ARTICLES

ADMINISTRATIVE BULKHEADS

BY
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Administrative agencies routinely predict the effects of their policy decisions. Unsurprisingly, they err, sometimes with catastrophic consequences. The cost of administrative prediction failure has been paid in lives, devastated ecosystems, untold sums of squandered tax dollars, and foregone wealth. As familiar names like Deepwater Horizon, Flint, and Fukushima attest, even in advanced industrialized societies, environmental policy remains a domain in which administrative prediction failure is strongly felt.

A crucial task for administrative law is to reduce the toll of such bureaucratic mistakes. One means is an administrative bulkhead rule: a rule that circumscribes administrative power where the costs of prediction failure are greatest. Like collision bulkheads in ships, such rules cabin the downside risk of prediction failure. This Article confronts the problem of agency prediction failure and the applicability of a bulkhead rule under one of the United States' most important administrative-environmental laws, the National Environmental Policy Act (NEPA). In passing NEPA, Congress attempted to impose analytical rigor and environmental solicitude on federal policy making. Today however, courts and agencies interpret NEPA to impose no coherent instructions regarding how they are to approach decisions that pose low probability but catastrophic risks to the environment. The prevailing interpretation is wrong.

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This Article interprets NEPA to provide a "bulkhead rule." Surveying the statutory text and the voluminous case law interpreting it, this Article argues the statute's scope and significance thresholds are subject to raised administrative-review requirements where actions have potential non-localized impacts. Uncertainty is treated differently depending on the cost of an agency mistake: where risks are not localized, and can imperil systemically important natural systems, the law demands deeper scrutiny and onerous procedural checks.

I. INTRODUCTION

Given their role in contemporary economic life, administrative agencies must make decisions in the absence of certainty. Without such decisions, social and economic life as currently arranged would grind to a halt. The conventional wisdom is that these agencies are staffed by experts who must be afforded ample discretion to make hard decisions. Simultaneously, the rule of law imposes stringent analytical procedures upon agencies and requires the testing of administrative decisions in a crucible of pluralistic competition among interested groups.[1] The combination of expert discretion, procedural rigor, and dynamic pluralism has not, however, assuaged doubts about the bureaucracy's tendency to brood catastrophic errors. Recent years have seen such errors,[2] and with them, debate over the legal rules that govern how bureaucratic actors make policy decisions in the face of uncertainty.

[1] *See* Richard B. Stewart, *The Reformation of American Administrative Law*, 88 HARV. L. REV. 1669, 1790 (1975).

[2] *See* discussion *infra* Part II.

Joining these debates, this Article urges that developments in administrative law recognize the shortcomings of bureaucratic prediction. This Article focuses on the environmental domain, more specifically the body of administrative law that has developed under the United States' most important environmental law, the National Environmental Policy Act (NEPA).[3] Beginning with the D.C. Circuit's *Calvert Cliffs*[4] decision and the Supreme Court's response in *Vermont Yankee*,[5] NEPA law has been the locus of struggle over bureaucratic rationality and federal administrative law. Today too, NEPA law is the setting for a debate over a central problem in the administrative state: whether and how the law can bind administrative agencies to account for their own limited knowledge and likely prediction failures.

NEPA opens a unique window into administrative rationality. Under this procedural law, administrative agencies must describe and consider the potential environmental impact of "major federal actions."[6] Where an impact is of uncertain probability or magnitude, two relevant legal thresholds determine how an agency will proceed. First, the agency must determine whether it confronts a "reasonably foreseeable" impact.[7] Impacts that are not reasonably foreseeable can be excluded from further consideration.[8] Second, the agency must determine whether an impact is potentially "significant."[9] If so, this potential impact warrants the burdensome preparation of an "environmental impact statement" (EIS)—effectively, a detailed report analyzing the action and its environmental consequences relative to alternative policies.[10] NEPA requirements are exclusively procedural. However, the administrative and political costs associated with its processes—particularly where an agency identifies a large or controversial impact—can determine whether an action proceeds at all. Therefore, the choice of legal rules structuring an action's scope of review and determination of impact significance is critical to the administrative state's decisions.

As currently understood, NEPA leaves a gap as to how an agency is to evaluate impacts of uncertain or low probability. Here, commentators have proposed solutions: Some argue agencies should have discretion to

[3] National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4370h (2018).

[4] Calvert Cliffs Coordinating Comm., Inc. v. U.S. Atomic Energy Comm'n. (*Calvert Cliffs*), 449 F.2d 1109, 1129 (D.C. Cir. 1971).

[5] Vermont Yankee Nuclear Power Corp. v. Nat. Res. Def. Council, Inc., 435 U.S. 519, 558 (1978). For the relationship of the *Calvert Cliffs* and *Vermont Yankee* decisions, see generally, Gillian Metzger, *The Story of* Vermont Yankee*: A Cautionary Tale of Judicial Review and Nuclear* Waste 7–11 (Columbia Law Sch. Pub. Law & Legal Theory Working Paper Grp., Paper No. 05-92, 2005); Cass R. Sunstein & Adrian Vermeule, *Libertarian Administrative Law*, 82 U. CHI. L. REV. 393, 394–95, 434–35 (2015) (describing *Calvert Cliffs* as an example of "progressive administrative law" and *Vermont Yankee* as the Supreme Court's response).

[6] 42 U.S.C. § 4321(a)(1).

[7] 40 C.F.R. § 1501.1(a)(2)–(3) (2020).

[8] *Id.* §§ 1501.1(a)(2)–(3), 1508.1(g).

[9] *Id.* § 1501.1(a)(2)–(3).

[10] 42 U.S.C. § 4332(2)(c)(i)–(v).

apply their expertise in these circumstances, eschewing a principled legal rule.[11] Others insist the problem of uncertain impacts can be eliminated by intensifying the search for relevant information.[12]

This Article proposes an alternative path: the bulkhead rule, under which administrative decisions are bound by deeper (more burdensome) analytical procedures when potential impacts are non-localized. The rule analogizes to the bulkhead structure within a boat, which vertically partitions and compartmentalizes the hull with watertight separations, preventing generalized flooding in the event of a breach. Although this rule is intuitive and prudent, NEPA is not currently understood or applied to include it. The bulkhead rule provides that potential, non-localized impacts to natural systems will be included per se in the scope of NEPA review and will be subject to a rebuttable presumption of significance. Agencies would face higher informational and political costs to undertake actions with potential systemic risks and, at the margin, would pursue fewer such actions. Meanwhile, the rule creates a better environment for adaptive management, with more narrowly localized actions becoming "laboratories of environmental policy," to paraphrase Justice Brandeis.[13] Regulators can learn by risking small, localized mistakes without endangering precious natural systems. Environmental policymaking can improve over time without collateral ecological disaster, adding robustness and possibly, antifragility, to federal environmental protection.[14] Just as a ship's bulkhead caps the downside cost of a breach at any one location on a vessel, the bulkhead rule reduces the risk of agency prediction failures by focusing attention and political pressure on larger scale risks and indirectly nudging agencies toward actions with only localized potential impacts.

After an initial overview of the NEPA regime, this Article describes the functional benefits of the bulkhead rule before turning to its legal basis. NEPA jurisprudence derives from broadly worded statutory language, elaborated by implementing regulations of the Council on Environmental Quality (CEQ).[15] This legislation and regulation have been interpreted in a body of decisions developed over NEPA's five decades, what Justice Thurgood Marshall described as NEPA "common law."[16] The bulkhead rule is not explicitly articulated in NEPA

11 *See* discussion *infra* Part IV.A.

12 *See* discussion *infra* Part IV.B.

13 New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting) ("It is one of the happy incidents of the federal system that a single courageous State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.").

14 NASSIM NICHOLAS TALEB, ANTIFRAGILE: THINGS THAT GAIN FROM DISORDER 8 (2012) ("The antifragile gains from prediction errors, in the long run."); *id.* at 31–33 (proposing the idea of antifragility—the property of deriving benefit from volatility).

15 *See* discussion *infra* Part III.A.

16 Kleppe v. Sierra Club, 427 U.S. 390, 421 (1976) (Marshall, J., concurring) (citations omitted).

implementing regulations nor in NEPA common law, but as this Article argues, it is implied in both and should be so recognized.

