight**ing chance against rising **Russian and Chinese** civilian **nuclear export competition.** As Victor Gilinsky and I warn in “The Nuclear Industry at the Feeding Trough,” posted by The American Interest, the American taxpayer shouldn’t buy this. First, the Russian and Chinese nuclear industry is not as healthy or as influential as claimed. Second, the nuclear industry’s pleas (most recently trumpeted in DOE’s nuclear strategy report, “Restoring America’s Competitive Nuclear Energy Advantage”) presume an American commercial nuclear industry that no longer exists. Westinghouse, General Electric, **and** Combustion Engineering have sold themselves out to foreign partners and holding companies. US nuclear exports are no longer significant. Also, US nuclear electricity is now more expensive than gas-fired electricity, hydroelectric, and renewables. Finally, what the industry is demanding in regulations to promote exports — a **relax**ed approach to nuclear **nonprolif**eration **controls** — will actually undermine America’s national security. The nuclear lobby is playing the national security card in trying to justify federal handouts. It’s a con. We are getting used to brazen coronavirus claims for federal largess, but it’s hard to beat the claims coming from the nuclear industry. Even before the pandemic hit, it had for the most part given up competing for new power plant sales in the domestic and international energy marketplace and instead was wrapping itself in the flag and declaring itself essential to U.S. national security, and therefore deserving of generous federal support. This approach has the full backing of the Trump Energy Department, and has been dutifully rolled out as part of the broader scramble for federal relief funds unleashed by the coronavirus crisis. As Energy Secretary Danny Ray Brouillette made clear to radio talk show host Hugh Hewitt in an April 28 interview: We’ve lost our leadership both on the technology side and on the market side… to the Russians and the Chinese. And why does that matter? Well, obviously it matters, because we are, we were the world leader not only in the development of nuclear technology, but in the export of this technology around the world. And we lost that, and it leads to a national defense issue. And, indeed, DOE’s web site announces: “Nuclear power is intrinsically tied to National Security.” Among the ways DOE plans to restore American nuclear energy leadership are “minimizing commercial fleet fiscal vulnerabilities [DOE-speak for subsidizing],” and “leveling the playing field against state-owned enterprises.” The implication is that other countries are not competing fairly, as if they snuck around us to jump the line. Now, to cope with this, we have to **sweeten the deals** we offer **to get the sales.** And as a thriving nuclear sector is supposedly a necessary condition for gaining foreign sales, we have to prop up domestic nuclear plants, too. If nothing else, there is a stunning lack of self-awareness in this view. Yes, the United States pioneered the light water reactor technology used around the world. But, as a result of U.S. business decisions, in part reflecting the unfavorable economics of nuclear power in the United States but also poor management, we effectively no longer have any reactor manufacturers. Combustion Engineering, a company with 28,000 employees, a pressurized water reactor manufacturer, sold itself in 1989 to the European firm ABB Asea Brown Boveri Ltd. The great Westinghouse firm, once the world leader on pressurized water reactors, blundered financially into becoming a subsidiary of the CBS Corporation. In 1995, CBS sold it to British Nuclear Fuels Limited. BNFL in turn sold Westinghouse nuclear activities to Toshiba in 2006. Westinghouse, by then a shell of its former self, performed so miserably in constructing the last large reactors to be built in the United States in South Carolina and Georgia that it went bankrupt and almost took Toshiba down, too. The South Carolina owners canceled their two plants, and the remaining two in Georgia will cost nearly $30 billion, double the original contract price. After this experience, it is hard to see any future sales of large reactors in the United States. General Electric used to build boiling water reactors, but it only offers sales abroad as a junior partner to Japan’s Hitachi Corporation. Its reputation is anyway tarnished because it designed the plants that failed during the 2011 Fukushima accident. In short, U.S. nuclear plant manufacturing capabilities are much diminished, and the domestic market just isn’t there. And it isn’t there because nuclear economics are extremely unfavorable. Currently, the US still has 95 power reactors online, supplying a bit less than 20 percent of America’s electrical demand. They are on average 39 years old. Only two plants, the ones in Georgia, are now under construction and they are expected to be the last large ones to be built for some time. That hasn’t fazed the nuclear faithful both in and out of government. They still think, as their predecessors thought sixty years ago, that nuclear power is the technology of the future. They paint a picture of our putative arch-enemies, Russia and China, selling nuclear power plants and locking up nuclear relationships with numerous states, including important friendly states such as Saudi Arabia and Turkey, relationships that will last for the rest of the century. We will be frozen out and will thereby lose influence throughout the world. But it’s still not too late if we follow the advice of the Energy Department, the nuclear industry, and a gaggle of consultants looking to cash in. What is it we have to do? The battles in Washington turn on so-called agreements for cooperation with potential customers that are prerequisites for sales of major reactors and components. The main issue concerns whether we will accept customers that also want to acquire acquires auxiliary facilities that can be used to produce plutonium and highly enriched uranium, the fuels that are also the explosives used in nuclear weapons. The only position consistent with non-proliferation, halting the spread of nuclear weapons, is “no.” But the nuclear **enthusiasts say** that’s too strict, that others have more accommodating terms, and that **if we sell with looser terms, we’ll have more influence.** They have their eye especially on Saudi Arabia, a country that at one point said, implausibly, it was going to build 16 nuclear power plants. They don’t seem to pay attention to the other thing the Saudis said—the crown prince’s statement that if Iran was going to get a bomb, he was going to get one, too, and fast. **It’s not just** the **Trump** crowd **that opposes** tightening **security** rules over nuclear exports (in the name, they say, of security). President **Obama’s Energy Secretary**, Ernest Moniz, has been arguing that subsidizing domestic nuclear power and **encourag**ing nuclear **sales without** especially tight **security restrictions**—restrictions that go by the rubric of “gold standard”—are in the interests of U.S. nuclear security, and even support the deterrence value of our nuclear weapons. All this is a bit much. Do we really think that Russia, with a GNP below that of Italy, is capable of freezing us out of the world? Does it have the financial capacity to offer generous terms on many projects? Will they ever be completed? Nuclear power is just one U.S. export technology, and not exactly the most promising. For example, the U.S. exported $136 billion in aircraft last year; U.S. nuclear exports for the same period could only be measured in millions of dollars. **China** is building a comparatively large number of nuclear plants but **nuclear** power **supplies less than five percent of** its electrical **demand** and is only projected to account for seven percent by 2040. Any large accident will turn this program off.

**It’s used for hegemonic expansion — incites Russian fears and conflict,**

**Ramana 24,** M.V. Ramana, 08/02/2024, “Eastern Europe’s purchase of US nuclear reactors is primarily about military ties, not climate change,” Bulletin of the Atomic Scientists [https://thebulletin.org/2024/08/eastern-europes-purchase-of-us-nuclear-reactors-is-primarily-about-military-ties-not-climate-change/]

US officials see the purchase of military equipment as one of the many ways the United States can bring Poland closer in geopolitical terms. Another is to have them buy US nuclear reactors. **In** its “Integrated Country **Strategy” for Poland** from June 2022, the **US** State Department’s top two mission **goals were** stated to involve **military** engagement **and** adoption of new **energy** technology, including nuclear power. The document praises the “potential partnership with the United States to develop large-scale nuclear power plants with US technology” because it “could result in over $18 billion dollars in US exports and strategically tie our two countries even more tightly together over the coming century.” It should be clear who would profit most at the expense of the Polish public. The United States has historically tried to use nuclear development to expand its empire and influence. **During the Cold War, US** nuclear power **companies** “**had** a specific **agenda to promote** the advancement of **nuclear tech**nology in non-communist countries,” which was one reason they exported nuclear reactors to South Korea. By all evidence, the focus on nuclear energy in Eastern Europe appears not to be driven mainly by climate change but by old-fashioned geopolitics in significant proportion. Were the urgency of climate change really driving investment in nuclear energy, Poland should have considered purchasing reactors also from Russia or China. In fact, over the past decade, Russia has dominated the export market for nuclear power plants and China has built more nuclear plants than any other country. Why it matters. The **geopolitical** framing of imports of nuclear energy is a problem, especially in Eastern Europe where there is an active war in neighboring Ukraine. **Build**ing **up** military forces using US technology and expanding US military presence in the region, even possibly basing nuclear weapons in Poland, may **increase** the **likelihood of** a catastrophic **war between Russia and NATO.** Such a war would be compounded by the potential for radioactive contamination from deliberate or inadvertent attacks on nuclear reactors, as illustrated by the Zaporizhzhia nuclear plant in Ukraine, which Russia has occupied since March 2022 and used as a source of leverage. Such geopolitical games also make dealing with climate change much more difficult. A geopolitical view, by its very nature, conceives of problems essentially as a zero-sum competition: Countries will avoid cooperating with each other. But as happened with the global response to the COVID-19 pandemic, the lack of cooperation will undermine the chances of quickly reducing global emissions. The analyst and disarmament activist Andrew Lichterman recently explained that anyone interested in a more fair, peaceful, and ecologically sustainable global society should avoid using “the conceptual frame of geopolitics” which “is limited to the imperatives of holding and deploying power in what is portrayed as an endless, inevitable struggle for dominance among the world’s most powerful states.” **Investments in nuclear** power in Eastern Europe **hide** geopolitical and **military motivations behind** a smoke screen of **fighting climate** change. When these motivations result in the massive acquisition of military equipment, manufacturing and operating them will increase carbon dioxide emissions. Worse, military buildups will also increase the risk of conflict, potentially leading to a catastrophic war that could involve nuclear weapons.

