Written Testimony of

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Chairwoman Lummis, Ranking Member Kelly, and Members of the Subcommittee, thank you for the opportunity to testify.

My name is Dr. Adam Stein, and I am the Director of Nuclear Energy Innovation at the Breakthrough Institute. The Breakthrough Institute is an independent 501(c)(3) research center that advocates for appropriate regulation and oversight of nuclear reactors to enable the new and continued use of safe and clean nuclear energy. The Breakthrough Institute acts in the public interest and does not receive funding from industry.

I have worked in the energy sector for more than twenty years with formal training in engineering, public policy, and business. I hold a Ph.D. and Master of Science in Engineering and Public Policy from Carnegie Mellon University, an MBA, and degrees in both Mechanical and Nuclear Engineering. My work has been published by Idaho National Laboratory and the Electric Power Research Institute, presented to the Nuclear Regulatory Commission (NRC), and has contributed to major nuclear projects, including the first license application for an advanced nuclear reactor in the United States.

At the Breakthrough Institute, our work focuses on addressing barriers to new nuclear deployment from an evidence-based approach. For more than a decade, we have been active participants in nuclear regulatory proceedings, licensing modernization efforts, and policy questions over how to make nuclear regulation more risk-informed, predictable, and effective. I am grateful to share these views with the Committee today.

The overarching point of my testimony is that the United States needs a nuclear regulatory system that protects public health and safety in a way that is credible, predictable, timely, and proportionate to actual risk. Such a system is necessary not only to maintain safety but to ensure that nuclear energy *can* benefit society.

Summary of Testimony

The central challenge facing nuclear regulation today is an implementation and decision-architecture problem.

Congress has already provided substantial direction to modernize the NRC through legislation, including NEIMA and the ADVANCE Act, and the NRC has begun to make visible progress. But modernization will ultimately be judged by implementation.

Nuclear power contributes simultaneously to reliability, energy security, national security, emissions reduction, air quality improvement, and long-term electricity price stability. Reliable and affordable electricity underpins advanced manufacturing, defense readiness, artificial intelligence infrastructure, industrial production, and economic competitiveness.

Nuclear deployment exists in an ecosystem. Nuclear projects must simultaneously satisfy financing requirements, customer demand, supply-chain readiness, public acceptance, permitting systems, environmental review, and regulatory approval. Any monocausal explanation of nuclear cost or delay is incomplete.

The first implementation challenge is decision-making that truly considers benefits to society. The NRC must maximize benefits to society in every decision, aligning with the Atomic Energy Act (AEA) and ensuring that regulatory processes consider the consequences of delay, foregone infrastructure, energy insecurity, and continued dependence on higher-risk or more polluting alternatives.

The second is the predictability and governance of Commission decisions. NRC staff can only implement reform effectively if the Commission is held accountable to timely votes, clear direction, and stable decision criteria.

The third challenge is radiation protection coherence. Radiation protection should be treated as a system-level issue rather than merely as a subset of NRC reform. Current federal radiation standards are fragmented across different agencies, producing inconsistent standards and practices disconnected from actual risk.

Environmental review and fuel facility licensing face similar challenges. The NRC has begun moving toward more risk-informed and right-sized environmental review, but that is not yet the default. Fuel-cycle facilities, especially enrichment ones, need a streamlined licensing process to meet projected fuel demand.

This Committee is currently evaluating a trio of bills that were introduced to help address parts of these implementation challenges. All of them work to enable smarter, risk-informed, and performance-based regulation: reducing costs associated with nuclear-grade concrete and steel without compromising public health and safety, enabling appropriate environmental review at brownfield sites, and reforming regulatory barriers to enrichment facility licensing.

Ultimately, successful NRC modernization will be measured by whether the United States has created a regulatory system capable of enabling the safe deployment of nuclear technology at the scale required for the nation's future.

1. The United States needs more firm power.

The United States is entering a period of rapidly rising and increasingly diversified electricity demand. This demand growth is not driven by any single sector. While artificial intelligence and data centers have received significant attention, they are only one part of a broader structural increase in electricity consumption: reshoring manufacturing, electrification of transportation, industrial decarbonization, defense infrastructure, semiconductor fabrication, and population growth are all increasing pressure on the grid. America will require far more reliable electricity in the coming decades than was projected only a few years ago.

Meeting this demand will require energy systems that are reliable, scalable, affordable, and resilient over the long term. The grid requires more than annual energy production; it needs capacity that is available when demand is high, when weather-dependent resources underperform, when fuel markets are stressed, and when regional transmission constraints bind. Nuclear energy is uniquely positioned to satisfy these requirements and is the only commercially proven, large-scale source of clean, firm power available today. The existing domestic

fleet of ninety-four reactors operates at an average capacity factor above ninety percent.[1] New reactor designs are entering the licensing and early commercial deployment phases. To meet national objectives, including quadrupling nuclear capacity by 2050, policymakers must lean into bipartisan support for nuclear energy. Nuclear energy is not the only resource the United States will need, but it is one of the few resources that can contribute simultaneously to reliability, energy security, national security, air quality, emissions reduction, and long-term price stability. Preserving and expanding nuclear energy should therefore be treated as part of the national response to rising electricity demand.

2. Nuclear Energy provides long-term system value that the market currently underprices.

Nuclear power plants require substantial upfront capital investment. It is one of the reasons first-of-a-kind (FOAK) projects are difficult to finance and why early projects require attention to construction risk, credit risk, supply chain depth, buyer confidence, and regulatory certainty.