II. NEPA AS ADMINISTRATIVE BATTLEGROUND

According to foundational, liberal political theory, a core governmental function is to provide an authoritative resolution to coordination problems that arise from decentralized private activity ("the market").[17] In this coordinating role, government's task is to identify harms that non-governmental entities generate, in order to develop and enforce rules that reduce those harms.[18] It may do this by setting expectations against which private actors can plan and privately arrange their affairs; for example, by defining (and enforcing) rights or by compelling harm-creators to internalize the harms, perhaps even shifting the costs of bearing harms onto the government itself—that is, to socialize them.

One area in which governments often play such a role is in coordinating use of the environmental commons. This domain presents difficulties, namely because the "environmental commons" entail complex systems that are poorly understood and illegible, and therefore often poorly managed by policy intervention. According to some commentators, the U.S. Federal Government manages these natural systems under laws from the 1960s and 1970s conceived in the so-called "equilibrium paradigm," in which the natural world is viewed in timeless stasis, disturbed only by anthropogenic, and more specifically, industrial activity.[19] These laws are outdated, the critics claim, because ecologists today have superseded this paradigm: Many natural systems are not stable over long time scales.[20] Critics conclude that, under the dead hand of the equilibrium paradigm, existing laws require regulators to manage unstable natural systems as though they were static, predictable, and amenable to technocratic management.[21]

Additionally, environmental policymaking is subject to a problem that afflicts social organizations as such: The knowledge problem. Centralized hierarchical organizations like bureaucracies and legislative bodies require aggregation and processing of information by some small subset of decision makers: finite persons, with finite resources and finite

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[17] *See, e.g.*, JOHN STUART MILL, 2 PRINCIPLES OF POLITICAL ECONOMY 558 (1857) ("There are matters in which the interference of law is required, not to overrule the judgment of individuals respecting their own interest, but to give effect to that judgment: they being unable to give effect to it except by concert, which concert again cannot be effectual unless it receives validity and sanction from the law.").

[18] *Id.*

[19] Julie Thrower, *Adaptive Management and NEPA: How a Nonequilibrium View of Ecosystem Mandates Flexible Regulation*, 33 ECOLOGY L.Q. 871, 874 (2006).

[20] *Id.* at 875–76, 879 (highlighting the inadequacies of the equilibrium paradigm leading to the adoption of a "dynamic, nonequilibrium model").

[21] *See id.* at 877 (discussing the difficulties created by the nonequilibrium paradigm in environmental decision-making by ecologists and lawmakers).

mental capacities. Even in the best circumstances, the most prudent, public-spirited, and intelligent officials face structural impediments to the necessary informational aggregation:

> the planning apparatus . . . staffed by persons possessed of the moral stature and material requirements of a Mohandas Gandhi combined with the mental capacity and creative genius of a Leonardo da Vinci . . . will not know what the right things to do *are*, even if they passionately wanted to do them.[22]

Needless to say, officialdom is rarely headed by Gandhis and da Vincis.[23]

The knowledge problem is pronounced when officials undertake environmental regulation. The vast majority of information about natural phenomena—for example: a watershed, a deep-water oil field, an endangered species—does not immediately exist as legible, accessible knowledge. Zoologists, geologists, and interested individuals devote time and energy to develop the limited amounts of knowledge we have about any of these phenomena. But the most important anthropogenic risks to these natural phenomena may be realized only rarely, meaning there is limited data to draw upon. Where information is available, it is mostly dispersed among individuals who live near or use the natural system in question, or with local officials; such information is difficult to gather. Over decades of administrative practice, the federal bureaucracy—acting under congressional and public oversight—has improved its knowledge-aggregating functions. It engages in research and experimentation and cultivates subject-matter specialists. In some circumstances, government decision-making is opened to the public, to gather even more data. But such information gathering can be costly in time and taxpayer money and thus remains limited.

Once available information is gathered, centralized decision-making generates an epistemic bottleneck, whereby the designated officials must process the information before it can be reflected in a decision.[24] Information aggregation and processing can lead to "filter failure," when officials confront huge quantities of data they cannot process, digest, and factor into administrative actions.[25] The situation creates ample

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[22] *Id. See also* F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 519 (1945) (discussing that social knowledge does not necessarily "exist[] in concentrated or integrated form," but rather, may be dispersed among different individuals).

[23] *See* FRIEDRICH A. HAYEK, THE ROAD TO SERFDOM 157–70 (Bruce Caldwell ed., 2014) (explaining "why the worst get on top").

[24] *See* ADRIAN VERMEULE, LAW *AND THE* LIMITS *OF* REASON 50 (2009) (discussing how, as the numbers of a group engaged in decision making increase, there is a "tendency for many minds to be directed by few" and describing how that tendency "undermines the epistemic superiority that many minds would otherwise display").

[25] *See* Wendy E. Wagner, *Administrative Law, Filter Failure, and Information Capture*, 59 DUKE L.J. 1321, 1353–62 (2010) (describing the information gathering process of the APA); Bradley C. Karkkainen, *Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance*, 102 COLUM. L. REV. 903, 919 (2002) (analyzing the requirements and the "consequences of open ended information production"); *id.* at 922

opportunity for abuse. For example, private actors who control the flow of information can feed it to the agency strategically, extracting rents by controlling the information process, a form of capture.[26] Because the requisite information may only partially exist, and even this information is imperfectly gathered and processed within the administrative state, governmental decisions are necessarily based on highly imperfect information.

Perhaps the more important problem, however, occurs where the centralized decision-maker fails to recognize how narrow, limited—and in many cases—deficient, the total knowledge at his or her disposal will be. The result may be bureaucratic hubris, where officials consider themselves competent to make what they deem informed decisions on the basis of their partial knowledge. Hubris can lead to catastrophically bad decisions.

The detriments of the knowledge problem cannot be considered in isolation. They must be traded-off against the costs of decentralization. Centralized hierarchies are equipped to coordinate activities with an energy and speed that might be impossible to recreate through decentralized coordination, notwithstanding the knowledge costs.[27] There will be situations in which, notwithstanding the limits on the bureaucracy, it is preferable to assign coordination to an administrative authority relative to leaving a solution "to the market." And, once a domain has been brought under the government's jurisdiction, officials cannot avoid making centralized decisions—passivity is itself a decision to let risks lie where they fall (which, in a democracy, may mean de facto socialization of costs if the risk materializes, i.e., where political pressure will guarantee a response). In this context, it is imperative to structure bureaucratic decision making rationally; that is, to recognize that flawed decisions are inevitable, and their consequences must be bounded.

III. NEPA DIRECTIVES ON UNCERTAIN IMPACTS

One important constraint on bureaucratic governance is law that requires agencies to present decisions for public scrutiny. In the environmental sphere, under NEPA, federal agencies are required to disclose the environmental impacts of "major federal actions" before they

(discussing the incentive for agencies to "overstuff" an environmental impact statement "with information from every available source, regardless of its quality").

[26] *See* Daniel Carpenter & David Moss, *Introduction*, *in* PREVENTING REGULATORY CAPTURE: SPECIAL INTEREST INFLUENCE AND HOW TO LIMIT IT 1, 13 (Daniel Carpenter & David Moss eds., 2014) (defining the general concept of regulatory capture); Richard A. Posner, *The Concept of Regulatory Capture: A Short Inglorious History*, *in* PREVENTING REGULATORY CAPTURE: SPECIAL INTEREST INFLUENCE AND HOW TO LIMIT IT 49, 53–54 (Daniel Carpenter & David Moss eds., 2014) (arguing that "newer forms of regulation are difficult to 'capture'").

[27] *See, e.g.*, Andrew Gamble, *Hayek and the Left*, 67 POL. Q. 46, 51 (1996) (discussing the need for direct government intervention, for example, to protect public goods or respond to catastrophes); HAYEK, *supra* note 23, at 40–42.

commit to them.[28] Under the statute, when a federal agency proposes a major federal action, it must assess potential significant impacts on the environment.[29] Where the agency finds potential significant impacts, it must undertake "an early and open process for determining the scope for analysis,"[30] taking public comment on its proposed decision and comparing alternative policies in an EIS.[31]

Formally, NEPA's "mandate to the agencies is essentially procedural."[32] The statute does not dictate substantive outcomes.[33] Once all available information has been fully examined and disclosed in an environmental impact statement, agencies are unconstrained (at least under NEPA) to run risks, whatever their magnitude.[34] Courts have reaffirmed this position on several occasions.[35]

Indirectly, however, disclosure of risks renders the bureaucracy more hesitant. Disclosure can prompt political backlash and catalyze opposition.[36] Affected individuals or groups can coalesce and organize to protect themselves, advocate before the agency—better yet, its legislative overlords—to change its decision, and mitigate the risks. NEPA

[28] National Environmental Policy Act of 1969, 42 U.S.C § 4332(2)(c) (2018).