**Steps to prolif cause pre-emption,**

**Hoffmann 24,** Fabian Hoffmann, 01/29/2024, “The Future of the Zeitenwende: Scenario 5—Poland Becomes a Nuclear Power,” International Politik Quarterly [https://ip-quarterly.com/en/future-zeitenwende-scenario-5-poland-becomes-nuclear-power]

Similarly, given that Polish nuclear proliferation might occur in the context of a crumbling nuclear order where non-proliferation norms have already been drastically undermined by several other instances of nuclear proliferation, any outcry based on the normative implications of Polish nuclear proliferation may be limited.  Finally, active **steps by Poland toward a nuclear deterrent** may temporarily destabilize the European security environment, due to **heighten**ed **pressures on** the **Russia**n side **for** military **operations** aimed at **preempting a Polish** nuclear **arsenal.** Once Poland has acquired nuclear weapons, Poland’s nuclear deterrent may serve to reinforce European deterrence. This being said, the exact dynamics that a Polish nuclear acquisition might induce into Europe’s security architecture are impossible to predict from today’s point of view.

**NATO-Russia war goes nuclear,**

**Kulesa 18,** Lukasz Kulesa, 02/01/2018, "Envisioning a Russia-NATO Conflict: Implications for Deterrence Stability,” JSTOR [ https://www.jstor.org/stable/resrep17437]

Escalation: Can a NATO - Russia conflict be managed? Once a conflict was under way, the “fog of war” and rising unpredictability would inevitably set in, complicating the implementation of any predetermined theories of escalation, deescalation and inter-conflict management. The actual dynamics of a conflict and the perceptions of the stakes involved are extremely difficult to predict. Simulations and table-top exercises can give only limited insights into the actual decision-making processes and interactions. Still, **Russian military** theorists and practitioners seem to **assume** that a **conflict** with NATO **can be managed** and controlled in a way that would bring it to a swift end consistent with Russian aims. The Russian theory of victory would seek to exploit weak points in an Alliance war effort. Based on the conviction that democracies are weak **and** their leaders and populations are risk-averse, Russia may assume that its threats of horizontal or vertical **escalation could be** particularly **effective**. It would also try to bring home the notion that it has much higher stakes in the conflict (regime survival) than a majority of the NATO members involved, and thus will be ready to push the boundaries of the conflict further. It would most likely try to test and exploit potential divisions within the Alliance, combining selective diplomacy and activation of its intelligence assets in some NATO states with a degree of selectivity in terms of targets of particular attacks. **Any** NATO-Russia **conflict would** inevitably **have a nuclear dimension**. The role of nuclear weapons as a tool for escalation control for Russia has been thoroughly debated by experts, but when and how Russia might use (and not merely showcase or activate) nuclear weapons in a conflict remains an open question. Beyond catch phrases such as “escalate to de-escalate” or “escalate to win” there are a wider range of options for Russian nuclear weapon use. For example, a single nuclear warning shot could be lethal or non-lethal. It could be directed against a purely military target or a military-civilian one. Detonation could be configured for an EMP effect. A “false flag” attack is also conceivable. These options might be used to signal escalation and could significantly complicate NATO’s responses. Neither NATO nor its member states have developed a similar theory of victory. Public NATO documents stipulate the general goals for the Alliance: defend against any armed attack and, as needed, restore the full sovereignty and territorial integrity of member states. It is less clear how far the Alliance would be willing to escalate the conflict to achieve these goals, and what mechanisms and means it would use while trying to maintain some degree of control over the conflict. The goals and methods of waging a conflict with Russia would probably have to be limited in order to avoid a massive nuclear exchange. Such limitations would also involve restrictions on striking back against targets on Russian territory. But too narrow an approach could put too much restraint on NATO’s operations: the Russian regime’s stability may ultimately need to be threatened in order to force the leadership into terminating the conflict. NATO would thus need to establish what a proportional self-defence response to Russian actions would involve, and to what extent cyber operations or attacks against military targets in quite different parts of Russia would be useful as tools of escalation to signal NATO’s resolve. Moreover, individual NATO Allies, especially those directly affected by Russia’s actions, might pursue their individual strategies of escalation. With regards to the nuclear dimension in NATO escalation plans, given the stakes involved, this element would most likely be handled by the three nuclear-weapon members of the Alliance, with the US taking the lead. The existence of three independent centres of nuclear decision-making could be exploited to complicate Russian planning and introduce uncertainty into the Russian strategic calculus, but some degree of “P3” dialogue and coordination would be beneficial. This coordination would not necessarily focus on nuclear targeting, but rather on designing coordinated operations to demonstrate resolve in order to keep the conflict below the nuclear threshold, or bring it back under the threshold after first use. Relying on concepts of escalation control and on lessons from the Cold War confrontation might be misleading. The circumstances in which **a Russia-NATO conflict would** play out would be radically different from the 20th century screenplay. Moreover, instead of gradual (linear) escalation or salami tactics escalation, it is possible to imagine surprizing “**leap frog” escalation**, possibly connected with actions in different domains (e.g. a cyberattack against critical infrastructure). Flexibility, good intelligence and inventiveness in responding to such developments would be crucial. Russian and NATO assumptions regarding conflict termination would most likely not survive the first hours of an actual conflict. **Both sides** are capable of **underestimat**ing the **resolve of the other** side to prevail in a conflict and the other side’s willingness to commit the necessary resources and endure the costs, especially once both sides start committing their political capital and resources and the casualties accumulate.

**That’s extinction,**

**Starr 14,** Steven Starr, 5/30/14, “The Lethality of Nuclear Weapons: Nuclear War has No Winner”, Centre for Research on Globalization,<http://www.globalresearch.ca/the-lethality-of-nuclear-weapons-nuclear-war-has-no-winner/5385611>]

Paul Craig Roberts held top security clearances. He has repeatedly warned that a US-Russian nuclear war would wipe out the human race, along with all other complex forms of life. As a scientist with expert knowledge, I wish to echo and explain his warning.//// Nuclear war has no winner. Beginning in 2006, several of the world’s leading climatologists (at Rutgers, UCLA, John Hopkins University, and the University of Colorado-Boulder) published a series of studies that evaluated the long-term environmental consequences of a nuclear war, including baseline scenarios fought with merely 1% of the explosive power in the US and/or Russian launch-ready nuclear arsenals. They concluded that the consequences of **even a “small” nuclear war would include catastrophic disruptions of global climate[i] and massive destruction of** Earth’s protective **ozone** layer[ii]. These and more recent studies predict that global agriculture would be so negatively affected by such a war, **a global famine would result**, which would cause up to 2 billion people to starve to death. [iii]//// These peer-reviewed studies – which were analyzed by the best scientists in the world and found to be without error – also predict that a war fought with less than half of US or Russian strategic nuclear weapons **would destroy the human race**.[iv] In other words, a US-Russian nuclear war would create such extreme long-term damage to the global environment that it would leave the Earth uninhabitable for humans and most animal forms of life.//// A recent article in the Bulletin of the Atomic Scientists, “Self-assured destruction: The climate impacts of nuclear war”,[v] begins by stating://// “A nuclear war between Russia and the United States, even after the arsenal reductions planned under New START, could produce a nuclear winter. Hence, an attack by either side could be suicidal, resulting in self-assured destruction.” In 2009, I wrote an article[vi] for the International Commission on Nuclear Non-proliferation and Disarmament that summarizes the findings of these studies. It explains that nuclear firestorms would produce millions of tons of smoke, which would rise above cloud level and form a global stratospheric smoke layer that would rapidly encircle the Earth. The smoke layer would remain for at least a decade, and it would act to destroy the protective ozone layer (vastly increasing the UV-B reaching Earth[vii]) as well as block warming sunlight, thus creating Ice Age weather conditions that would last 10 years or longer.//// Following a US-Russian nuclear war, temperatures in the central US and Eurasia would fall below freezing every day for one to three years; the intense cold would completely eliminate growing seasons for a decade or longer. No crops could be grown, leading to a famine that would kill most humans and large animal populations.//// Electromagnetic pulse from high-altitude nuclear detonations would destroy the integrated circuits in all modern electronic devices[viii], including those in commercial nuclear power plants. Every nuclear reactor would almost instantly meltdown; every nuclear spent fuel pool (which contain many times more radioactivity than found in the reactors) would boil-off, releasing vast amounts of long-lived radioactivity. The fallout would make most of the US and Europe uninhabitable. Of course, the survivors of the nuclear war would be starving to death anyway.