Once constructed, nuclear power plants provide stable, low marginal cost electricity over a projected operating life of forty to eighty years. No other generation technology can match nuclear's long asset life, high capacity factor, low land use, stable fuel costs, and low exposure to short-term fuel price volatility. Unlike fossil fuel generation, nuclear plants are not heavily exposed to volatility in fuel markets because fuel costs constitute only a small portion of total generating costs. Fuel makes up between 60-90% of operational expenditures for gas plants, whereas fuel costs represent approximately 17% of costs for nuclear power plants.[2] Nuclear generation can reduce exposure to wholesale electricity price swings and improve system stability by diversifying the generation mix away from fuel-price-dependent resources.[3] Electricity markets reward the lowest marginal-cost resource in a given hour, but that does not necessarily produce the lowest-cost or most reliable system over years and decades. Allowing long-lived nuclear assets to be undercut by short-term market fluctuations can create the appearance of temporary savings while increasing long-term costs and system risk. Policies that retain or expand

[1] World Nuclear Association, "Nuclear Power in the USA," May 18, 2026, https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power.
[2] Nuclear Energy Instituite, "Nuclear Costs in Context," 2025, https://www.nei.org/resources/reports-briefs/nuclear-costs-in-context
[3] Mari, Carlo, "Hedging Electricity Price Volatility Using Nuclear Power," Applied Energy, 2013, https://doi.org/10.1016/j.apenergy.2013.08.016

firm generation for the grid may lower ratepayer exposure to volatility and scarcity, while policies that redirect firm generation away from the grid may increase it.

In 2021, Illinois lawmakers and Governor J.B. Pritzker passed and signed the Climate and Equitable Jobs Act (CEJA) to help save the Byron, Dresden, and Braidwood nuclear plants in northern Illinois. The CEJA established the Carbon Mitigation Credit program to preserve existing nuclear generation that was at risk of premature closure. The program recognized that nuclear plants provide substantial public benefits, which were not fully compensated in wholesale markets. The law included a provision requiring any revenue generated by the plants beyond a certain threshold, including federal subsidies, to be returned to customers. CEJA allowed the plants to ride out an unfavorable market. Eventually, the market turned, and the nuclear plants have paid back more than $2 billion to consumers through early 2026.[4]

Beyond affordability and reliability, nuclear energy provides public health and environmental benefits. Nuclear plants produce electricity without combustion and therefore without the particulate pollution, sulfur dioxide, nitrogen oxides, and other pollutants associated with fossil fuel generation. These pollutants have been linked to respiratory illness, cardiovascular disease, premature death, and other significant public health costs.

By comparison, the radiological impact of civilian nuclear energy in the United States is minuscule. Commercial nuclear plants operate at radiation exposure levels that are typically orders of magnitude below conservative federal regulatory limits. These limits themselves are set so low that health impacts are not statistically observable in populations. Even at regulatory limits, the public health risk associated with nuclear energy remains substantially lower than the health burdens imposed by many polluting energy sources. Nuclear power is an exceptionally safe way to produce electricity on an industrial scale; per kWh of energy produced, nuclear energy has the lowest number of direct fatalities of any major energy source, and over 100 times fewer fatalities than hydro and liquefied natural gas.[5,6]

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[4] Illinois Power Agency, "Carbon Mitigation Credit Reports," https://ipa.illinois.gov/carbon-mitigation-credit-reports.html

[5] Rehm, Thomas, "Advanced Nuclear Energy: The Safest and Most Renewable Clean Energy," *Current Opinion in Chemical Engineering*, Volume 39, March 2023, https://doi.org/10.1016/j.coche.2022.100878

[6] Ritchie, Hannah,"What are the safest and cleanest sources of energy?", February 10, 2020, https://ourworldindata.org/safest-sources-of-energy

Nuclear technologies can also be deployed in forms customized for different needs. The United States is developing a diverse portfolio of advanced nuclear designs intended to serve a wide variety of customers and applications. Large reactors continue to provide reliable bulk electricity generation, while advanced reactors and small modular reactors may provide industrial heat, remote power generation, hydrogen production, and dedicated power for energy-intensive industries and data centers, as well as other benefits such as grid balancing and military installation resilience. This diversity increases the strategic value of nuclear energy as part of a resilient national energy system.

3. Nuclear is essential to energy and national security imperatives.

America's energy security and national security are inseparable from its ability to build and sustain a robust domestic nuclear industry. Reliable access to affordable energy has always been a foundation of economic strength, industrial capability, and geopolitical influence. In the twenty-first century, that reality has only become more important. Nations that can provide abundant, stable, and secure electricity will possess major advantages in manufacturing, advanced computing, defense readiness, industrial production, and technological innovation. Nations that cannot will face increasing economic and strategic vulnerability.

Modern energy security is an issue concerning both geopolitical and engineering dimensions: fuel supply, price exposure, infrastructure reliability, grid stability, and system resilience all matter. Energy security risks often emerge when an energy system has too little margin, too much exposure to a single fuel, or too little ability to absorb shocks. Nuclear power does not eliminate those risks by itself, nor can any single technology, but nuclear energy contributes to energy security in several distinct ways. It can provide firm electricity, reduce dependence on fuel imports, diversify the generation mix, limit exposure to natural-gas price volatility, support grid reliability, and provide heat and power for industrial applications that are difficult to electrify with variable resources alone.

The United States faces increasing competition in global nuclear markets from state-supported foreign suppliers, particularly Russia and China, both of which have pursued long-term industrial strategies to dominate reactor exports and fuel supply chains. Russia currently supplies a substantial portion of the world's commercial

enrichment capacity and remains deeply embedded in global nuclear fuel markets.[7] This dependence creates strategic vulnerabilities for the United States and its allies. China is building reactors at a pace that strengthens its workforce, supply chains, construction experience, regulator familiarity, and export position.[8]

Nuclear cooperation agreements are important in this context. Section 123 of the AEA governs the legal framework for significant peaceful nuclear cooperation between the United States and other countries. Such agreements reflect U.S. commitments to safeguards, security, nonproliferation, and responsible nuclear trade. Civilian nuclear exports also have long strategic implications. A reactor export involves decades of fuel supply, operational support, safety cooperation, workforce training, regulatory engagement, financing, maintenance, and future technology upgrades. These relationships can last for the operating life of the plant and often beyond it. When the United States is a credible nuclear supplier, these agreements also allow it to export safety norms, nonproliferation expectations, and long-term institutional relationships. When the United States is not a credible supplier, those relationships are more likely to be shaped by competitors with different strategic objectives. Domestic deployment and international influence cannot be separated; the United States cannot maintain a strong position in global nuclear markets through diplomacy alone. It must be able to demonstrate that reactors can be licensed, financed, built, fueled, and operated at home.