[29] *Id.*

[30] 40 C.F.R. § 1501.9 (2020).

[31] *Id.* § 1502.14.

[32] *Vermont Yankee Nuclear Power Corp.*, 435 U.S. 519, 558 (1978) (citations omitted); Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350 (1989) ("NEPA itself does not mandate particular results, but simply prescribes the necessary process." (citations omitted)). Some scholars argue that this exclusively procedural interpretation is unduly narrow. *See, e.g.*, Nicholas C. Yost, *NEPA's Promise-Partially Fulfilled*, 20 ENV'T L. 533, 539–40 (1990).

[33] *See Robertson*, 490 U.S. at 350.

[34] *Id.* ("If the adverse environmental effects of the proposed action are adequately identified and evaluated, the agency is not constrained by NEPA from deciding that other values outweigh the environmental costs." (citations omitted)); New York v. U.S. Nuclear Regulatory Comm'n, 824 F.3d 1012, 1022 (D.C. Cir. 2016) ("An agency does not engage in arbitrary or capricious decision-making by making predictive judgments or even by relying on incomplete data. To the contrary, such judgments are entitled to deference" (internal quotation marks omitted)).

[35] In *Baltimore Gas & Elec. Co. v. Natural Resources Defense Council*, the Nuclear Regulatory Commission had promulgated a generic rule instructing individual licensing boards to adopt a "zero-release assumption" regarding harms from waste impoundment in a future permanent nuclear waste depository which the federal government would one day create (the facility has still not been established 38 years after *Baltimore Gas*). 462 U.S. 87, 93–94 (1983). The agency recognized the risks associated with the repository issue. Provided it was actually established, the repository would impound waste for thousands of years. The agency could not rule out the major risks associated with release of radioactive materials to the environment. However, the agency decided that as a matter of policy, the risk was worth running. *Id.* The Court held that the agency had discretion to run these risks, having "allow[ed] all significant environmental risks to be factored into the decision." *Id.* at 100.

[36] *See* Daniel A. Farber, *Confronting Uncertainty Under NEPA*, ISSUES IN LEGAL SCHOLARSHIP—BALANCING THE RISKS: MANAGING TECHNOLOGY AND DANGEROUS CLIMATE CHANGE, 2009, at 1, 32 ("Regardless of the agency's good faith, credibility is difficult to establish when a potential catastrophic risk might raise serious doubts about a major project or regulatory program to which an agency is clearly committed.") [hereinafter Farber, *Confronting Uncertainty*].

procedure thus translates into political resistance and bears on policy substance.

Given the political effect of disclosing risks, the key practical question is how much an agency must disclose to be absolved of liability. Under the statute, an overstatement of risks may dissuade officials from taking socially beneficial actions. Under-emphasis unduly reduces procedural checks on the agency, allowing the agency to follow the pressure of interests that stand to benefit from laxity, with potentially disastrous results.

A. Legal Thresholds in NEPA Common Law

Under NEPA, two legal thresholds govern how much an agency must disclose about the environmental risks it intends to run—the scope of review and the significance of impacts.[37] The statute itself is worded broadly and does not elaborate either threshold.[38] Instead, the thresholds are articulated by implementing regulations promulgated by the CEQ.[39] Courts accord these CEQ implementing regulations *Skidmore* deference,[40] accepting these regulations as authoritative interpretations of the statute to the extent they have the power to persuade.[41] A main source of law is what Justice Marshall described as the "common law of NEPA" arising from courts' interpretations of the statute and CEQ regulations.[42]

The case law on how agencies are to treat uncertain impacts under NEPA has been characterized as internally inconsistent and lacking in

[37] *See* National Environmental Policy Act of 1969, 42 U.S.C. § 4332(C), (F) (2018).

[38] *See generally id.* § 4332.

[39] *See generally*, Jamison E. Colburn, *Administering the National Environmental Policy Act*, 45 ENV'T L. REP. 10287 (2015) (examining the foundation and evolution of the CEQ, its authority, and its impact on the administration of NEPA).

[40] *But see infra* note 54 and accompanying text (regarding proposed changes to these regulations).

[41] Andrus v. Sierra Club, 442 U.S. 347, 358 (1979) ("CEQ's interpretation of NEPA is entitled to substantial deference." (citations omitted)); Hanly v. Kleindienst, 471 F.2d 823, 838 (2d Cir. 1972) (Friendly, C.J., dissenting) ("Beyond the general scheme of the legislation, a court normally looks for guidance, in the case of a statute calling for administrative action, to the views of those charged with its administration . . . . However, this does not mean that dominating weight should be given to the views of agencies upon whom NEPA placed a duty to make impact statements when the result would be to relieve them from that obligation—particularly when these are 'action' agencies like the GSA. The National Environmental Policy Act established its own watch-dog agency, The Council on Environmental Quality." (citations omitted)). *See also* Colburn, *supra* note 39, at 10287 ("CEQ's rules have been regarded by courts and most action agencies as law"); Thomas W. Merrill & Kristin E. Hickman, *Chevron's Domain*, 89 GEO. L.J. 833, 895 n.296 (2001) (arguing that CEQ's implementing regulations are entitled to *Skidmore* deference).

[42] *Kleppe*, 427 U.S. 390, 421 (1976) (Marshall, J., concurring in part, dissenting in part) (describing the federal courts' development of a "common law" of NEPA and stating that "that development is the source of NEPA's success").

governing principles.[43] Critics note that courts reach irreconcilable holdings.[44] These critics describe the area of law as devoid of structuring legal principles and "susceptible to results-driven reasoning."[45]

Notwithstanding conflicting perspectives of individual judges, the case law yields emergent rules of "constancy and uniformity and average value greater than its component elements."[46] It is possible to observe convergence on structuring rules in accord with the so-called "Cardozo theorem."[47] Specifically, there are two emergent rules regarding uncertain impacts under NEPA. First, the scope of NEPA review will be bounded by a causation analysis borrowed from tort law. Second, the significance of an action's impact is defined as its expected impact value: the sum of potential (in-scope) impacts discounted by their probabilities.

The following section describes the relevant statutory language, CEQ regulations, the case law that has developed around each, and the emergent legal rules in "the common law of NEPA."

1. Defining the Scope of NEPA Review

Under NEPA, an agency must initially determine whether a potential impact is within the scope of analysis, which is bounded but ultimately broad.[48] The statute provides that an agency must consider and disclose "any adverse environmental effects" associated with a proposed action, without qualification, and instructs agencies to "recognize the worldwide and long-range character of environmental problems . . . ."[49] With respect to uncertain impacts that could follow from an action, CEQ's implementing regulations retain the recognition that "reasonably foreseeable" impacts will, at times, include some low probability "catastrophic" outcomes.[50] The current regulatory language originates from 1986, when the Reagan Administration replaced a previous instantiation of the regulation that had required a worst-case

[43] Todd. S. Aagaard, *A Functional Approach to Risks and Uncertainties Under NEPA*, 1 MICH. J. ENV'T & ADMIN. L. 87, 98–102 (2012) (describing the differences in court opinions regarding NEPA); Farber, *Confronting Uncertainty*, *supra* note 36, at 1 (discussing the struggle courts have faced regarding the "treatment of uncertainty in environmental impact statements"); Irene Weintraub, *NEPA and Uncertainty in Low-Risk, High-Impact Scenarios: Nuclear Energy as a Case Study*, 37 CARDOZO L. REV. 1565, 1567–68 (2016) (recognizing that "courts have continued to interpret NEPA's requirements in areas of uncertainty in different ways").

[44] *See* Aagaard, *supra* note 43, at 98–102.

[45] *Id.* at 101.

[46] Nicola Gennaioli & Andrei Shleifer, *The Evolution of Common Law*, 115 J. POL. ECON. 43, 44–45 (2007).

[47] *Id.* at 60.

[48] 40 C.F.R. § 1501.9 (2020).

[49] National Environmental Policy Act of 1969, 42 U.S.C. § 4332(C)(ii), (F).