**Contention Two is Water**

**Water quality has been improving, GAO 24 finds**

**GAO 24,** 09/2024, "Water Quality and Protection," [https://www.gao.gov/water-quality-and-protection] [ACC: 3-31-2025]

Safe and clean water is necessary for human and environmental health and the nation’s economic well-being. **Over the past 50 years, the nation’s water quality** and drinking water **have improved**, but threats to water quality and safety remain. For example, the Environmental Protection Agency (EPA) and the states have identified almost 70,000 water bodies nationwide that do not meet water quality standards. Further, studies show that most people in the U.S. have been exposed to per- and polyfluoralkyl substances (PFAS)—likely from contaminated water, food, or air. Known as forever chemicals, they can persist in the environment and cause adverse health effects. Additionally, emerging contaminants near military bases and other communities has renewed awareness about the risks that lead and other chemical compounds pose to public health. Nation states, cybercriminals, and hacktivists have also attacked the nation’s water and wastewater systems, making cybersecurity a top concern. Examples of How Per- and Polyfluoroalkyl Substances (PFAS) Enter the Environment Examples of How Per and Polyfluoroalkyl Substances Enter the Environment The EPA and other federal agencies face a number of challenges in ensuring that the nation has access to safe and clean water. For instance: Contaminants. Under the Safe Drinking Water Act (SDWA), EPA establishes legally enforceable standards that limit the levels of specific contaminants in drinking water. EPA identifies unregulated contaminants, monitors them, and determines whether to regulate them based on things like how dangerous they are to public health, and how often they occur. Public water systems must comply with monitoring, reporting, and other requirements established by EPA and responsible states. But the data that states reported to EPA did not always reflect the frequency of health-based and monitoring violations by community water systems or the status of enforcement actions. Regarding certain PFAS contaminants, public water systems will need to implement a treatment method by 2029. But treating PFAS in drinking water also creates waste that needs to be properly disposed of to avoid future environmental contamination.

**However, Nuclear energy is bad for water contamination, Wasserman 16 quantifies,**

**Wasserman 16,** Harvey Wasserman, 09/21/2016, “How Nuclear Power Causes Global Warming,” Transcend, [https://www.transcend.org/tms/2016/09/how-nuclear-power-causes-global-warming/]

Supporters of nuclear power like to argue that nukes are the key to combatting climate change. Here’s why they are dead wrong. Every nuclear generating station spews about two-thirds of the energy it burns inside its reactor core into the environment.Only one-third is converted into electricity. Another tenth of that is lost in transmission. According to the Union of Concerned Scientists: **Nuclear** fission **is the most water intensive method** of the principal thermoelectric generation options in terms of the amount of water withdrawn from sources. In 2008, nuclear power plants withdrew eight times as much freshwater as natural gas plants per unit of energy produced, and up to 11 percent more than the average coal plant. Every day, **large reactors** like the two at Diablo Canyon, California, individually **dump** about **1.25 billion gallons of water into the ocean** at temperatures up to **20 degrees Fahrenheit warmer than the natural environment**. Diablo’s “once-through cooling system” takes water out of the ocean and dumps it back superheated, irradiated and **laden with toxic chemicals**. Many U.S. reactors use cooling towers which emit huge quantities of steam and water vapor that also directly warm the atmosphere. These emissions are often chemically treated to prevent algae and other growth that could clog the towers. Those chemicals can then be carried downwind, along with radiation from the reactors. In addition, hundreds of thousands of birds die annually by flying into the reactor domes and towers. The Union of Concerned Scientists states: The temperature increase in the bodies of water can have serious adverse effects on aquatic life. Warm water holds less oxygen than cold water, thus discharge from once-through cooling systems can create a “temperature squeeze” that elevates the metabolic rate for fish. Additionally, suction pipes that are used to intake water can draw plankton, eggs and larvae into the plant’s machinery, while larger organisms can be trapped against the protective screens of the pipes. Blocked intake screens have led to temporary shut downs and NRC fines at a number of plants. And that’s not all. All nuclear reactors emit Carbon 14, a radioactive isotope, invalidating the industry’s claim that reactors are “carbon free.” And the fuel that reactors burn is carbon-intensive. The mining, milling, and enrichment processes needed to produce the pellets that fill the fuel rods inside the reactor cores all involve major energy expenditures, nearly all of it based on coal, oil, or gas. And of course there’s the problem of nuclear waste. After more than a half-century of well-funded attempts, we’ve seen no solution for the management of atomic power’s intensely radioactive waste. There’s the “low-level” waste involving enormous quantities of troublesome irradiated liquids and solid trash that must be dealt with outside the standard civilian waste stream. And that handling involves fossil fuels burned in the process of transportation, management, and disposal as well As for the high-level waste, this remains one of humankind’s most persistent and dangerous problems. Atomic apologists have claimed that the intensely radioactive spent fuel rods can somehow be usable for additional power generation. But after a half-century of efforts, with billions of dollars spent, all attempts to do that have utterly failed. There are zero successful reactors capable of producing more reactor fuel than they use, or able to derive more energy from the tens of thousands of tons of spent fuel rods they create. Some reactors, like Fukushima, use “mixed-oxide” fuels that have proven to be extremely dirty and expensive. It’s possible some of this “MOX” fuel containing plutonium, actually fissioned at Fukushima Unit Three, raising terrifying questions about the dangers of its use. The mushroom cloud that appears on video as Fukushima Unit Three exploded stands as an epic warning against further use of these impossible-to-manage fuels. The MOX facility under construction near Aiken, South Carolina, is now projected to require another ten years to build with another ten possible after that to phase into production. U.S. Secretary of Energy Ernest Moniz said on September 13, 2016, at the Carnegie Endowment for International Peace that the mismanaged project was "impossible" to carry out and that it could cost $30 billion to $50 billion. Even the current pro-nuclear Congress won’t fully fund the project and the Department of Energy DOE continues to recommend abandoning it. There are no credible estimates of the global warming damage done by the intensely hot explosions at the four Fukushima reactors, or at Chernobyl, or at any other past and future reactor meltdowns or blowups. Atomic apologists argue that the disposal of high-level reactor wastes should be a relatively simple problem, lacking only the political will to proceed. The industry touts New Mexico’s Waste Isolation Pilot Project, or WIPP, which has long been the poster child for military attempts to deal with high-level trash from the nuclear weapons program. Accepting its first shipment of waste in 1999, WIPP was touted as the ultimate high-tech, spare-no-expense model that proved radioactive waste disposal “can be done.” But a series of disastrous events in February, 2014, led WIPP to stop accepting wastes—the sole function for which it was designed. Most significant was the explosion of a single barrel of highly radioactive waste materials (it was mistakenly packed with organic rather than clay-based kitty litter). About a dozen WIPP workers were exposed to potentially harmful radiation. The entire facility remains closed. In a phone interview, facility management told me it may again accept some wastes before the end of this year. But at least part of the cavernous underground labyrinth may never be reopened. The Los Angeles Times estimated the cost of this single accident at $2 billion. Overall, the idea that atomic power is “clean” or “carbon free” or “emission free” is a very expensive misconception, especially when compared to renewable energy, efficiency, and conservation. Among conservation, efficiency, solar and wind power technologies, there are no global warming analogs to the heat, carbon, and radioactive waste impacts of nuclear power. No green technology kills anywhere near the number of marine organisms that die through reactor cooling systems. Rooftop solar panels do not lose ten percent of the power they generate to transmission, as happens with virtually all centralized power generators. S. David Freeman, former head of numerous large utilities and author of All Electric America: A Climate Solution and the Hopeful Future, says: “Renewables are cheaper and safer. That argument is winning. Let’s stick to it.” No terrorist will ever threaten one of our cities by blowing up a solar panel. But the nuclear industry that falsely claims its dying technology doesn’t cause global warming does threaten the future of our planet.