Energy infrastructure should be understood as strategic infrastructure. The ability to deploy reliable domestic energy systems affects military readiness, industrial resilience, technological leadership, and economic stability. A nation that cannot build the infrastructure necessary to power its economy risks dependence on foreign competitors for both energy and critical technologies. Nuclear energy policy must be viewed as an integral component of American national security strategy.

4. Nuclear deployment depends on a distributed decision system.

Nuclear projects are often discussed as if one constraint determines success. Sometimes the constraint is said to be the NRC. Sometimes it is financing. Sometimes it is public acceptance, supply chain capacity, or fuel

[7] Lloyd, Juzel, Adam Stein, Seaver Wang, Peter Cook, and Matthew Wald, "Abundant Fuel for Abundant Reactors," Breakthrough Institute, November 6, 2025, https://thebreakthrough.org/issues/energy/abundant-fuels-for-abundant-reactors

[8] Jiang, Yue, "What Can the U.S. Learn from Chinese Nuclear Deployment?", Breakthrough Institute, October 14, 2025, https://thebreakthrough.org/issues/nuclear-energy-innovation/what-can-the-u-s-learn-from-chinese-nuclear-deployment

availability. Any monocausal framing is incomplete. A nuclear project must satisfy multiple decision systems. The NRC must reach a safety and licensing decision. A buyer must commit to a revenue pathway. Investors must accept construction, market, and regulatory risk. Suppliers must be willing to qualify and scale production. State and local institutions must accept siting and infrastructure consequences. Grid operators must integrate the project. Communities must trust the process enough to allow it to proceed. Factors must be understood as components of a single system defined by distributed decision authority, non-fungible approvals, fragmented risk, and binding constraints. A successful project requires joint satisfiability across domains.[9]

The condition of joint satisfiability is demanding because it requires simultaneous satisfaction across actors that do not share a common framework; it is unstable because it must persist over time as conditions change; and it is frequently misunderstood because progress in one domain is often mistaken for progress in the system as a whole. Regulators, investors, utilities, grid operators, policymakers, and communities each evaluate the project using different criteria, under different constraints, and with different consequences for failure. These evaluations are not reducible to a common metric and do not converge through centralized authority, resulting in a system in which decisions are distributed, interdependent, and only indirectly coordinated.

The result is a persistent pattern in policy and project design: interventions are routinely applied at the wrong level of the system. Policy operates within this system, not above it. Policies, financing structures, and regulatory reforms are typically developed within a single stakeholder domain and reflect the objectives and constraints of that domain. This is not a design flaw at the institutional level; it is a consequence of how authority and expertise are organized. Each actor operates with a partial view of the system and optimizes within it.

Measures that reduce risk for one stakeholder often increase it for another. Policies that remove a barrier in one domain frequently shift that barrier into a different part of the system. This dynamic explains why many interventions appear successful within their own domain but fail to produce project realization. Nuclear project development is determined across multiple stakeholder strata, and interventions that do not account for that

[9] Stein, Adam, "Stakeholder Stratification: Risk Fragmentation and Distributed Decision Systems in Nuclear Energy Deployment," Breakthrough Institute, *forthcoming*.

structure cannot resolve the system. Effective action depends on understanding not only where a constraint appears, but how it is connected to other domains and where it will re-emerge when displaced.

This requires evaluating how approvals, risk allocation, and constraints interact, and how those interactions change over time. Recognizing this at analytical and tangible levels will provide a basis for more realistic analysis, more robust project design, and more effective policy.

5. Reform at the NRC is underway, but not complete.

Over the past seven years, Congress and the executive branch have repeatedly directed the NRC to modernize its processes, improve efficiency, and establish more predictable licensing pathways for advanced nuclear technologies. The Nuclear Energy Innovation and Modernization Act (NEIMA)[10] of 2019 mandated risk-informed, performance-based regulation for advanced reactors. The Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act of 2024 went further and directed the NRC to align closer to its goals with the AEA, which declared that developing nuclear energy was essential for the general welfare.[11] And in 2025, Executive Order 14300[12] added further direction, requiring a broader review of NRC regulations, radiation standards, and licensing processes.

These efforts came at a time when many pointed to the NRC as a barrier to new nuclear deployment. For many years, regulatory delays became the default condition of the licensing process. The accumulation of procedural friction, serial reviews, and extended deliberative cycles created a regulatory culture oriented toward preserving the status quo rather than evaluating whether existing approaches continued to maximize public benefit.

As a result of legislative and executive direction, the NRC has made notable progress toward becoming a more streamlined and modernized regulator. The NRC's updated mission statement now states that the agency "protects public health and safety and advances common defense and security by enabling the safe and secure use and deployment of civilian nuclear energy technologies and radioactive materials through efficient and reliable licensing, oversight, and regulation for the benefit of society and the environment."[13] After years of

[10] Nuclear Energy Innovation and Modernization Act, Pub. L. No. 115-439, 132 Stat. 5565 (2019)
[11] Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy Act of 2024, Public Law 118-67, section 501.
[12] Executive Order No. 14300, Ordering the Reform of the Nuclear Regulatory Commission, 90 Fed. Reg. 22,587 (May 29, 2025).
[13] U.S. Nuclear Regulatory Commission, https://www.nrc.gov/about-nrc

development, the NRC has finalized the Part 53 licensing framework.[14] The NRC has also reviewed and issued the first commercial advanced reactor construction permit ahead of schedule, approved a restart pathway for a decommissioned reactor, renewed operating reactor licenses, licensed a fuel fabrication facility, launched a proposed fusion regulatory framework, and is currently preparing numerous rules under Executive Order 14300.