[50] 40 C.F.R. § 1502.21(d) (2020) ("For the purposes of this section, 'reasonably foreseeable' includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.").

scenario analysis.[51] The worst-case analysis requirement had proved too burdensome and supposedly would have required analysis of scenarios agencies did not reasonably foresee following from their actions.[52]

Until July 2020, CEQ-implementing regulations also expressly emphasized that an agency must consider not only an action's direct effects, but also indirect impacts, including those from connected actions and the effects of the action taken cumulatively with other past, present, and future actions.[53] More recently, in July 2020, the Trump Administration revised CEQ's implementing regulations to remove express references to indirect effects and cumulative impacts, conceding such impacts will, in some instances, fall within the scope of review as "reasonably foreseeable effects."[54] In so revising the implementing regulations, the Administration alluded to the statute's incorporation of a tort law causation doctrine, as described by the Supreme Court.[55]

The Trump Administration's regulatory revisions—whatever their ultimate fate—cannot change NEPA's legislative mandate that the administrative state consider a broad array of impacts over an extended time horizon. As courts have long recognized,

> particular provisions of the Act explicitly mandate concern for the long run. Section 102(2)(C) itself requires agencies that propose major actions that will significantly affect the environment to consider and disclose "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." Moreover, section 101(b), which articulates the ultimate purposes of NEPA's procedural requirements, establishes the federal government's continuing

[51] National Environmental Policy Act Regulations; Incomplete or Unavailable Information, 51 Fed. Reg. 15,618, 15,618 (Apr. 25, 1986). *See generally* Edward A. Fitzgerald, *The Rise and Fall of Worst Case Analysis*, 18 U. DAYTON L. REV. 1 (1992) (discussing the history of worst-case analyses under NEPA).

[52] *See* National Environmental Policy Act Regulations, 50 Fed. Reg. 32,234, 32,236 (Aug. 9, 1985) (stating in connection with proposed rule that the worst-case analysis provision "is an unsatisfactory approach . . . challeng[ing] the agencies to speculate on the 'worst' possible consequence of a proposed action . . . .[O]ne can always conjure up a worse 'worst case'"). *But see Robertson*, 490 U.S. 332, 354–55 (1989) (holding that the then-current version of the regulation was permissible under NEPA, and also finding that NEPA does not necessarily require a worst-case analysis in all circumstances).

[53] 40 C.F.R. §§ 1502.16, 1508.7–1508.8 (2019); *Kleppe*, 427 U.S. 390, 409–10 (1976) (holding that "[a] comprehensive impact statement may be necessary in some cases" and that when multiple proposals have "cumulative or synergistic environmental impact[s] upon a region" that are "pending concurrently before an agency, their environmental consequences must be considered together").

[54] *See* Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, 85 Fed. Reg. 43,304, 43,331, 43,343 (July 16, 2020); 40 C.F.R. §§ 1502.15, 1502.16 (2020).

[55] 85 Fed. Reg. 43,304, 43,343–44. *See infra* notes 58–79 and accompanying text.

> responsibility to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations."[56]

Additionally, to the extent the Administration sought to foreshorten such consideration by the revisions' reliance on causation doctrine, it wanders into doctrinal misunderstanding. Unlike in their proposed rulemaking, the Administration's final revised CEQ-implementing regulations do not mandate agencies ignore cumulative or indirect effects.[57] Rather, these revisions simply remove CEQ's administrative gloss on the bare statutory language. As this section will show, the Supreme Court reads NEPA to bound the scope of required review by a causal inquiry analogized to tort law's proximate causation inquiry.[58] Consistent with causation doctrine at common law, the scope of legally relevant causal connections maps to the policy of the underlying law: The scope of impacts attributable to an agency action track NEPA's broader purposes, among which are protection of the environment and economizing resources so that they can be devoted to such protection.

Given the breadth of the environmental protection Congress effected by passing NEPA, the relevant causal scope is necessarily expansive.[59] For this reason, under the Court's holdings—and not merely the previous instantiation of CEQ's implementing regulations—reasonably foreseeable impacts include indirect and cumulative effects.[60] Notwithstanding the Administration's intentions, their revisions cannot categorically exclude cumulative and indirect effects from consideration where such effects fall within the expansive field of a federal action's causal connections.

An early decision introducing the tort-causation standard in NEPA law jurisprudence appears in *Metropolitan Edison Company v. People Against Nuclear Energy*.[61] There, the Supreme Court evaluated the Nuclear Regulatory Commission's (NRC) reopening of the Three Mile Island nuclear plant following its disaster in 1979.[62] Plaintiffs challenged the Commission's refusal to consider potential psychological consequences to neighboring communities from the restarting of the plant.[63] The Supreme Court held for the agency, finding that psychological consequences flowing from fear of a repeat disaster were

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[56] Potomac All. v. U.S. Nuclear Regulatory Comm'n, 682 F.2d 1030, 1036 (D.C. Cir. 1982) (Bazelon, J., concurring).

[57] *See* 85 Fed. Reg. 43,305, 43,344 (explaining that the final rule does not provide additional direction on indirect effects and instead, provides "considerable flexibility" in structuring the analysis of effects).

[58] *See* Metro. Edison Co. v. People Against Nuclear Energy, 460 U.S. 766, 774 (1983).

[59] *See id.* at 773–74 (defining the boundaries of causation under NEPA; discussing, for example, how stringent hospital requirements fall within the causal spectrum, but psychological health problems arising from the operation are too attenuated. The causal relationship is broad and resembles proximate cause from tort law.)

[60] Dep't of Transp. v. Pub. Citizen, 541 U.S. 752, 763–64, 769–70 (2003).

[61] *Metro. Edison Co.*, 460 U.S. at 774.

[62] *Id.* at 768.

[63] *Id.* at 769.

beyond the scope of NEPA review.[64] In reaching this holding, the Court interpreted NEPA: Looking at the legislative concerns behind the statute, the Court concluded that the statute required "a reasonably close causal relationship between a change in the physical environment and the effect at issue. This requirement is like the familiar doctrine of proximate cause from tort law."[65]

The analogy did not make tort doctrine directly applicable in the NEPA context. Rather, the Court imported theories of causation, including the doctrine that the law's underlying policies delimited "a manageable line between those causal changes that may make an actor responsible for an effect and those that do not."[66] Here, an underlying policy of NEPA was protection of the physical environment and natural resources; in light of this policy, the Court held that the "manageable line" severed the causal chain between the NRC's restarting decision and the mental health impacts to neighbors.[67] The impacts in question followed not from realization of a risk associated with the action, but from plaintiffs' perception of and reactions to the risk: "A risk is, by definition, unrealized in the physical world. . . . [T]he element of risk lengthens the causal chain beyond the reach of NEPA."[68] The remoteness of the impacts would have required the agency to expend inordinate time and resources to gather information and disaggregate bona fide mental health issues from mere disagreement with the decision[69]—possibly rendering the agency unable to otherwise pursue environmental protection.[70] As the Court put it, "[t]ime and resources are simply too limited for us to believe that Congress intended to extend NEPA as far as the Court of Appeals has taken it."[71]

In 2004, the Supreme Court again analogized to proximate causation doctrine in determining the scope of NEPA review. In *Department of Transportation v. Public Citizen*,[72] the Supreme Court addressed the promulgation of safety regulations for Mexican motor carriers in the United States.[73] Plaintiffs challenged the action on the basis of the agency's failure to consider the impacts from increased volumes of Mexican trucks within the United States following the implementation of NAFTA.[74] The Court held for the agency, finding that "the causal connection between [the agency's] issuance of the proposed regulations and the entry of the Mexican trucks is insufficient to make [the agency] responsible under NEPA to consider the environmental effects of the

64 *Id.* at 779.
65 *Id.* at 774.
66 *Id.* at 774 n.7.
67 *Id.* at 777.
68 *Id.* at 775.
69 *Id.* at 777–78.
70 *Id.* at 775.
71 *Id.* (citations omitted).
72 541 U.S. 752 (2004).
73 *Id.* at 765–67.
74 *Id.* at 762.