**Overall, Poor Water quality kills biodiversity,**

**Bagayas 24,** Mckenzie Bagayas, a human, 5-21-2024, "How Does Water Pollution Affect Aquatic Biodiversity ," Kraken Sense, https://krakensense.com/blog/water-pollution-aquatic-biodiversity, accessed 3-27-2025

“Living species variations from sources that include terrestrial, marine, different aquatic ecosystems and also ecological groups to which they belong: including diversity among species and also ecosystems.” This is the well-accepted definition of biodiversity that was made by the United Nations Convention on Biological Diversity. Biodiversity could also refer to the variety of life on Earth. Variety of life and living things can come in the form of genetic diversity among species within an ecosystem and diversity of ecological systems. Biodiversity may also include evolutionary, ecological, and cultural processes that sustain life. Biodiversity is not solely about rare, threatened, and endangered species. Instead, biodiversity is about the interconnectedness of all living things. Although we, humans, are just a single species amidst all of the living things present on this Earth, we are the only species whose actions can have a huge impact on biodiversity. With that said, we have the obligation to try our best to practice biodiversity conservation. Biodiversity - Why is it important People value biodiversity differently, some through a utilitarian lens while others value their intrinsic value. Biodiversity in some form or way is capable of providing for our basic needs like food, fuel, shelter, and even medicine. This is where the utilitarian perspective of the value of biodiversity comes in. Being conscious of the utilitarian value of biodiversity leads to the appreciation of ecosystems. With the appreciation and care of ecosystems natural and beneficial processes such as pollination, seed dispersal, climate regulation, water purification, nutrient cycling, and control of agricultural pests are improved. The utilitarian value of biodiversity could also come in the form of possible unknown services and the possibility of discovering new medicines. Moreover, people also value biodiversity for their cultural, spiritual, and religious value. Biodiversity also holds intrinsic value. In other words, people value biodiversity for its inherent worth regardless of its value to anyone or anything else. The intrinsic value of biodiversity is more of a philosophical concept that can stem from an individual’s belief in the right to exist regardless of species. People may also value biodiversity for its relational value. We find value in the intricate relationships we form with nature. These relationships impart a sense of wellbeing, responsibility, and connection. The various ways people value biodiversity are important because this can be leveraged to influence conservation decisions people make every day. How does water pollution affect Biodiversity? For aquatic environments, pollution poses a serious issue as it can cause variations in the environmental conditions to which aquatic organisms are sensitive. **Aquatic organisms respond to drastic changes in their environment by migrating to any other suitable habitat or in extreme cases they just die off.** In less extreme cases only the reproductive capacity **and** metabolism of the aquatic organisms are affected negatively. However, this can **have a negative consequence on their population in the long run.** Every species present in various trophic levels is important for freshwater ecosystems. Zooplankton and macrobenthic organisms modulate the aquatic productivity of aquatic ecosystems by occupying the intermediate level in the food chain. The aforementioned aquatic organisms are also capable of indicating changes in the aquatic environment. Recent studies have demonstrated that some species of zooplankton and macrobenthic organisms can be used as an indicator of deteriorating water quality resulting from eutrophication and or pollution. The intricate relationships between species in a food web are important. Fish numbers may start to dip as a result of food chain disruption and diversity loss or degradation. The relationship between biodiversity decline and food chain disruption was demonstrated when data from two separate studies about the Egyptian Nile waters conducted several years apart were compared side by side. In 1907 the first study reported that there are a total of 85 fish species in the Egyptian Nile waters. However, the second study, which was conducted in 1997, reported that there are a total of 71 fish species. This significant reduction in fish species has been attributed to several pollution sources generated by industrial activities, agricultural sources, and sewage drains. These findings showed evidence that pollution can reduce species diversity and affect the fish population. Studies have also shown that pollution can make rivers more susceptible to drastic changes. In one study, researchers investigated the effects of rising water temperature and low oxygen levels brought about by pollution on the common mayfly species. Mayfly species are considered cool water insects and they are used as bioindicators that help determine ecologically important features of freshwater ecosystems. During warmer seasons, they have trouble thriving in polluted waters due to elevated temperatures and reduced dissolved oxygen; conditions that the mayfly species are not accustomed to. In a controlled laboratory setting, mayfly species such as the green drake and blue-winged olive, or Ephemera danica and Serratella ignita respectively, are capable of tolerating higher temperatures where dissolved oxygen levels are sufficient. Lowered oxygen levels, near depletion, can lower the mayflies’ ability to tolerate temperature extremes. These laboratory findings were substantiated by field study data. Analysis of data collected by the Environment Agency and Natural Resources Wales demonstrated that mayflie populations dropped when the freshwater oxygen concentration decreased and temperature increased. So with all the findings of the studies combined, there is strong evidence that water pollution can reduce dissolved oxygen in freshwater environments and increase temperature. Moreover, reductions in dissolved oxygen compromised the mayflies’ ability to survive temperature extremes. Their ability to increase in numbers was also severely restricted even at temperatures below the lethal limits. Improving dissolved oxygen levels in freshwater environments is one method of improving their resilience against rising temperatures. By reducing the amount of pollution, especially those of agricultural origins, the freshwater environment can absorb oxygen better. This is supported by a review published in Global Change Biology, which mentioned that there is growing evidence that freshwater ecosystems that contain minimal pollution are resilient against changes brought about by climate change. Pollution reduction may also help improve biodiversity in the freshwater ecosystem.

**Mass biodiversity loss would cause cataclysmic extinction for all species, including humans,**

**University of Exeter 18,** 02/19/2018, “Biodiversity loss raises risk of 'extinction cascades” Science Daily, [https://www.sciencedaily.com/releases/2018/02/180219155019.htm#:~:text=New%20research%20shows%20that%20the,domino%20effect%20of%20further%20extinctions.&text=%22And%20because%20sp ecies%20are%20interconnected,can%20affect%20others%20as%20well]

The researchers, from the University of Exeter, showed there is a higher risk of extinction cascades when other species are not present to fill the "gap" created by the loss of a species. Even if **the loss of one species** does not directly cause knock-on extinctions, the study shows that this **leads to** simpler ecological communities that are at **greater risk of "run-away extinction cascades**" with the potential loss of many species. With extinction rates at their highest levels ever and numerous species under threat due to human activity, the findings are a further warning about the consequences of eroding biodiversity. "Interactions between species are important for ecosystem (a community of interacting species) stability," said Dr Dirk Sanders, of the Centre for Ecology and Conservation at the University of Exeter's Penryn Campus in Cornwall. "And because species are interconnected through multiple interactions, **an impact on one species can affect others as well.** "It has been predicted that more complex food webs will be less vulnerable to extinction cascades because there is a greater chance that other species can step in and buffer against the effects of species loss. "In our experiment, we used communities of plants and insects to test this prediction." The researchers removed one species of wasp and found that it led to secondary extinctions of other, indirectly linked, species at the same level of the food web. This effect was much stronger in simple communities than for the same species within a more complex food web. Dr Sanders added: "Our results demonstrate that **biodiversity loss can increase the vulnerability of ecosystems to secondary extinctions** which, when they occur, can then lead to further simplification causing run-away extinction cascades." The study, supported by France's Sorbonne Université, is published in the journal Proceedings of the National Academy of Sciences. The paper is entitled: "Trophic redundancy reduces vulnerability to extinction cascades." How extinction cascades work The loss of a predator can initiate a cascade, such as in the case of wolves, where their extinction on one mountain can cause a large rise in the number of deer. This larger number of deer then eats more plant material than they would have before. This reduction in vegetation can cause extinctions in any species that also relies on the plants, but are potentially less competitive, such as rabbits or insects.