The progress is visible but not all-encompassing at the agency. In the coming months, the NRC has a lot of work to do. If the NRC truly embraces reform, not just in its regulations but in its staff culture and operations, the agency will be able to license nuclear technologies safely, predictably, and at scale.

6. The NRC should consider the benefit to society in every decision.

Directly considering benefits to society is essential for effective regulation because it changes the fundamental framing of regulatory decision-making. Instead of centering deliberations on whether a proposed change has justified departure from the status quo, the more appropriate question becomes whether the status quo itself maximizes benefits to society or whether a superior alternative exists. That distinction centers the interests of the American public rather than the inertia of existing processes, recognizing that maintaining current conditions is itself a policy choice with consequences. Delayed deployment of reliable clean energy, prolonged dependence on polluting sources, higher electricity costs, and reduced energy security all impose real societal harms that must be weighed alongside regulatory considerations.[15]

In a modernized NRC, public benefit is a core regulatory responsibility. It should be considered alongside safety and environmental impact in all significant decisions. The agency must apply transparent, risk-informed methods to evaluate how each licensing action or regulatory change affects public welfare and environmental outcomes. In a modernized NRC, public benefit would not be treated as a competing priority but as an objective to achieve and a natural complement to safety.

Although the NRC did not have precedent for considering benefits to society, the statute always required it, and the updated mission statement calls for it. The agency's decision-making, internal processes, and public

[14] Stein, Adam and Spencer Toohill, "Part 53: A Viable Licensing Pathway for New Reactors," Breakthrough Institute, April 9, 2026, https://thebreakthrough.org/issues/nuclear-energy-innovation/part-53-a-viable-licensing-pathway-for-new-reactors

[15] Stein, Adam, "Considering Nuclear Energy's Benefits to Society," Breakthrough Institute, November 25, 2024, https://thebreakthrough.org/issues/energy/considering-nuclear-energys-benefit-to-society

engagement must be consistently guided by its updated mission statement, ensuring that "for the benefit of society and the environment" is not aspirational language but a daily operational standard.

Considering societal benefits is not synonymous with favoring industry at the expense of public protection. Properly understood, it means evaluating all consequences, including economic, environmental, public health, reliability, and national security outcomes, within a framework that remains firmly grounded in rigorous safety standards. A modern regulatory system should ask whether society is being denied substantial benefits through unnecessary delay, procedural inefficiency, or adherence to assumptions that no longer reflect technological realities.

7. The NRC's wholesale rulemaking review and revision must be done correctly.

Executive Order 14300, *Ordering the Reform of the Nuclear Regulatory Commission*, directed the NRC to undertake a wholesale revision of its regulatory framework. This is one of the most ambitious regulatory revision efforts in the NRC's history. A successful outcome must produce an internally coherent framework that is aligned with the NRC's updated mission to enable the safe deployment of nuclear energy for the benefit of society.

Twenty-seven actions are currently under active development.[16] The high volume of new and revised rules raises concerns about coordination, as rules are being developed and finalized on compressed and overlapping timelines. Many of these rules affect multiple regulations and require conforming changes, meaning adjacent rules may alter assumptions affecting other rules, and related issues are being addressed in separate dockets.

When a proposed rule's analytical foundation depends on the outcome of a later rulemaking that is not yet resolved, the public cannot meaningfully evaluate what the rule will require in practice. A rule finalized before related rulemakings are complete may lock in regulatory mechanisms based on framework assumptions that remain in flux in adjacent dockets. The practical risk is that, while each rule may be individually defensible at the time of finalization, the full EO 14300 package may produce a regulatory system that does not function coherently as a whole and whose combined effect is misaligned with the updated mission it is intended to serve.

[16] U.S. Nuclear Regulatory Commission, *Wholesale Revision of Regulations Under Executive Order 14300*, https://www.nrc.gov/about-nrc/governing-laws/advance-act/wholesale-revision-regs

EO 14300 also directs the NRC to undertake specific changes that have unintended consequences, introducing new failure modes. The NRC's Fiscal Year 2026 Proposed Fee Rule is a core example. The FY 2026 Proposed Fee Rule does several things at once: some aspects are routine annual fee updates, some implement recent statutory changes, and some reflect broader NRC modernization efforts. The NRC presents a fee cap regime as implementing Section 5(a) of EO 14300. The proposed fixed-fee cap is a serious flaw because it attempts to create predictability through a pricing mechanism that is poorly matched to the work the NRC actually performs. The proposal does not solve uncertainty at its source. It attempts to manage that uncertainty indirectly by fixing an upper bound on recovery at the outset of a process whose burden is often contingent and only partially knowable ex ante.[17]

The proposed Part 57 rule is an example of how the wholesale rulemaking process is introducing questions of actual regulatory need as opposed to solving problems that need no fixing. Part 57 proposes a new licensing framework for microreactors and other reactors with comparable risk profiles, but its purpose in practice is being debated. If Part 57 is to simply create another optional licensing pathway for advanced reactors, the NRC risks adding complexity without clarifying how applicants should choose among licensing pathways. And because Part 53 already provides a technology-inclusive pathway for licensing advanced reactors, including microreactors, the NRC must clearly define Part 57's distinct purpose.[18] It *should* serve as a targeted pathway for high-volume deployment of microreactors and small modular reactors, as directed by Executive Order 14300.[19]

The rulemakings also now hold transparency concerns. For more than four decades, the Office of Information and Regulatory Affairs (OIRA) within the White House Office of Management and Budget has reviewed rulemakings from most federal agencies. Independent agencies such as the NRC were previously exempt from this review. Under Executive Order 14215, OIRA now reviews NRC rulemakings. This new step adds time to the rulemaking process, reduces public engagement, and removes from public view the Commission votes on