entry."[75] Promulgation of the rule was a condition precedent to the entry of Mexican trucks, but the Court held that "a 'but for' causal relationship is insufficient to make an agency responsible for a particular effect under NEPA and the relevant regulations."[76] Rather, "NEPA requires a reasonably close causal relationship between the environmental effect and the alleged cause," specifically, one analogical to "the familiar doctrine of proximate cause from tort law."[77] This doctrine required "draw[ing] a manageable line between those causal changes that may make an actor responsible for an effect and those that do not," based upon "underlying policies or legislative intent."[78] Under NEPA, Congress's intent was that analysis prove "useful[] . . . to the decision making process."[79] Here, the influx of Mexican trucks was attributable not to the Department's action, but rather to President Clinton's lifting of a moratorium on Mexican motor carriers.[80]

Lower courts have also applied the tort-causation rule where third-party acts intervene between agency action and environmental impact. An early decision along these lines was *Glass Packaging Institute v. Regan*,[81] in which the D.C. Circuit addressed the Bureau of Alcohol, Tobacco and Firearms decision to authorize the packaging of liquor in plastic polyethylene terephthalate (PET) bottles.[82] The agency had issued an environmental assessment, which concluded use of PET bottles would have no significant environmental effect.[83] The plaintiff, a glass manufacturers trade association, challenged the agency's analysis on the basis of its failure to consider the risk of potential tampering with PET bottles, specifically the risk that a deranged criminal would inject poisons through their plastic walls.[84] In response to the plaintiff's argument that criminal tampering was reasonably foreseeable, the D.C. Circuit found that mere foreseeability was insufficient: Here, the nexus between the agency's action and the impact in question required the failure of both Food and Drug Administration (FDA) regulation of food adulteration and criminal deterrents under the Federal Anti-Tampering Act,[85] as well as the supervening deranged criminal's act.[86] In these circumstances, "it would be absurd to hold that susceptibility to tampering is an environmental health risk which the Bureau and every other agency must consider in making an environmental assessment."[87]

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75 *Id.* at 754.
76 *Id.* at 767.
77 *Id.* (internal quotation marks omitted).
78 *Id.* (internal quotation marks omitted).
79 *Id.* (citations omitted).
80 *Id.* at 769.
81 737 F.2d 1083 (D.C. Cir. 1984).
82 *Id.* at 1084.
83 *Id.* at 1091.
84 *Id.*
85 Federal Anti-Tampering Act, 18 U.S.C. § 1365, 35 U.S.C. § 155A (2018).
86 *Glass Packaging Inst.*, 737 F.2d at 1092.
87 *Id.*

In *No GWEN Alliance v. Aldridge*,[88] the Ninth Circuit addressed the Air Force's installation of a radio-tower network intended for use in the aftermath of a nuclear war.[89] In its NEPA analyses, the Air Force stated the network was intended to deter nuclear war by lowering the benefits and increasing the costs of a nuclear strike by adversaries—knowing American communications would withstand a strike and would be used to coordinate a counterstrike, the Soviets would be less inclined to strike first.[90] The Air Force concluded the project would have no significant impact.[91] Plaintiffs challenged the Air Force's decision, arguing construction of the network was geopolitically destabilizing, making nuclear war more probable, and the Air Force's failure to consider the environmental impacts of a resulting nuclear holocaust violated NEPA.[92] The Ninth Circuit held for the agency,[93] finding "the nexus between construction of [the network] and nuclear war . . . too attenuated to require discussion of the environmental impacts of nuclear war in an environmental assessment or environmental impact statement."[94]

The Ninth Circuit further circumscribed the bounds of administratively "cognizable" impacts in *Presidio Golf Club v. National Park Service*.[95] In this case, the court addressed the National Park Service's decision to deactivate the private Presidio Golf Course on public lands and replace it with a public golf facility.[96] Plaintiffs argued the Park Service failed to account for reasonably foreseeable effects the new facility would have on a historic private clubhouse on adjacent private lands.[97] The Ninth Circuit held these impacts were beyond the scope of NEPA analysis: "While we have found an adequate string of causation necessary to confer standing, it does not necessarily follow that such a highly attenuated chain of causation as the Club alleges would lead to injuries cognizable under NEPA."[98]

Similarly, in *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission*,[99] the Ninth Circuit addressed the NRC's licensing of a spent nuclear-fuel storage facility at a power plant in San Luis Obispo, California.[100] The agency categorically decided that NEPA does not require consideration of the environmental effects of potential terrorist attacks because such attacks were too removed from the agency's

88 855 F.2d 1380 (9th Cir. 1988).
89 *Id.*
90 *Id.* at 1382.
91 *Id.* at 1381.
92 *Id.*
93 *Id.* at 1384–85, 1387.
94 *Id.* at 1386.
95 155 F.3d 1153, 1163 (9th Cir. 1998).
96 *Id.* at 1156.
97 *Id.* at 1163.
98 *Id.*
99 449 F.3d 1016 (9th Cir. 2006).
100 *Id.* at 1020.

decision, and the risk of the attack was not possible to determine.[101] On review, however, the Ninth Circuit rejected the agency's position.[102] The court noted the agency's characterization of the risk was at odds with the "government's efforts and expenditures to combat this type of terrorist attack against nuclear facilities."[103] The court also rejected the agency's argument that an inability to quantify a risk rendered it excludable for NEPA purposes:

> It is therefore possible to conduct a low probability-high consequence analysis without quantifying the precise probability of risk. . . . No provision of NEPA, or any other authority cited by the Commission, allows the NRC to eliminate a possible environmental consequence from analysis by labeling the risk as "unquantifiable."[104]

The court therefore held that the analysis was inadequate and remanded for the district court to remedy the NEPA violation.[105]

The Third Circuit also applied the tort-causation rule in *New Jersey Department of Environmental Protection v. Nuclear Regulatory Commission*,[106] addressing a decision by the NRC to relicense the Oyster Creek Nuclear Generating Station in New Jersey.[107] The agency had refused to consider the potential impacts of an airborne terrorist attack, finding such a risk "too far removed from the natural or expected consequences of agency action."[108] The Third Circuit held for the agency, limiting the scope of NEPA analysis by a causal nexus similar to that in tort law.[109] Here, the causal chain between agency action and impact were severed by the intervening responsibilities of Congress and other federal agencies to conduct criminal investigations and maintain air security, as well as the intervening criminal act of the terrorist perpetrators.[110] "[T]his causation chain is too attenuated to require NEPA review. Moreover, this conclusion is supported by traditional tort law concepts of causation."[111]

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101 *Id.* at 1028.

102 *Id.* at 1030.

103 *Id.* at 1030–31 ("We find it difficult to reconcile the Commission's conclusion that, as a matter of law, the possibility of a terrorist attack on a nuclear facility is 'remote and speculative,' with its stated efforts to undertake a 'top to bottom' security review against this same threat."). Note that this evidence could cut both ways: If the government's efforts were highly effective, the efforts and expenditures should correlate inversely—not positively—with the possibility of attacks.

104 *Id.* at 1031–32 (citations omitted).

105 *Id.* at 1035.

106 561 F.3d 132 (3d Cir. 2009).

107 *Id.* at 133.

108 *Id.* The agency also found such analysis redundant given a programmatic EIS's analysis. *Id.* at 135–36.

109 *Id.* at 137–38. The court also held that sabotage impacts had already been accounted for in the programmatic EIS. *Id.* at 136.

110 *Id.* at 139.

111 *Id.* at 140.

A few outlier decisions suggest a secondary inquiry, looking for an additional causal nexus between the environmental impact and the agency's decision-making. Where the expected marginal return to analysis is zero, these decisions suggest no further analysis is required. For example, in *Warm Springs Dam Task Force v. Gribble*,[112] the Ninth Circuit addressed the Army Corps of Engineers' decision to construct the Warm Spring Dam in Sonoma County, California. The Corps had prepared a NEPA analysis but did not consider a potential total failure of the dam.[113] Plaintiffs challenged this omission.[114] The Ninth Circuit also held for the Corps, finding a discussion of catastrophic failure unnecessary.[115] Although "[a]n impact statement must be particularly thorough when the environmental consequences of federal action are great,"[116] here, with respect to the risk of catastrophic failure, "Everyone recognizes the catastrophic results . . . to detail these results would serve no useful purpose."[117] The court suggested similarly in the *No GWEN Alliance* decision, finding that examination of the impacts of nuclear war—even if in scope—were obviated by the negligible marginal return of further analysis: "[E]veryone recognizes that . . . effects [from a nuclear war] would be catastrophic. Detailing these results would serve no useful purpose."[118]

To summarize, the Supreme Court's decision in *Public Citizen* holds that NEPA analysis is necessitated only where the agency's decision has some potential causal nexus to the relevant environmental impacts.[119] Courts interpret the marginal return to analysis generously: "To permit an agency to ignore its duties under NEPA with impunity because we have serious doubts that its ultimate decision will be affected by compliance would subvert the very purpose of the Act and encourage further administrative laxity in this area."[120] This holding speaks to the efficacy of analysis: NEPA analysis is not an abstract exercise, but informs an agency's choices. Regarding the ambit of the agency's review, duties are broad: The scope of its review reaches at least as far and wide as the causal chains running from the agency's choice, as recognized in causation doctrine at common law. The statute itself instructs that the scope of reviewable impacts includes not only direct impacts of the agency's decision, but also any reasonably foreseeable indirect and cumulative impacts, even including impacts separated from the choice by a reasonably foreseeable third-party intervention.