**Independently, mass Biodiversity loss causes nuclear war,**

**Torres 16,** TORRES Institute for Ethics and Emerging Technologies 2016 (Phil, affiliate scholar at the Institute for Ethics and Emerging Technologies, “Biodiversity Loss and the Doomsday Clock: An Invisible Disaster Almost No One Is Talking About”, Common Dreams, Feb 10, , [CORNELL DBT] note://// indicates par.breaks)[AR UMW17]

But there’s another global catastrophe that the Bulletin neglected to consider — a catastrophe that will almost certainly have conflict multiplying effects no less than climate change. I’m referring here to biodiversity loss — i.e., the reduction in the total number of species, or in their population sizes, over time. The fact is that in the past few centuries, the loss of biological diversity around the world has accelerated at an incredible pace. Consider the findings of a 2015 paper published in Science Advances. According to this study, we’ve only recently entered the early stages of the sixth mass extinction event in life’s entire 3.5 billion year history. The previous mass extinctions are known as the “Big Five,” and the last one wiped out the dinosaurs some 65 million years ago. Unlike these past tragedies, though, the current mass extinction — called the “Holocene extinction event” — is almost entirely the result of a one species in particular, namely Homo sapiens (which ironically means the “wise man”).//// But biodiversity loss isn’t limited to species extinctions. As the founder of the Long Now Institute, Stewart Brand, in an article for Aeon, one could argue that a more pressing issue is the reduction in population sizes around the globe. For example, the (GBO-3), published in 2010, found that the total abundance of vertebrates — a category that includes mammals, birds, reptiles, sharks, rays, and amphibians — living in the tropics declined by a whopping 59% between 1970 and 2006. In other words, the population size of creatures with a spine more than halved in only 36 years. The study also found that farmland birds in Europe have declined by 50% since 1980, birds in North America have declined by 40% between 1968 and 2003, and nearly 25% of all plant species are currently “threatened with extinction.” The latter statistic is especially worth noting because many people suffer from what’s called “,” according to which we fail “to recognize the importance of plants in the biosphere and in human affairs.” Indeed, plants form the very bottom of the food chains upon which human life ultimately depends.//// Even more disturbing is the claim that amphibians “face the greatest risk” of extinction, with “42% of all amphibian species … declining in population,” as the GBO-3 reports. Consistent with this, from 2013 that focused on North America found that “frogs, toads and salamanders in the United States are disappearing from their habitats … at an alarming and rapid rate,” and are projected to “disappear from half of the habitats they currently occupy in about 20 years.” The decline of amphibian populations is ominous because amphibians are “ecological indicators” that are more sensitive to environmental changes than other organisms. As such they are the “canaries in the coal mine” that reflect the overall health of the ecosystems in which they reside. When they start to disappear, bigger problems are sure to follow.//// Yet comes from the Living Planet Report — and its results are no less dismal than those of the GBO-3. For example, it finds that the global population of vertebrates between 1970 and 2010 dropped by an unbelievable 52%. Although the authors refrain from making any predictions based on their data, the reader is welcome to extrapolate this trend into the near future, noting that **as ecosystems weaken**, the **likelihood of further population losses increases**. This study thus concludes that humanity would “need 1.5 Earths to meet the demands we currently make on nature,” meaning that we either need to reduce our c ollective consumption and adopt less myopic economic policies or hurry up and start colonizing the solar system.//// Other studies have found that , , , and are currently threatened with extinction. There’s also talk about the Cavendish banana , and research has confirmed that honey bees, “the most important insect that transfers pollen between flowers and between plants,” are dying out around the world at an alarming rate due to what’s called “colony collapse disorder” — perhaps a good metaphor for our technologically advanced civilization and its self-destructive tendencies.//// Turning to the world’s oceans, one finds few reasons for optimism here as well. Consider the fact that atmospheric carbon dioxide — the byproduct of burning fossil fuels — is not only warming up the oceans, but it’s making them . The resulting changes in ocean chemistry are inducing a process known as “coral bleaching,” whereby coral loses the algae (called “zooxanthellae”) that it needs to survive. Today, . This has direct consequences for humanity “provide us with food, construction materials (limestone) and new medicines,” and in fact “more than half of new cancer drug research is focused on marine organisms.” Similarly, yet found that ocean acidification is becoming so pronounced that the shells of “tiny marine snails that live along North America’s western coast” are literally dissolving in the water, resulting in “pitted textures” that give the shells a “cauliflower” or “sandpaper” appearance.//// Furthermore, human-created pollution that makes its way into the oceans is carving out vast regions in which the amount of dissolved oxygen is too low for marine life to survive. These regions are called “dead zones,” and by Robert Diaz and his colleagues found more than 500 around the world. The biggest dead zone discovered so far is located in the Baltic Sea, and it’s been estimated to be about 27,000 square miles, or a little less than the size of New Hampshire, Vermont, and Maryland combined. Scientists have even discovered an “island” of trash in the middle of the Pacific called the “Great Pacific Garbage Patch” that could be up to “.” Similar “patches” of floating plastic debris can be found in the Atlantic and Indian oceans as well, although these are not quite as impressive. The point is that “Earth’s final frontier” — the oceans — are becoming vast watery graveyards for a huge diversity of marine lifeforms, and in fact in Science predicts that there could be virtually no more wild-caught seafood by 2048.//// Everywhere one looks, the biosphere is wilting — and a single bipedal species with large brains and opposable thumbs is almost entirely responsible for this worsening plight. If humanity continues to prune back the Tree of Life with reckless abandon, we could be forced to confront a global disaster of truly unprecedented proportions. Along these lines, published in Nature and authored by over twenty scientists claims that humanity could be teetering on the brink of a catastrophic, irreversible collapse of the global ecosystem. According to the paper, **there could be “tipping points”** — also called “critical thresholds” — lurking in the environment that, **once crossed, could initiate** radical and **sudden changes** in the biosphere. Thus, an event of this sort could be preceded by little or no warning: everything might look more or less okay, until the ecosystem is suddenly in ruins.//// We must, moving forward, never forget that just as we’re minds embodied, so too are we bodies environed, meaning that **if the environment implodes** under the weight of civilization, then **civilization itself is doomed**. While the threat of nuclear weapons deserves serious attention from political leaders and academics, as the Bulletin correctly observes, it’s even more imperative that we focus on the broader “contextual problems” **that could inflate** the overall **probability of wars** and terrorism in the future. Climate change and **biodiversity loss** are both **conflict multipliers** of precisely this sort, and each is a contributing factor that’s exacerbating the other. If we fail to make these threats a top priority in 2016, the **likelihood of nuclear weapons** — or some other form of emerging technology, including biotechnology and artificial intelligence — **being used in the future will only increase.**//// Perhaps there’s still time to avert the sixth mass extinction or a sudden collapse of the global ecosystem. But time is running out — the doomsday clock is ticking

**Draw-in causes extinction,**

**Clare 25,** Stephen Clare, 03/18/2025, “Great power war,” 8000 Hours [https://80000hours.org/problem-profiles/great-power-conflict/]