[17] Toohill, Spencer, "NRC Fee Reform Should Improve Performance, Not Impose Rigid Caps," Breakthrough Institute, April 16, 2026, https://thebreakthrough.org/issues/nuclear-energy-innovation/nrc-fee-reform-should-improve- performance-not-impose-rigid-caps

[18] Part 57 includes several ideas that were recommended in the Breakthrough Institute's comment on Part 53 but were not fully incorporated. The Breakthrough Institute, *Comment on 10 CFR Part 53: Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors (NRC–2019–0062)*, Feb. 28, 2025

[19] Stein, Adam, "Part 57: Right-Sizing Nuclear Regulation for Low-Consequence Reactors," Breakthrough Institue, May 1, 2026, https://thebreakthrough.org/issues/nuclear-energy-innovation/part-57-right-sizing-nuclear-regulation-for-low- consequence-reactors

proposed and final rules submitted for OIRA review; information that has historically been part of the public record and a core mechanism of Commission accountability.

The Breakthrough Institute is highly engaged in the wholesale rulemaking process to communicate that EO 14300 reforms should be implemented as an integrated regulatory undertaking rather than a series of isolated dockets. The test for the wholesale review is system-level performance, not docket-by-docket completion. Reform will succeed only if the final package reduces unnecessary burden without weakening safety, preserves transparency and Commission accountability, avoids conflicting assumptions across related rules, is mission-aligned, and gives applicants a predictable and flexible path through the licensing system.

8. Construction standards and quality assurance should be graded by safety significance.

Nuclear construction standards show a repeating regulatory pattern: a principle intended to be reasonable and risk-informed has too often become absolute, costly, and disconnected from consequence.

Nuclear facilities require high-quality materials, strong construction controls, and careful verification. Some systems need special nuclear-grade materials and quality assurance because their failure could affect safety. But many components in a nuclear facility do not present that kind of risk. The materials, engineering practices, and quality-control systems trusted in higher-consequence civil infrastructure, including bridges, buildings, dams, chemical plants, and aviation-related facilities, are often considered inadequate for routine use within a nuclear power plant.

This is not what NRC quality assurance rules require on their face. Appendix B to 10 CFR Part 50 establishes quality assurance requirements for structures, systems, and components that prevent or mitigate accidents, and it states that quality assurance controls should apply "to an extent consistent with their importance to safety."[20] That is a risk-informed concept. It does not require every component, supplier, or construction activity to be treated as if it carries the same safety significance. In practice, however, NRC implementation has often treated Appendix B as synonymous with ASME NQA-1, the nuclear industry quality assurance standard developed by

[20] Code of Federal Regulations, Appendix B to Part 50, Title 10, "Appendix B to Part 50—Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," https://www.ecfr.gov/current/title-10/chapter-I/part-50/subject-group-ECFR89aa6ca4aada73c appendix-Appendix%20B%20to%20Part%2050

the American Society of Mechanical Engineers that establishes detailed requirements for the design, procurement, fabrication, construction, testing, and maintenance of safety-related nuclear systems and components. NQA-1 is a consensus standard and can be appropriate for many nuclear safety-related applications, but the regulation itself does not state "use NQA-1 for everything." NRC Regulatory Guide 1.28 endorses editions of NQA-1 as an acceptable way to meet Appendix B, while Appendix B itself is written in functional terms: adequate confidence, appropriate controls, and application commensurate with importance to safety.

This distinction has large consequences for the supply chain. Many capable suppliers already meet demanding commercial, industrial, aerospace, or infrastructure quality standards. They do not necessarily add NQA-1 on top of existing systems because they lack quality; suppliers often do not do so because the cost, audit burden, legal exposure, and uncertainty of recovering those costs are not justified by the limited and unpredictable nuclear market. The NRC's unnecessary adherence to NQA-1 narrows the supplier base, raises costs, slows construction, and makes nuclear projects more fragile. It also undermines the very industrial scaling that the United States needs. A supply chain cannot be rebuilt if otherwise-qualified suppliers are excluded by requirements that are more stringent than the safety function warrants.

Part 57 begins to move in the right direction by recognizing that microreactors, modular reactors, and low-consequence designs should not be forced into regulatory assumptions built for large light-water reactors. But that principle should apply more broadly. The NRC should distinguish between components whose failure could produce meaningful safety consequences and components whose failure would not. It should allow applicants to use widely accepted commercial and industrial standards where those standards provide adequate confidence for the safety function at issue.

The goal should not be lower quality. Nuclear construction should be held to standards that are rigorous, auditable, protective, *and* proportionate to risk. A system that treats ordinary components as extraordinary ones does not necessarily make the public safer. It often makes nuclear energy harder to build, more expensive to finance, and less available to displace higher-risk energy sources.

9. The NRC must use the appropriate threshold of environmental review.

The NRC is somewhat unique among federal agencies in implementing the National Environmental Policy Act (NEPA) through 10 CFR Part 51. In addition to Part 51, the NRC is subject to a broader statutory framework in which it must protect public health, safety, security, and the environment. NEPA is primarily procedural: it requires agencies to consider and disclose environmental impacts. The NRC is responsible for environmental protection under statute in the use of radioactive materials and nuclear facilities.

NEPA reviews have long served as a vital guardrail, ensuring that federal decisions do not result in unchecked environmental damage. Agencies use a tiered approach to environmental reviews under NEPA, falling into three main categories, each differing in scope, complexity, and resource demands: categorical exclusions (CatEx), environmental assessments (EA), and environmental impact statements (EIS). The NRC, in theory, selects the appropriate level of review based on the potential environmental impact of the proposed action. In practice, the NRC must do a better job of triaging its environmental review process and providing the appropriate level of environmental review to individual projects. Using the wrong threshold does not make the review more protective, but it can make the review slower, more expensive, and less focused on the impacts that actually warrant attention.[21]

The NRC has begun to move in this direction. For Kairos Power's Hermes 2 construction permit application, NRC staff appropriately used an EA rather than a full EIS, based on the environmental impact of the project and, in part, from the agency's prior review of the related Hermes 1 project.[22] The NRC staff prepared a draft EA in accordance with the requirements in 10 CFR 51.30 and concluded "that the potential impacts from Hermes 2 would be SMALL for each potentially affected environmental resource."[23] Doing so reduced both the cost and duration of review compared to a full EIS.