112 621 F.2d 1017 (9th Cir. 1980).
113 *Id.* at 1026.
114 *Id.* at 1019.
115 *Id.* at 1026.
116 *Id.* (citations omitted).
117 *Id.* at 1026–27.
118 *No GWEN All.*, 855 F.2d 1380, 1386 (9th Cir. 1988) (internal quotation marks omitted).
119 Dep't of Transp. v. Pub. Citizen, 541 U.S. 752, 767–68 (2004).
120 City of New York v. United States, 337 F. Supp. 150, 160 (E.D.N.Y. 1972).

2. Evaluating Impact Significance

A second threshold under NEPA is the "significance" of a potential environmental impact. An agency is required to disclose and examine potentially "significant[]" impacts in an environmental impact statement.[121] Where the agency deems impacts not significant, it may relegate them to briefer mention in preliminary analysis.[122] NEPA's reference to a significance threshold generates ambiguity. As one jurist commented, "all words may be 'chameleons, which reflect the color of their environment,' . . . [but] 'significant' has that quality more than most. It covers a spectrum ranging from 'not trivial' through 'appreciable' to 'important' and even 'momentous.'"[123] The term resists definition by a general quantitative threshold as there is no obvious unit by which to make impacts commensurable.

Following the Trump Administration's July 2020 revisions, CEQ's implementing regulations state that significance, for NEPA purposes, is a function of an impact's "potentially affected environment and the degree of the effects of the action."[124] With regard to "potentially affected environment," the regulation instructs that "[s]ignificance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend only upon the effects in the local area."[125]

As with the previous version of this regulation (formerly at 40 C.F.R. § 1508.27), the regulation conveys that scale bears on an impact's significance,[126] but not how it does so. There are at least two possible interpretations: First, the regulation could express that significance is defined relative to the natural system affected, in which case it is hard to imagine an impact that is not significant—with a small enough frame of reference, all changes are significant. Alternatively, the regulation could be interpreted to express that magnitude matters to an impact's significance—above a certain threshold, all impacts will be considered significant.[127] In the few instances where courts have interpreted the previous version of this CEQ regulation's explanation of significance—which included the same ambiguity—they tended to adopt a meaning

121 National Environmental Policy Act of 1969, 42 U.S.C. § 4332(C) (2018).

122 *Id.*

123 *Hanly*, 471 F.2d 823, 837 (2d Cir. 1972) (Friendly, C.J., dissenting) (citing C.I.R. v. Nat'l Carbide Corp., 167 F.2d 304, 306 (2d Cir. 1948) ("The scheme of the National Environmental Policy Act argues for giving 'significant' a reading which places it toward the lower end of the spectrum.").

124 40 C.F.R. § 1501.3(b) (2020).

125 *Id.*

126 40 C.F.R. § 1508.27(b) (2019).

127 It does not follow that a small-scale impact is necessarily insignificant, however, because officials must consider an impact's intensity (which the regulations imply is distinct from magnitude).

closer to the latter, although the doctrine had not been clearly articulated.[128]

Instructions to evaluate an impact's significance by assessing its "degree" are not necessarily easier to understand. Formerly, the CEQ regulations delineated factors for an agency to consider (using the term "intensity" of effect rather than "degree") including "[t]he degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks."[129] Even under the revised regulations, which no longer specifically refer to effect uncertainty,[130] all things equal, higher uncertainty regarding potential impacts—i.e., a flatter distribution of potential outcomes—militates in favor of affording harmful impacts scrutiny and disclosure in public, that is by deeming them "significant."

Since NEPA's passage in 1969, courts have repeatedly asked whether agencies have properly evaluated an impact's "significance." An emergent rule from the case law is that agencies must consider the expected value of an action's impacts—that is, the sum of the in-scope impacts' magnitudes, weighted by their probabilities of occurring. Where the expected value rises above the level deemed "significant," the agency must disclose these impacts in an environmental impact statement. The expected impact–value rule provides a means of separating out situations in which possible impacts are so small that uncertainty as to their probabilities makes no difference as a practical matter. Even with potentially high-magnitude impacts, the associated probabilities can be so low as to render the situation negligible. The agency has a clear course

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128 These holdings often merge into discussions of what should be the relevant level of analysis. *See* Kentuckians for the Commonwealth v. U.S. Army Corps of Eng'rs, 746 F.3d 698, 707 (6th Cir. 2014) ("[T]he regulations allow substantial flexibility in delimiting which subsets of effects are relevant. In particular, the context of the federal agency's action should be considered in determining the scope of its relevant effects."); Tri-Valley CARES v. U.S. Dep't of Energy, 671 F.3d 1113, 1126–27 (9th Cir. 2012) ("[Plaintiff] contends that the DOE's analysis is deficient because . . . the DOE must assess the risk of terrorist theft and release 'in the context of the Livermore locale.' We disagree. Although 40 C.F.R. § 1508.27(a) suggests that site-specific actions are generally evaluated in the context of a project locale, nothing in the regulation prohibits the DOE from exercising its discretion to apply a nationwide analysis when appropriate.") (citations omitted). *But see* Middle Rio Grande Conservancy Dist. v. Norton, 294 F.3d 1220, 1229 (10th Cir. 2002) ("[T]he context of the designation is such that its effects will be felt locally in the Middle Rio Grande valley. Given the aesthetic, economic, ecological, and cultural value of agriculture to the region, even a loss of 2,000 acres of irrigated farmland is significant.") (citation omitted); Barnes v. U.S. Dep't of Transp., 655 F.3d 1124, 1139 (9th Cir. 2011) ("Building a new runway . . . is a site-specific project. Petitioners therefore argue that the agencies cannot dilute their analysis of environmental impacts by averaging out across the nation or the globe. More specifically, they contend that the EA is deficient because its analysis of greenhouse gases is not specific to the locale. But the effect of greenhouse gases on climate is a *global problem*. . . .").

129 40 C.F.R. § 1508.27(b)(5).

130 Determine the Appropriate Level of NEPA Review, 85 Fed. Reg. 43,304, 43,360 (July 16, 2020) (to be codified at 40 C.F.R. § 1501.3) (noting that discussion of "uncertainty" is absent).

of action in this situation: Determine there is no significant impact and foreclose further analysis.

An early case, *Trout Unlimited v. Morton*,[131] provides an initial indication of how improbable a possible impact must be for the agency to exclude it from consideration.[132] In that case, the Ninth Circuit addressed the Bureau of Reclamation's construction of the Teton Dam in Idaho.[133] The agency prepared an environmental impact statement analyzing the impacts of the project, but plaintiffs argued that many potential impacts, like follow-on residential home development, had been excluded.[134] The Ninth Circuit held for the agency, finding that discussion of "*probable* environmental consequences is all that is required . . . ."[135] In this case, "second home development and its consequences" were "only remote possibilities" in light of the agency's studies that "concluded . . . no significant change could be expected either in population or land use patterns" together with "testimony offered at trial [that] was not sufficient to rebut this conclusion."[136]

A year later, in 1975, the D.C. Circuit further articulated a rationale for exclusion of low probability risks. In *Carolina Environmental Study Group v. United States*,[137] the court addressed an Atomic Energy Commission licensing decision for a nuclear power plant in Lake Norman, North Carolina.[138] Faced with the possibility of a reactor breach, the agency found that an accident had such a low probability that it could be excluded from the environmental impact statement.[139] The D.C. Circuit upheld the agency's decision, finding the magnitudes of impacts must be discounted by their probabilities: "There is a point at which the probability of an occurrence may be so low as to render it almost totally unworthy of consideration."[140]