A modern great power war could see nuclear weapons, bioweapons, autonomous weapons, and other destructive new technologies deployed on an unprecedented scale. It would probably be the most destructive event in history, shattering our world. It could even threaten us with extinction. We’ve come perilously close to just this kind of catastrophe before.¶ On October 27, 1962 — near the peak of the Cuban Missile Crisis — an American U-2 reconnaissance plane set out on a routine mission to the Arctic to collect data on Soviet nuclear tests. But, while flying near the North Pole, with the stars obscured by the northern lights, the pilot made a navigation error and strayed into Soviet airspace.1¶ Soviet commanders sent fighter jets to intercept the American plane. The jets were picked up by American radar operators and nuclear-armed F-102 fighters took off to protect the U-2.¶ Fortunately, the reconnaissance pilot realised his error with enough time to correct course before the Soviet and American fighters met. But the intrusion enraged Soviet Premier Nikita Khrushchev, who was already on high alert amidst the crisis in Cuba.¶ “What is this, a provocation?” Khrushchev wrote to US President John F. Kennedy. “One of your planes violates our frontier during this anxious time when everything has been put into combat readiness.”¶ If the U-2’s path had strayed further west, or the Soviet fighters had been fast enough to intercept it, this incident could have played out quite differently. Both the United States and the USSR had thousands of nuclear missiles ready to fire. Instead of a nearly-forgotten anecdote, the U-2 incident could have been a trigger for war, like the assassination of Franz Ferdinand.¶ Competition among the world’s most powerful countries shapes our world today. And whether it’s through future incidents like the lost U-2, or something else entirely, it’s plausible that it could escalate and lead to a major, devastating war.¶ Is there anything you can do to help avoid such a terrible outcome? It is, of course, difficult to imagine how any one individual can hope to influence such world-historical events. Even the most powerful world leaders often fail to predict the global consequences of their decisions.¶ But I think the likelihood and severity of great power war makes this among the most pressing problems of our time — and that some solutions could be impactful enough that working on them may be one of the highest-impact things to do with your career.¶ By taking action, I think we can create a future where the threat of great power war is a distant memory rather than an ever-present danger.¶ Summary¶ Economic growth and technological progress have bolstered the arsenals of the world’s most powerful countries. That means the next war between them could be far worse than World War II, the deadliest conflict humanity has yet experienced.¶ Could such a war actually occur? We can’t rule out the possibility. Technical **accidents or** diplomatic **misunderstandings could** spark a conflict that quickly **escalate**s. Or international **tension** could **cause leaders to** decide they’re better off **fight**ing **than negotiat**ing. It seems hard to make progress on this problem. It’s also less neglected than some of the problems that we think are most pressing. There are certain issues, like making nuclear weapons or military artificial intelligence systems safer, which seem promising — although it may be more impactful to work on reducing risks from AI, bioweapons or nuclear weapons directly. You might also be able to reduce the chances of misunderstandings and miscalculations by developing expertise in one of the most important bilateral relationships (such as that between the United States and China).¶ Finally, by making conflict less likely, reducing competitive pressures on the development of dangerous technology, and improving international cooperation, you might be helping to reduce other risks, like the chance of future pandemics.¶ Our overall view¶ Recommended¶ Working on this issue seems to be among the best ways of improving the long-term future we know of, but all else equal, we think it’s less pressing than our highest priority areas (primarily because it seems less neglected and harder to solve).¶ Scale There’s a significant chance that a new great power war occurs this century.¶ Although the world’s most powerful countries haven’t fought directly since World War II, war has been a constant throughout human history. There have been numerous close calls, and several issues could cause diplomatic disputes in the years to come.¶ These considerations, along with forecasts and statistical models, lead me to think there’s about a one-in-three chance that a new great power war breaks out in roughly the next 30 years.¶ Few wars cause more than a million casualties and the next great power war would probably be smaller than that. However, there’s some chance it could escalate massively. Today the great powers have much larger economies, more powerful weapons, and bigger military budgets than they did in the past. An all-out war could kill far more people than even World War II, the worst war we’ve yet experienced.¶ Could it become an existentially threatening war — one that could cause human extinction or significantly damage the prospects of the long-term future? It’s very difficult to say. But my best current guess is that the chance of an existential catastrophe due to war in the next century is somewhere between 0.05% and 2%.¶ Neglectedness War is a lot less neglected than some of our other top problems. There are thousands of people in governments, think tanks, and universities already working on this problem. But some solutions or approaches remain neglected. One particularly promising approach is to develop expertise at the intersection of international conflict and another of our top problems. Experts who understand both geopolitical dynamics and risks from advanced artificial intelligence, for example, are sorely needed.¶ Solvability Reducing the risk of great power war seems very difficult. But there are specific technical problems that can be solved to make weapons systems safer or less likely to trigger catastrophic outcomes. And in the best case, working on this problem can have a leverage effect, making the development of several dangerous technologies safer by improving international cooperation and making them less likely to be deployed in war.¶ At the end of this profile, I suggest five issues which I’d be particularly excited to see people work on. These are:¶ Developing expertise in the riskiest bilateral relationships¶ Learning how to manage international crises quickly and effectively and ensuring the systems to do so are properly maintained¶ Doing research to improve particularly important foreign policies, like strategies for sanctions and deterrence¶ Improving how nuclear weapons and other weapons of mass destruction are governed at the international level¶ Improving how such weapons are controlled at the national level¶ Why might preventing great power war be an especially pressing problem?¶ A modern great power war — an all-out conflict between the world’s most powerful countries — could be the worst thing to ever happen to humanity.¶ Historically, such wars have been exceptionally destructive. Sixty-six million people died in World War II, likely the deadliest catastrophe humanity has experienced so far.¶ Since World War II, the global population and world economy have continued to grow, nuclear weapons have proliferated, and military technology has continued to advance. This means the next world war could be even worse, just as World War II was much deadlier than World War I.¶ It’s not guaranteed that such a war will break out. And if it does, it may not escalate to such a terrible extent. But the chance can’t be ignored. In fact, there are reasons to think that the odds of World War III breaking out this century are worryingly high.¶ A modern great power war would be devastating for people alive today. But its effects could also persist long into the future. That’s because there is a substantial chance that this century proves to be particularly important. Technologies with the potential to cause a global catastrophe or radically reshape society are likely to be invented. How we choose to develop and deploy them could impact huge numbers of our descendants. And these choices would be affected by the outcomes of a major war.¶ To be more specific, there are three main ways great power conflict could affect the long-term future:¶ High international tension could increase other risks. Great power tensions could make the world more dangerous even if they don’t lead to war. During the Cold War, for example, the United States and the USSR never came into direct conflict but invested in bioweapons research and built up nuclear arsenals. This dynamic could return, with tension between great powers fueling races to develop and build new weapons, raising the risk of a disaster even before shots are fired.¶ War could cause an existential catastrophe. If war does break out, it could escalate dramatically, with modern weapons (nuclear weapons, bioweapons, autonomous weapons, or other future technologies) deployed at unprecedented scale. The resulting destruction could irreparably damage humanity’s prospects.¶ War could reshape international institutions and power balances. While such a catastrophic war is possible, it seems extremely unlikely. But even a less deadly war, such as another conflict on the scale of World War II, could have very long-lasting effects. For example, it could reshape international institutions and the global balance of power. In a pivotal century, different institutional arrangements and geopolitical balances could cause humanity to follow different long-term trajectories.¶ The rest of this profile explores exactly how pressing a problem great power conflict is. In summary:¶ Great power relations have become more tense. (More.)¶ Partly as a result, a war is more likely than you might think. It’s reasonable to put the probability of such a conflict in the coming decades somewhere between 10% and 50%. (More.)¶ If war breaks out, it would probably be hard to control escalation. The chance that it would become large enough to be an existential risk cannot be dismissed. (More.)¶ This makes great power war one of the biggest threats our species currently faces. (More.)¶ It seems hard to make progress on solving such a difficult problem (more) — but there are many things you can try if you want to help (more).¶ International tension has risen and makes other problems worse¶ Imagine we had a thermometer-like device which, instead of measuring temperature, measured the level of international tension.2 This ‘tension metre’ would max out during periods of all-out global war, like World War II. And it would be relatively low when the great powers3 were peaceful and cooperative. For much of the post-Napoleonic 1800s, for example, the powerful European nations instituted the Concert of Europe and mostly upheld a continental peace. The years following the fall of the USSR also seem like a time of relative calm, when the tension metre would have been quite low.4¶ How much more worried would you be about the coming decades if you knew the tension metre would be very high than if you knew it would be low? Probably quite a lot. In the worst case, of course, the great powers could come into direct conflict. But even if it doesn’t lead to war, a high level of tension between great powers could accelerate the development of new strategic technologies, make it harder to solve global problems like climate change, and undermine international institutions.¶ During the Cold War, for instance, the United States and USSR avoided coming into direct conflict. But the tension metre would still have been pretty high. This led to some dangerous events:¶ A nuclear arms race. The number of nuclear warheads in the world grew from just 300 in 1950 to over 64,000 in 1986.