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[21] Toohill, Spencer, Yue Jiang, and Deric Tilson, "Environmental Reviews Should Empower Nuclear Energy, Not Stall It," Breakthrough Institute, May 5, 2025, https://thebreakthrough.org/issues/energy/environmental-reviews-should-empower-nuclear-energy-not-stall-it

[22] Kairos Power, LLC; Hermes 2; Environmental Assessment, Finding of No Significant Impact, and Exemptions, September 5, 2024, Docket Nos. 50-611 and 50-612; NRC-2023-0138, https://www.federalregister.gov/documents/2024/09/05/2024-19914/kairos-power-llc-hermes-2-environmental-assessment-finding-of-no-significant-impact-and-exemptions

[23] Kairos Power, LLC; Hermes 2; Environmental Assessment, Finding of No Significant Impact, and Exemptions, September 5, 2024, Docket Nos. 50-611 and 50-612; NRC-2023-0138, Paragraph 13, https://www.federalregister.gov/d/2024-19914/p-13

The proposed Part 57 is also taking a "right-sized" approach to environmental review. For microreactors and modular reactors whose environmental impacts are demonstrably bounded, the NRC should not default to full project-specific EIS treatment when realized environmental impacts will be small or nonexistent. A low-consequence reactor should still be reviewed carefully, but the review should be tailored to the likely impacts rather than inherited assumptions for large light-water reactors.

One promising deployment pathway is the potential to redevelop retired brownfield sites with new nuclear energy infrastructure. Such a pathway should come with an environmental review tailored to the site context. Where a project remediates contamination, reuses existing infrastructure, and replaces an impaired site with a low-emission energy facility, the environmental baseline should not be treated as if the project were disturbing an undeveloped site. Remediating many brownfield sites and building a nuclear power plant will leave the site better than found. Environmental review should recognize and enable site remediation and repurposing, not hinder it.

But, regulations, precedence, and agency culture can still favor an EIS for major licensing actions over an EA or even a CatEx when a lower threshold is appropriate. A default EIS made sense when reactor licensing almost surely involved large, site-specific projects with limited standardized experience. But the deployment context is changing. Very few recent environmental reviews have identified large unbounded impacts for construction and operation across most resource categories.[24,25] That does not mean future projects can never have significant impacts, but repeated findings of small or bounded impacts should inform the approach and depth of future review.

The ADVANCE Act specifically directed the NRC to modernize its environmental reviews. The NRC recently finalized a rule for a *Generic Environmental Impact Statement for Licensing of New Nuclear Reactors* (NR GEIS), which is an important step intended to make reviews for advanced reactors more efficient by using a

[24] Environmental Assessment and Finding of No Significant Impact for the Construction Permits and Environmental Review Exemptions for the Kairos Hermes 2 Test Reactors, ML2424A034.
[25] Environmental Assessment and Finding of No Significant Impact for the Construction Permit Application for the Abilene Christian University Molten Salt Research Reactor, ML23300A053.

technology-neutral, performance-based approach that distinguishes impacts appropriate for generic analysis from impacts that require project-specific analysis.[26]

Section 506 of the ADVANCE Act specifically required the NRC to consider "establishing new categorical exclusions that could be applied to actions relating to new applications" for licenses under Section 103 of the AEA, meaning the NRC can and should pursue CatExs on its own. The ADVANCE Act set this requirement because the NRC was slow and negligent in its deployment of new CatExs. Statutory CatExs are another viable pathway as CatExs have successfully been defined in statute before.[27]

The agency still has yet to make a streamlined and right-sized environmental review the status quo for every application.[28] The objective should not be a lesser environmental review but a better and more informed one. When a project presents genuinely site-specific or novel environmental concerns, the NRC should focus its resources there. When prior reviews, generic findings, or categorical-exclusion records show that impacts are small or bounded, the NRC should use that evidence to select a narrower threshold of review. That is a stronger environmental review system, not a weaker one.

10. Domestic enrichment capacity is necessary for nuclear deployment.

A credible nuclear deployment strategy requires a credible fuel strategy. Reactors cannot be built, licensed, financed, or operated at scale if the fuel supply chain remains uncertain. For existing reactors, that means reliable access to uranium conversion, enrichment, and fuel fabrication. For many advanced reactors, it also means access to high-assay low-enriched uranium (HALEU).

The United States should support the development of additional domestic enrichment capability. A stronger enrichment sector would reduce exposure to foreign supply disruption, support allied fuel security, improve confidence for advanced reactor developers, and strengthen the broader industrial base needed for nuclear

[26] Toohill, Spencer, and Yue Jiang, "Strengthening the NRC's Environmental Review Framework," Breakthrough Institute, March 27, 2025, https://thebreakthrough.org/issues/energy/strengthening-the-nrcs-environmental-review-framework

[27] 15 U.S.C. § 4659(d) for CHIPS-related semiconductor assistance; 16 U.S.C. §§ 6591b, 6591d, 6591e, and 6592b for certain forest and habitat activities; 33 U.S.C. § 2349 for emergency repair of water resources projects; 42 U.S.C. § 15942 for certain oil and gas-related activities on public lands and National Forest System lands; 46 U.S.C. § 50505 for Maritime Administration use of other DOT CEs.

[28] The National Environmental Policy Act Requirements rulemaking is still open, NRC-2025-0478.

deployment. It would also improve the credibility of U.S. nuclear exports. A country that cannot reliably supply fuel for its own reactor fleet will have difficulty serving as a durable nuclear partner abroad.