A concurrence by Judge Bazelon in the 1982 decision *Potomac Alliance v. Nuclear Regulatory Commission* best articulates the expected impact–value rule. In this case, plaintiffs challenged the NRC's decision to authorize expansion of a spent-fuel storage facility at a plant in Virginia.[141] When originally licensing the plant, the agency anticipated spent fuel would be held on-site for five months, at which point it would be moved to a permanent facility.[142] Eleven years later, no permanent storage had been established; spent fuel rods were accumulating on-site,

131 509 F.2d 1276 (9th Cir. 1974).
132 *Id.* at 1282–83.
133 *Id.* at 1278.
134 *Id.* at 1283.
135 *Id.* at 1283, 1287 (emphasis added).
136 *Id.* at 1284.
137 510 F.2d 796 (D.C. Cir. 1975).
138 *Id.* at 797–98.
139 *Id.* at 798–99.
140 *Id.* at 799.
141 *Potomac All.*, 682 F.2d 1030, 1030–31 (D.C. Cir. 1982) (per curiam).
142 *Id.* at 1032 (Bazelon, J., concurring).

with remaining space running out.[143] Evaluating the plant's application to expand its on-site "temporary" storage space, the agency concluded expansion would have no significant impacts.[144] Plaintiffs challenged the agency's failure to consider that spent fuel would remain on-site indefinitely, with attendant long-term harms to the local environment.[145] The D.C. Circuit held for the petitioners, remanding for the NRC to consider whether it was reasonably foreseeable that spent fuel would remain on-site for the long term, and, if so, to consider associated impacts.[146] In a concurrence, Judge Bazelon described how agency analysis should look to the action's expected impact value on remand:

> When confronting a set of uncertain environmental effects, an agency's goal must be to trace each reasonably foreseeable contingency and determine, first, the likelihood of its occurring, and second, the environmental damage that would result should it occur. . . . At the threshold stage of the NEPA inquiry . . . an agency must determine, to the extent feasible, whether the sum of all reasonably foreseeable effects, discounted by the probability of their occurrence, represents a "significant" effect on the environment. If it does, then the agency must issue an EIS analyzing the probabilistic facets of the prospective environmental impact.[147]

Courts continue to apply the expected impact–value rule, not looking for a precise quantified value, but as a rough heuristic. In *City of New York v. Department of Transportation*,[148] the Second Circuit addressed the Department of Transportation's promulgation of a rule regulating the movement of radioactive materials on highways.[149] The agency prepared an environmental assessment, concluding there were no significant impacts, estimating an accident of sufficient seriousness to cause one or more early fatalities would occur approximately once every thousand years; catastrophic accidents in urban centers, according to the agency, would occur only once every 300 million years.[150] The Second Circuit upheld the decision.[151] Acknowledging its own "intuitive reaction that the transportation of radioactive materials through the cities of America poses risks that warrant careful consideration,"[152] the court found the probabilities sufficiently low to be deemed insignificant:[153] "The concept of overall risk incorporates the significance of possible adverse consequences discounted by the improbability of their occurrence."[154]

143 *Id.*
144 *Id.* at 1033.
145 *Id.*
146 *Id.* at 1032 (per curiam).
147 *Id.* at 1037 (Bazelon, J., concurring).
148 715 F.2d 732 (2d Cir. 1983).
149 *Id.* at 737.
150 *Id.* at 738, 746.
151 *Id.* at 745.
152 *Id.*
153 *Id.* at 752.
154 *Id.* at 738.

Regarding risks related to human error and sabotage, which had been entirely excluded from consideration, the court held that "[w]ith respect to environmental consequences that are only remote possibilities, an agency must be given some latitude to decide what sorts of risks it will assess."[155]

In *Limerick Ecology Action, Inc. v. Nuclear Regulatory Commission*,[156] the Third Circuit addressed the NRC's licensing of a nuclear power plant near Philadelphia.[157] The Commission had declined to consider site-specific design alternatives to reduce the severity of an accident at the plant as well as risks of sabotage,[158] which was "beyond state of the art probabilistic risk analysis."[159] On review, the Third Circuit found the agency's NEPA analysis inadequate.[160] The agency had not considered the potential impact's magnitude:

> [R]isk equals the likelihood of an occurrence times the severity of the consequences . . . the risk will vary with the potential consequences. . . . [T]he same probability of the same accident in a plant such as Limerick will produce a higher risk than that produced by the same accident at a plant not located within twenty-five miles of a major metropolitan area. Therefore, it is unlikely that severe accident mitigation can be treated as a generic issue.[161]

The court also pointed out the agency's own practice—investment of tens of millions of dollars into accident mitigation at the plant, extensive research projects into nuclear accidents—belied the characterization of the risk as so negligible as to warrant no review.[162]

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155 *Id.* at 750; *id.* at 751 (citing *Baltimore Gas*, 462 U.S. 87, 97 (1983)) (discussing deference afforded to agency).

156 869 F.2d 719 (3d Cir. 1989).

157 *Id.* at 751 (citing *Baltimore Gas*, 462 U.S. at 97) (discussing deference afforded to agency).

158 *Id.* at 731–32, 741–42.

159 This reasoning appeared in the agency's position in the context of an administrative appeal. *Id.* at 742.

160 *Id.* at 731.

161 *Id.* at 738–39.

162 *Id.* at 740–41. Regarding consideration of sabotage risk, the court held for the agency. The court upheld the agency's decision to forego separate analysis of sabotage risk, deferring to the agency's finding that such analysis was beyond the capacity of risk assessment techniques. *Id.* at 743–44. Dissenting, Judge Scirica objected to the majority's decision regarding the risk of sabotage. The dissent specifically criticized the agency's "equat[ing of] the word 'meaningful' with the word 'quantifiable.'" *Id.* at 754 (Scirica, J., dissenting). "No court, however, has suggested that merely because a risk evades quantification, and is in that sense 'speculative,' the NRC is relieved of its statutory duty to adequately consider and disclose its potential environmental effects." *Id.* at 755. Judge Scirica also pointed out that remote and highly speculative impacts were excluded from NEPA consideration, but "the test . . . is stated in the conjunctive, requiring that a risk meet both prongs to be properly excluded," meaning it must be both "far removed in time . . . [or] space," and "not subject to clear-cut demonstration or analysis." *Id.* at 755 n.1 (citations omitted).

The Ninth Circuit alluded to the expected impact–value rule in *Ground Zero Center for Non-Violent Action v. Department of the Navy*,[163] a case addressing the Navy's upgrade of the Trident II missile program base in Bangor, Washington.[164] The Navy determined its upgrade could have no significant environmental impacts and thus required no further environmental analysis.[165] The plaintiffs challenged this conclusion, arguing that the Navy was required to consider the risk of an accidental detonation of a nuclear weapon.[166] The Ninth Circuit held for the Navy.[167] Earlier Navy studies quantified the probability of any accident occurring during operations at less than one in one million, and the risk of an accidental detonation at between one in 100 million and one in one trillion.[168] The court characterized the probability of the risk as "infinitesimal."[169] The court granted summary judgment to the defendant without referring to a quantified expected impact value.[170]

In *Tri-Valley CAREs v. Department of Energy*,[171] the Ninth Circuit considered the Department of Energy's authorization of a biological weapons laboratory near San Francisco.[172] In an environmental assessment, the agency concluded a catastrophic failure of the laboratory could have no significant environmental impact.[173] The plaintiffs alleged the agency did not consider low probability events such as fires, earthquakes, and terrorist attacks.[174] The Ninth Circuit upheld the agency's decision.[175] Although it conceded that the plaintiffs raised "substantial questions about the validity of DOE's substantive conclusions,"[176] it deferred to the agency's judgment about probability being sufficiently low, and thus, not significant.[177]

In *New York v. Nuclear Regulatory Commission I*,[178] the D.C. Circuit addressed a NRC rule regarding temporary storage and permanent disposal of nuclear waste, specifically an update to a rule known as the Waste Confidence Decision.[179] The agency's action at issue was a finding