¶ The development of new bioweapons. Despite signing the Biological Weapons Convention in 1972, the search for military advantages motivated Soviet decision makers to continue investing in bioweapon development for decades. Although never used in combat, biological agents were accidentally released from research facilities, resulting in dozens of deaths and threatening to cause a pandemic.5¶ Nuclear close calls. Military accidents and false alarms happened regularly, and top decision makers were more likely to interpret these events hostilely when tensions were high. On several occasions it seems the decision about whether or not to start a nuclear war came down to individuals acting under stress and with limited time.¶ This makes international tension an existential risk factor. It’s connected to a number of other problems, which means reducing the level of international tension would lower the total amount of existential risk we face.¶ The level of tension today¶ Recently, international tension seems to have once again been rising. To highlight some of the most salient examples:¶ China-United States relations have deteriorated, leading to harsh diplomatic rhetoric and protectionist trade policies that aim to reduce the countries’ economic interdependence.¶ Russia’s invasion of Ukraine has killed about a hundred thousand people so far, raised the risk of nuclear war, and sent United States-Russia relations to their lowest point since the Cold War.¶ Chinese and Indian soldiers fought deadly skirmishes along their countries’ disputed border in 2020–21.¶ These dynamics raise an important question: how much more dangerous is the world given this higher tension than it would be in a world of low tension?¶ I think the answer is quite a bit more dangerous — for several reasons. First, international tension seems likely to make technological progress more dangerous. There’s a good chance that, in the coming decades, humanity will make some major technological breakthroughs. We’ve discussed, for example, why one might worry about the effects of advanced artificial intelligence systems or biotechnology. The level of tension could strongly affect how these technologies are developed and governed. Tense relations could, for example, cause countries to neglect safety concerns in order to develop technology faster.6¶ Second, great power relations will strongly influence how nations do, or do not, cooperate to solve other global collective action problems. For example, in 2022, China withdrew from bilateral negotiations with the United States over climate action in protest of what it perceived as American diplomatic aggression in Taiwan. That same year, efforts to strengthen the Biological Weapons Convention were reportedly hampered by the Russian delegation after their country’s invasion of Ukraine raised tensions with the United States and other western countries.¶ And third, if relations deteriorate severely, the great powers could fight a war.¶ How likely is a war?¶ Wars are destructive and risky for all countries involved. Modern weapons, especially nuclear warheads, make starting a great power war today seem like a suicidal undertaking.¶ But factors like the prevalence of war throughout history, the chance that leaders make mistakes, conflicting ideologies, and commitment problems, make me think that conflict could break out anyway.¶ On balance, I think such an event is somewhat unlikely but hardly unthinkable. To quantify this: I put the chance we experience some kind of war between great powers before 2050 at about one-in-three.7¶ War has occurred regularly in the past¶ One reason to think a war is quite likely is that such conflicts have been so common in the past. Over the past 500 years, about two great power wars have occurred per century.8¶ Naively, this would mean that every year there’s a 2% chance such a war occurs, implying the chance of experiencing at least one great power war over the next 80 years — roughly until the end of the century — is about 80%.9¶ This is a very simple model. In reality, the risk is not constant over time and independent across years. But it shows that if past trends simply continue, the outcome is likely to be very bad.¶ Has great power war become less likely?¶ One of the most important criticisms of this model is that it assumes the risk is constant over time. Some researchers have argued instead that, especially since the end of World War II, major conflicts have become much less likely due to:¶ Nuclear deterrence: Nuclear weapons are so powerful and destructive that it’s just too costly for nuclear-armed countries to start wars against each other.10¶ Democratisation: Democracies have almost never gone to war against each other, perhaps because democracies are more interconnected and their leaders are under more public pressure to peacefully resolve disputes with each other.11 The proportion of countries that are democratic has increased from under 10% in 1945 to about 50% today.¶ Strong economic growth and global trade: Global economic growth accelerated following World War II and the value of global exports grew by a factor of almost 30 between 1950 and 2014. Since war disrupts economies and international trade, strong growth raises the costs of fighting.12¶ The spread of international institutions: Multilateral bodies like the United Nations General Assembly and Security Council promote diplomatic dialogue and facilitate coordination to punish transgressors.13¶ It is true that we are living through an unusually long period of great power peace. It’s been about 80 years since World War II. We just saw that a simple model using the historical frequency of great power wars suggests there was only a 20% chance of going that long without at least one more war breaking out. This is some evidence in favour of the idea that wars have become significantly less common.¶ At the same time, we shouldn’t feel too optimistic.¶ The numerous close calls during the Cold War suggest we were somewhat lucky to avoid a major war in that time. And a 20% chance of observing 80 years of peace is not that low.14 Structural changes might have dramatically reduced the likelihood of war. Or perhaps we’ve just been lucky. It could even be that technological advances have made war less likely to break out, but more deadly when it occurs, leaving the overall effect on the level of risk ambiguous. It just hasn’t been long enough to support a decisive view.15¶ So while the recent historical trend is somewhat encouraging, we don’t have nearly enough data to be confident that great power war is a thing of the past. To better predict the likelihood of future conflict, we should also consider distinctive features of our modern world.16¶ One might think that a modern great power war would simply be so destructive that no state leader would ever choose to start one. And some researchers do think that the destruction such a war would wreak globally makes it less likely to occur. But it would be hard to find anyone who claims this dynamic has driven the risk to zero.¶ First, a war could be started by accident.¶ Second, sometimes even prudent leaders may struggle to avoid a slide towards war.¶ We could blunder into war¶ An accidental war can occur if one side mistakes some event as an aggressive action by an adversary.¶ This happened several times during the Cold War. The earlier example of the wayward American reconnaissance plane shows how routine military exercises carry some escalation risk. Similarly, throughout history, nervous pilots and captains have caused serious incidents by attacking civilian planes and ships.17 Nuclear weapons allow for massive retaliatory strikes to be launched quickly — potentially too quickly to allow for such situations to be explained and de-escalated.¶ It is perhaps more likely, though, that an accidental war could be triggered by a technological malfunction. Faulty computers and satellites have previously triggered nuclear close calls. As monitoring systems have become more reliable, the rate at which such accidents have occurred has been going down. But it would be overconfident to think that technological malfunctions have become impossible.¶ Future technological changes will likely raise new challenges for nuclear weapon control. There may be pressure to integrate artificial intelligence systems into nuclear command and control to allow for faster data processing and decision making. And AI systems are known to behave unexpectedly when deployed in new environments.18¶ New technologies will also create new accident risks of their own, even if they’re not connected to nuclear weapon systems. Although these risks are hard to predict, they seem significant. I’ll say more about how such technologies — including AI, nuclear, biological, and autonomous weapons — are likely to increase war risks later.¶ Leaders could choose war¶ All that said, most wars have not started by accident. If another great power war does break out in the coming decades, it is more likely to be an intentional decision made by a national leader.¶ Explaining why someone might make such a costly, destructive, unpredictable, and risky decision has been called “the central puzzle about war.” It has motivated researchers to search for “rationalist” explanations for war. In his 2022 book Why We Fight, for example, economist Chris Blattman proposes five basic explanations: unchecked interests, intangible incentives, uncertainty, commitment problems, and misperceptions.19¶ This section discusses how great power tensions may escalate to war in the next few decades. It focuses on three potential conflicts in particular: war between the US and China, between the US and Russia, and between China and India. These are discussed because each of these countries are among the world’s largest economies and military spenders, and seem particularly likely to fight. At the end, I briefly touch on other potential large conflicts.¶ United States-China¶ The most worrying possibility is war between the United States and China. They are easily the world’s largest economies. They spend by far the most on their militaries. Their diplomatic relations are tense and have recently worsened. And their relationship has several of the characteristics that Blattman identifies as causes of war.¶ At the core of the United States-China relationship is a commitment problem.¶ China’s economy is growing faster than the United States’. By some metrics, it is already larger.20 If its differential growth continues, the gap will continue to widen between it and the United States. While economic power is not the sole determinant of military power, it is a key factor.21¶ The United States and China may be able to strike a fair deal today. But as China continues to grow faster, that deal may come to seem unbalanced. Historically, such commitment problems seem to have made these kinds of transition periods particularly dangerous.22¶ In practice, the United States and China may find it hard to agree on rules to guide their interactions, such as how to run international institutions or govern areas of the world where their interests overlap.¶ The most obvious issue which could tip the United States-China relationship from tension into war is a conflict over Taiwan. Taiwan’s location and technology industries are valuable for both great powers.¶ This issue is further complicated by intangible incentives.¶ For the United States, it is also a conflict over democratic ideals and the United States’ reputation for defending its allies.¶ For China, it is also a conflict about territorial integrity and addressing what are seen as past injustices.¶ Still, forecasts suggest that while a conflict is certainly possible, it is far from inevitable. As of 8 June 2023, one aggregated forecast23 gives a 17% chance of a United States-China war breaking out before 2035.24¶ A related aggregated forecast of the chance that at least 100 deaths occur in conflict between China and Taiwan by 2050 gives it, as of 8 June 2023, a much higher 68% chance of occurring.25¶ United States-Russia¶ Russia is the United States’ other major geopolitical rival.¶ Unlike China, Russia is not a rival in economic terms: even after adjusting for purchasing power, its economy is only about one-fifth the size of the United States’.¶ However, Russia devotes a substantial fraction of its economy to its military. Crucially, it has the world’s largest nuclear arsenal. And Russian leadership has shown a willingness to project power beyond their country’s borders.