At the same time, enrichment facilities are not ordinary industrial facilities. They involve source material, special nuclear material, safeguards, security, environmental review, emergency planning, decommissioning, and long-term public trust. Communities asked to host enrichment infrastructure are entitled to clear information, a meaningful process, and enforceable standards. Local concerns, when properly addressed, can help create a predictable and legitimate licensing process that is capable of distinguishing real risk from procedural burden.

Removing statutory requirements that predetermine the most burdensome NEPA instrument regardless of actual environmental conditions, converting mandatory hearings into a demand-driven process more consistent with the Atomic Energy Act, and allowing appropriate pre-license construction to reduce timelines for facilities critical to domestic fuel supply security are sound objectives to modernize fuel facility licensing. Those reforms are consistent with a performance-based and risk-informed approach. But they must be implemented carefully. A poorly drafted modernization statute can create new legal vulnerabilities, new ambiguity, and new delay.

11. The Commission's decision process remains a governance issue.

The Breakthrough Institute's analysis of NRC Commission voting records, across the decades, shows a consistent and systemic failure for the Commissioners to meet the procedural decision-making timeline targets. Only 34 percent of Commission papers had all commissioner votes submitted on time. Voting times for Commission papers lengthened substantially after 2016 as on-time voting rates fell below 20 percent for much of the period, never fully recovered, and set a new baseline.[29]

These statistics show that amid tangible progress, the Commissioners themselves are a bottleneck. If the Commission itself remains unable to make predictable and timely decisions, petitioning the agency or directing rulemaking changes can not resolve the underlying governance constraint. As discussed above, interventions are

[29] Jiang, Yue, Adam Stein, and Deric Tilson, "Regulatory Throughput and Governance: Evidence from Commissioner Voting Timelines at the U.S. Nuclear Regulatory Commission," *forthcoming*.

often applied at the wrong layer of the system. In this case, Congress or other stakeholders may focus on NRC staff delays without realizing that the binding constraint may lie in Commission-level decision-making.

If the Commission's decision timelines remain unpredictable, regulatory uncertainty will persist as an institutional risk. The broader lesson is that reform must reach the level where delay actually happens; otherwise, Congressional direction, staff effort, and rulemaking initiatives may not fully translate into deployable projects.

12. NRC independence must be preserved, but not misdefined.

The independence of the NRC is essential to public trust, effective governance, and the long-term success of American nuclear energy. But independence must be understood correctly.[30]

Recent debates surrounding the role of the Department of Government Efficiency, White House oversight, OIRA, and the dismissal of former Commissioner Christopher Hanson have raised broader questions about what independence at the NRC truly means. These questions deserve careful consideration because both excessive political influence and institutional insularity can undermine effective regulation.

The NRC was intentionally established by Congress as an independent agency under the AEA following concerns about the structure of the former Atomic Energy Commission, which combined promotional and regulatory functions within a single institution. Congress recognized that nuclear regulation required public credibility, technical rigor, and insulation from improper political or commercial pressure. At the same time, the NRC has never been wholly independent from the rest of the government. Congress defines its statutory mission, appropriates resources, establishes procedural requirements, and conducts oversight. The President appoints Commissioners and designates the Chair. Executive coordination can, and should, occur, provided it is consistent with law and does not compromise adjudicatory independence or technical integrity.

The AEA and Energy Reorganization Act established multiple layers of independence throughout the NRC's structure precisely to preserve effective and technically grounded decision-making. These protections extend not

[30] Stein, Adam, "Understanding the NRC Independence Debate," Breakthrough Institute, December 10, 2025, https://thebreakthrough.org/issues/nuclear-energy- innovation/understanding-the-nrc-independence-debate

only to the Commission itself, but also to the professional staff, technical review processes, and the Advisory Committee on Reactor Safeguards (ACRS). The ACRS, in particular, was created to provide independent technical expertise and outside scrutiny of reactor safety matters. Maintaining the integrity and independence of these internal technical institutions is critical to maintaining confidence in the regulatory process.

Equally important is transparency. Public confidence in nuclear regulation depends not only upon safety outcomes, but upon confidence that decisions are made openly, consistently, and according to technically defensible standards. External transparency helps ensure that regulatory decisions remain grounded in evidence rather than politics, ideology, or institutional inertia.

The challenge is ensuring that reform strengthens the agency's effectiveness while preserving the technical and institutional safeguards that make independent regulation credible. A healthy regulatory system requires both accountability and independence. Political leadership has a legitimate role in establishing national priorities, improving efficiency, and ensuring that agencies faithfully execute congressional mandates. But technical safety determinations must remain grounded in evidence, transparent processes, and independent expert judgment. The United States should avoid two equally harmful extremes: a regulatory system captured by short-term political pressure, and a regulatory system so insulated that procedural preservation becomes more important than public outcomes.

NRC independence should mean independence from undue political interference, undue industry influence, and undue institutional inertia. It should protect the ability of professional staff, technical experts, and advisory bodies to provide honest analysis even when inconvenient. It should preserve transparency so the public can understand how decisions are made. And it should ensure that the agency remains capable of adapting to new technologies and national needs without sacrificing rigor or public confidence.

13. Radiation protection should be treated as a system-level issue.

Radiation protection should be treated as a system-level issue, not merely as a subset of NRC reform. The United States regulates the same physical hazard through a fragmented structure comprising multiple statutes,

agencies, metrics, and acceptable risk thresholds, which are sometimes in conflict. A Breakthrough Institute review found that 79 radiation protection rules are implemented across ten federal agencies, with acceptable risk levels varying by up to 100,000-fold depending on the regulatory program rather than the physical hazard.[31] Regulatory and statutory fragmentation has practical consequences: A reactor developer may have to satisfy NRC dose-based limits, Environmental Protection Agency (EPA) air-emission standards, EPA environmental standards, state implementation requirements, and NRC "as low as reasonably achievable" (ALARA) expectations for the same underlying release pathway. These analyses can use different assumptions and produce different controlling constraints. The nominal NRC limit may not be the practical limit if EPA standards or ALARA implementation become the de facto design constraint.