¶ Top five countries by estimated military spending, 2021. Source: SIPRI¶ Russia’s 2022 invasion of Ukraine demonstrated the dangers of renewed rivalry between Russia and the United States-led West. The war has already been hugely destructive: the largest war in Europe since World War II, with hundreds of thousands of casualties already and no end to the conflict in sight. And it could get much worse. Most notably, Russian officials have repeatedly refused to rule out the use of nuclear weapons.¶ Unchecked interests and intangible incentives are again at play here. Vladimir Putin leads a highly-centralised government. He has spoken about how his desire to rebuild Russia’s reputation played in his decision to invade Ukraine.¶ Given their ideological differences and history of rivalry, it is reasonable to expect that the United States and Russia will continue to experience dangerous disagreements in the future. As of 8 June 2023, an aggregated forecast gives a 20% chance that the United States and Russia will fight a war involving at least 1,000 battle deaths before 2050.¶ China-India¶ India is already the world’s third-largest economy. If national growth rates remain roughly constant, the size of the Indian economy will surpass that of the United States’ sometime this century. India also has nuclear weapons and is already the world’s third-largest military spender (albeit at a much lower level than China or the United States).¶ One reason to worry that China and India could fight a war is that they already dispute territory along their border. Countries that share a border, especially when it is disputed, are more likely to go to war than countries that do not. By one count, 88% of the wars that occurred between 1816 and 1980 began as wars between neighbours.26¶ In fact, China and India already fought a brief but violent border war in 1962. Deadly skirmishes have continued since, resulting in deaths as recently as 2020.¶ Forecasters agree that a China-India conflict seems relatively (though not absolutely) likely. An aggregated forecast gives a 19% chance of war before 2035.¶ Other dangerous conflicts¶ These three conflicts — United States-China, United States-Russia, and China-India — are not the only possible great power wars that could occur. Other potential conflicts could also pose existential risk, either because they drive dangerous arms races or see widespread deployment of dangerous weapons.¶ We should keep in mind India-Pakistan as a particularly likely conflict between nuclear-armed states and China-Russia as a potential, though unlikely, conflict between great powers with a disputed border and history of war. Plus, new great powers may emerge or current great powers may fade in the years to come.¶ While I think we should prioritise the three potential conflicts I’ve highlighted above, the future is highly uncertain. We should monitor geopolitical changes and be open to changing our priorities in the future.¶ Overall predictions¶ Below is a table listing relevant predictions from the forecasting platform Metaculus, including the number of predictions made, as of 10 March 2023. Note the different timescales and resolution criteria for each question; they may not be intuitively comparable.¶ I have previously independently estimated the likelihood of seeing a World War III-like conflict this century. My calculation first adjusts historical base rates to allow for the possibility that major wars have become somewhat less likely, and uses the adjusted base rate to calculate the probability of seeing a war between now and 2100.¶ This method gives a 45% chance of seeing a major great power war in the next 77 years. If the probability is constant over time then the cumulative probability between now and 2050 would be 22%. This is aligned with the Metaculus predictions above.¶ We can also ask experts what they think. Unfortunately, there are surprisingly few expert predictions about the likelihood of major conflict. One survey was conducted by the Project for the Study of the 21st Century. The numbers were relatively aligned with the Metaculus forecasts, though slightly more pessimistic. However, it seems a mistake to put too much stock in this survey (see footnote).27¶ We now have at least a rough sense of a great power war’s probability. But how bad could it get if it occurred?¶ A new great power war could be devastating¶ At the time, the mechanised slaughter of World War I was a shocking step-change in the potential severity of warfare. But its severity was surpassed just 20 years later by the outbreak of World War II, which killed more than twice as many people.¶ A modern great power war could be even worse.¶ How bad have wars been in the past?¶ The graph below shows how common wars of various sizes are, according to the Correlates of War’s Interstate War dataset.28¶ The x-axis here represents war size in terms of the logarithm of the number of battle deaths. The y-axis represents the logarithm of the proportion of wars in the dataset that are at least that large.¶ Using logarithms means that each step to the right in the graph represents a war not one unit larger, but 10 times larger. And each step up represents a war that is not one unit more likely, but 10 times more likely.¶ What the graph shows is that wars have a heavy tail. Most wars remain relatively small. But a few escalate greatly and become much worse than average.¶ Of the 95 wars in the latest version of the database, the median battle death count is 8,000. But the heavy tail means the average is 334,000 battle deaths. And the worst war, World War II, had almost 17 million battle deaths.30¶ The number of battle deaths is only one way to measure the badness of wars. We could also consider the proportion of the population of the countries involved who were killed in battle. By this measure, the worst war since 1816 was not World War II. Instead, it’s the Paraguayan War of 1864–70. In that war, 30 soldiers died for every 1,000 citizens of the countries involved. It’s even worse if we also consider civilian deaths; while estimates are very uncertain, it’s plausible that about half of the men in Paraguay, or around a quarter of the entire population, was killed.31¶ What if instead we compared wars by the proportion of the global population killed? World War II is again the worst conflict since 1816 on this measure, having killed about 3% of the global population. Going further back in time, though, we can find worse wars. Ghengis Khan’s conquests likely killed about 9.5% of people in the world at the time.¶ The heavy tail means that some wars will be shockingly large.32 The scale of World War I and World War II took people by surprise, including the leaders who initiated it.¶ It’s also hard to know exactly how big wars could get. We haven’t seen many really large wars. So while we know there’s a heavy tail of potential outcomes, we don’t know what that tail looks like.¶ That said, there are a few reasons to think that wars much worse than World War II are possible:¶ We’re statistically unlikely to have brushed up against the end of the tail, even if the tail has an upper bound.¶ Other wars have been deadlier on a per-capita basis. So unless wars involving countries with larger populations are systematically less intense, we should expect to see more intense wars involving as many people as World War II.¶ Economic growth and technological progress are continually increasing humanity’s war-making capacity. This means that, once a war has started, we’re at greater risk of extremely bad outcomes than we were in the past.¶ So how bad could it get? How bad could a modern great power war be? Over time, two related factors have greatly increased humanity’s capacity to make war. 33 First, scientific progress has led to the invention of more powerful weapons and improved military efficiency. Second, economic growth has allowed states to build larger armies and arsenals. Since World War II, the world economy has grown by a factor of more than 10 in real terms; the number of nuclear weapons in the world has grown from basically none to more than 9,000, and we’ve invented drones, missiles, satellites, and advanced planes, ships, and submarines. Ghengis Khan’s conquests killed about 10% of the world, but this took place over the course of two decades. Today that proportion may be killed in a matter of hours. First, **nuclear weapons could be used.** Today there are around 10,000 nuclear warheads globally.34 At the peak of nuclear competition between the United States and the USSR, though, there were 64,000. If arms control agreements break down and competition resurges among two or even three great powers, nuclear arsenals could expand. In fact, China’s arsenal is very likely to grow — though by how much remains uncertain. Many of the nuclear weapons in the arsenals of the great powers today are at least 10 times more powerful than the atomic bombs used in World War II.35 Should these weapons be used, the consequences would be catastrophic. By any measure, such a war would be by far the most destructive, dangerous event in human history, **with** the potential to cause billions of deaths. The probability that it would, on its own, lead to humanity’s extinction or unrecoverable collapse, is contested. But there seems to be some possibility — whether through **a famine caused** by nuclear **winter, or** by **reducing** humanity’s **resilience** enough that something else, like a catastrophic pandemic, would be far more likely **to reach extinction-levels**(read more in our problem profile on nuclear war). Nuclear weapons are complemented and amplified by a variety of other modern military technologies, including improved missiles, planes, submarines, and satellites. They are also not the only military technology with the potential to cause a global catastrophe — bioweapons, too, have the potential to cause massive harm through accidents or unexpected effects. What’s more, humanity’s war-making capacity seems poised to further increase in the coming years due to technological advances and economic growth. Technological progress could make it cheaper and easier for more states to develop weapons of mass destruction. In some cases, political and economic barriers will remain significant. Nuclear weapons are very expensive to develop and there exists a strong international taboo against their proliferation. In other cases, though, the hurdles to developing extremely powerful weapons may prove lower. Improvements in biotechnology will probably make it cheaper to develop bioweapons. Such weapons may provide the deterrent effect of nuclear weapons at a much lower price. They also seem harder to monitor from abroad, making it more difficult to limit their proliferation. And they could spark a global biological catastrophe, like a major — possibly existentially catastrophic — pandemic. Artificial intelligence systems are also likely to become cheaper as well as more powerful. It is not hard to imagine important military implications of this technology. For example, AI systems could control large groups of lethal autonomous weapons (though the timeline on which such applications will be developed is unclear). They may increase the pace at which war is waged, enabling rapid escalation outside human control. And AI systems could speed up the development of other dangerous new technologies. Finally, we may have to deal with the invention of other weapons which we can’t currently predict. The feasibility and danger of nuclear weapons was unclear to many military strategists and scientists until they were first tested. We could similarly experience the invention of destabilising new weapons in our lifetime. What these technologies have in common is the potential to quickly kill huge numbers of people: A nuclear war could kill tens of millions within hours, and many more in the following days and months. A runaway bioweapon could prove very difficult to stop. Future autonomous systems could act with lightning speed, even taking humans out of the decision-making loop entirely. Faster wars leave less time for humans to intervene, negotiate, and find a resolution that limits the damage. How likely is war to damage the long-run future? When a war begins, leaders often promise a quick, limited conflict. But escalation proves hard to predict ahead of time (perhaps because people are scope-insensitive, or because escalation depends on idiosyncratic decisions). This raises the possibility of enormous wars that threaten all of humanity.

**Thus, we negate.**