ALARA is another example where the principle is sound, but implementation has drifted. ALARA means "as low as reasonably achievable," not "as low as technologically imaginable." The word "reasonable" is essential. The evidence does not support treating routine public exposures from nuclear facilities in the low-millirem range as a measurable public-health hazard. That does not prove that low-dose radiation risk is zero; however, it shows that at very low doses, any incremental risk is model-dependent, uncertain, and too small to distinguish from normal variation in cancer incidence.[32,33] Risk projections can be useful for planning and bounding, but they should not be treated as observed health effects. ALARA should therefore be returned to its proper role as optimization, not minimization. It was intended to be a reasonable standard: additional dose reduction should be pursued only when the incremental health and safety benefit justifies the cost. Below a de minimis level, additional regulatory control may provide no observable public-health benefit while increasing cost, delay, and unnecessary concerns.[34] Above that level, optimization remains appropriate. This is a more durable reform than simply announcing that linear-no-threshold (LNT) or ALARA is wrong.

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[31] Seel, P.J. and Adam Stein, "The Current State of Radiation Protection in the United States," Breakthrough Institute, December 2, 2025, https://thebreakthrough.org/issues/nuclear-energy-innovation/the-current-state-of-radiation-protection-in-the-united-states

[32] U.S. Nuclear Regulatory Commission, Linear No-Threshold Model and Standards for Protection Against Radiation, Federal Register, August 17, 2021

[33] Stein, Adam, "Quantitative Health Objectives in a Performance-based Regulation," Breakthrough Institute, October 8, 2025, https://thebreakthrough.org/issues/nuclear-energy-innovation/quantitative-health-objectives-in-a-performance-based-regulation

[34] Seel, P.J. and Adam Stein, "Drawing the Line: The Linear No-Threshold Model, and When are Doses Too Small to Matter?", Breakthrough Institute, July 16, 2025, https://thebreakthrough.org/issues/energy/drawing-the-line

The NRC cannot solve this alone: radiation standards need to be synchronized across federal and state agencies to resolve the decades of overlapping statutory conflicts.[35] Durable reform should distinguish dose limits, action levels, optimization thresholds, and doses too small to matter for regulatory decisions.

14. Recommendations for congressional oversight and legislation.

The following recommendations are actions Congress can take to address outstanding concerns:

1. Congress should pass the "Build Nuclear with Local Materials Act of 2026" to require the NRC to allow the use of commercial-grade steel and concrete in non-safety-related and non-safety-significant structures at nuclear power plants.
2. Congress should pass the "Revitalizing Energy Communities by Hosting Advanced Reactors and Generating Energy Act of 2026" (or the "RECHARGE Act of 2026") to exempt the conversion of covered sites into certain types of nuclear reactor plants from the requirements of the NEPA.
3. Congress should pass the "Enrichment Licensing Modernization Act of 2026" to align the licensing of uranium enrichment facilities with utilization facilities under the AEA.
4. The Senate Environment and Public Works Committee should direct the Department of Energy to implement Congress's mandate in the Energy Act of 2020 to establish a HALEU Availability Program to support civilian domestic research, development, demonstration, and commercial use of HALEU fuels.
5. Congress should amend the AEA to establish the NRC as the primary federal authority for radiation protection standard-setting, with binding quantitative methodology, a de minimis threshold, and a tiered dose framework. Conforming amendments to the CAA, Safe Drinking Water Act, NWPA, and Energy Reorganization Act would require other agencies to derive their radionuclide standards from the AEA methodology while retaining implementation and enforcement authority under their own statutes.

[35] Seel, P.J., "Decay Fragments: A Health Physics History," Breakthrough Institute, March, 10, 2026, https://thebreakthrough.org/issues/nuclear-energy-innovation/decay-fragments-a-health-physics-history

Conclusion

The United States needs nuclear energy to help meet rising electricity demand, preserve affordability, strengthen energy security, support industrial growth, reduce pollution, and maintain national security. Those goals require a nuclear regulatory system that is rigorous, technically competent, transparent, and capable of making decisions in proportion to actual risk.

The NRC has built and maintained a strong safety record. That achievement should be recognized. But over time, the regulatory structure built around the prevention of one hazard (radiological harm) has become increasingly difficult to reconcile with the broader public benefits nuclear energy delivers. Rules, guidance, statutory mandates, environmental procedures, radiation standards, quality assurance expectations, and interagency responsibilities have accumulated over decades. Each may have been understandable in context. Taken together, they have produced a system that is cautious but not always coherent; protective but not always proportionate; technically serious but not always timely.

For many years, the practical cost of regulatory incoherence was easier to tolerate because the country was not trying to build much new nuclear energy. That is no longer the case: the United States will be unable to respond effectively if its own regulatory system cannot support safe and repeatable deployment.

Congress has already taken important steps to modernize the NRC. This Committee has been responsive to the need for a regulator that is not only safe, but also efficient, predictable, and aligned with the public benefits of civilian nuclear technology. The next step is broader and more difficult: fine-tuning NRC modernization. Reforms up until this point are not sufficient if the surrounding statutory and regulatory framework remains fragmented across agencies and programs. Only Congress can harmonize the laws that created that structure.

Safety and reform are not opposites. A durable nuclear safety system depends on credible institutions, clear decision criteria, sufficient technical capacity, transparent Commission accountability, and standards that are proportionate to actual risk.

The public interest is not served by a system that is either careless or paralyzed. It is served by a system that can distinguish between real risks and remote ones, focus attention where consequences matter, and make timely decisions that the public can understand and trust. That is the standard that Congress and the American people should expect from nuclear regulation: safe, credible, predictable, timely, and proportionate regulation that allows nuclear energy to benefit society.