163 383 F.3d 1082 (9th Cir. 2004).
164 *Id.* at 1084.
165 *Id.* at 1085.
166 *Id.* at 1086.
167 *Id.*
168 *Id.* at 1090.
169 *Id.*
170 *Id.* at 1092.
171 203 F. App'x 105 (9th Cir. 2006) (*Tri-Valley CAREs I*); 671 F.3d 1113 (9th Cir. 2012) (*Tri-Valley CAREs II*).
172 *Tri-Valley CAREs I*, 203 F. App'x at 106; *Tri-Valley CAREs II*, 671 F.3d at 1118.
173 *Tri-Valley CAREs II*, 671 F.3d at 1120.
174 *Tri-Valley CAREs I*, 203 F. App'x at 106.
175 *Id.* at 107.
176 *Id.*
177 However, it made an exception with respect to the lack of analysis concerning the possibility of a terrorist attack, which it found compelled by the holding of *Mothers for Peace*. *Id.* It therefore remanded for the agency to consider whether the threat of terrorist activity necessitates preparation of an environmental impact statement. *Id.*
178 681 F.3d 471 (D.C. Cir. 2012).
179 *Id.* at 473–74.

that the government would prepare a permanent repository for spent fuel rods by the time temporary storage at the site was at capacity.[180] On this basis, the agency determined the rule would have no significant impacts.[181] Petitioners argued that the agency's conclusion of no significant impacts was deficient because it excluded from consideration the risk of leaks and fires, as well as the effects of on-site storage in the absence of a permanent repository.[182] On review, the D.C. Circuit held for the plaintiffs.[183] Regarding leaks, the agency had considered neither probability nor magnitude of impact;[184] regarding fires, the agency argued that the risk of fires was too low to warrant consideration.[185] The court disagreed: "unless the risk is remote and speculative, the Commission must put the weights on both sides of the scale before it can make a determination."[186] Regarding the possibility of the government failing to establish a permanent nuclear waste repository, the court found that the agency did not examine the possibility that a repository would not be established, while it treated the probability of failure to establish the repository as non-negligible.[187]

In *New York v. Nuclear Regulatory Commission II*,[188] the D.C. Circuit addressed the NRC's attempt to correct the NEPA analysis invalidated by *New York v. Nuclear Regulatory Commission I*.[189] The agency prepared a Generic Environmental Impact Statement (GEIS) and proposed a Continued Storage Rule which directed agency licensing boards to rely on the findings of the GEIS, unless granted a waiver.[190] Plaintiffs argued the agency violated NEPA by failing to quantify the probability of failure to site a repository.[191] The court disagreed, holding that it was possible to consider both probability and magnitude of an impact.[192]

Most recently, in *San Diego Navy Broadcast Complex Coalition v. U.S. Department of Defense*,[193] the Ninth Circuit addressed the Department of Defense's decision to develop an administrative office complex on San Diego's waterfront.[194] In an environmental assessment, the agency found the specific risk of terrorism at the location was "too speculative, remote, and removed from the environmental effects of the

180 *Id.* at 474–75.
181 *Id.* at 479.
182 *Id.*
183 *Id.* at 483.
184 *Id.* at 481.
185 *Id.* at 482.
186 *Id.* (internal quotation marks omitted).
187 *Id.* at 478.
188 824 F.3d 1012 (D.C. Cir. 2016).
189 *Id.* at 1016.
190 *Id.*
191 *Id.* at 1020.
192 *Id.*
193 817 F.3d 653 (9th Cir. 2016).
194 *Id.* at 655–56.

proposed action to merit further analysis under NEPA."[195] The Ninth Circuit disagreed, holding the agency was required to consider the risk of a possible terrorist attack in its NEPA analysis.[196] The agency conceded the existence of a general terrorist threat; additionally, the location of the project and its value as a military target necessitated analysis of a potential terrorist attack.[197]

B. Gaps

Both emergent rules identified above—the tort-causation rule and the expected impact-value rule—are premised on an agency's ability to project from history to a hypothetical future.[198] Such analysis is unreliable, as there is no way for the agency to consider whether the past provides an adequate sample size from which to generalize. Moreover, scaling one's expectation only to what one has already experienced is incautious and imprudent; apparently, improbable outcomes are occasionally realized. The application of proximate causation doctrine in a tort context requires establishment of actual causation as a precondition.[199] But in NEPA's ex ante review, an agency must consider a future before it has manifested in the real world: The agency's hypothetical proximate causation analysis may have few bonds tethering it to reality. Similarly, an agency will be unable to consider an action's expected impact value where it lacks confidence in, or simply does not know, an impact's probability. Generally, analysis is severely limited if it rises and falls with bureaucratic forecasting.

An example of the problem is the inconsistent application of the causation rule. In effect, the importation of common law causation doctrine has meant courts often defer to an agency's decision about the scope of their analysis. Courts defer to agencies to determine that a third party's intervening wrongful act severs the causal nexus between action and impact, for example, with respect to criminal poisoners tampering

195 *Id.* at 657 (internal quotation marks omitted). The Ninth Circuit consequently issued a finding of no significant impact. *Id.* at 657–58.

196 *Id.* at 660.

197 *Id.* The court found that notwithstanding the agency's characterization of its own EA (as excluding terrorism from the scope of analysis), the EA's discussion of terrorism impacts satisfied the NEPA requirement. *Id.* The analysis had incorporated Navy's Anti-Terrorism Force Protection requirements, which examined plausible terrorist attack scenarios and mandated "a planning process . . . to ensure protection against terrorism"; moreover, the EA stated that antiterrorism measures "reduce[d] the potential damage that could be inflicted by terrorist activity." *Id.* at 661 (internal quotation marks omitted). The court held that this discussion was sufficient, if not ideally presented. *Id.*

198 Mehrsa Baradaran, *Regulation by Hypothetical*, 67 VAND. L. REV. 1247, 1295 (2014) ("This is the significant problem of the hypothetical regime: it can prepare firms for cyclical market problems, but it cannot prepare them for unprecedented market occurrences.").

199 *See* RESTATEMENT (SECOND) OF TORTS § 431, cmt. a (AM. L. INST. 1934) (describing that causation-in-fact is generally "necessary but . . . not of itself sufficient" to establish "legal cause").

with PET bottles,[200] with terrorists targeting power plants,[201] and the Soviets initiating nuclear war.[202] The third-party wrongdoer rule is not upheld consistently, however. For example, in *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission*, the Ninth Circuit required consideration of impacts arising from terrorism.[203] Besides intervening third-party acts, existing cases provide little guidance on how an agency (and ultimately a reviewing court) should treat potential impacts that have low probabilities of arising. Tort doctrine indicates the connection between a defendant's act and low-probability harm can be too attenuated to constitute a proximate causal nexus, even in the absence of intervening third-party acts.[204] As argued below, NEPA law would benefit from a fuller explication of how importation of tort law's causation doctrine defines contours for the scope of NEPA analysis, with particular attention to low probability outcomes.

As for the expected impact–value rule, in almost no situation does an agency actually know the probability and magnitude of a potential impact. Probability figures are derived from historical frequencies.[205] The agency can rarely project from its own experiences; given the time scale across which frequencies are projected, it seems difficult to understand how the agency could generate reliable figures. Their probability numbers are necessarily provisional and uncertain, but the rule does not assign the agency a means of accounting for second-order uncertainty.

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200 *Glass Packaging Inst.*, 737 F.2d 1083, 1092 (D.C. Cir. 1984).

201 New Jersey Dep't of Env't Prot. v. Nuclear Regulatory Comm'n, 561 F.3d 132, 140 (3d Cir. 2009). The Third Circuit's holding with respect to sabotage risks in *Limerick Ecology Action* is less conclusive but seems to arise from a similar idea that the intervention of malign third parties confounds standard risk analysis. 869 F.2d 719, 743 (3d Cir. 1989).

202 *No GWEN All*, 855 F.2d 1380, 1385–86 (9th Cir. 1988).

203 The court pointed to facts (other than the action itself) confirming the government's contemplation of terrorist attacks. *San Luis Obispo Mothers for Peace*, 449 F.3d 1016, 1030–31 (9th Cir. 2006).

204 *See* RESTATEMENT (SECOND) OF TORTS § 435(2) (1965) ("The actor's conduct may be held not to be a legal cause of harm to another where after the event and looking back from the harm to the actor's negligent conduct, it appears to the court highly extraordinary that it should have brought about the harm.").

205 Professor Colburn provides a helpful description of the trouble with this form of analysis:

> A classical or 'frequentist' conception of probability defines the probability (*P*) of an event's occurring in a particular trial as the frequency (*f*) with which it occurs in a long sequence of similar trials. *P* is the value to which the long-run *f* converges as the number of trials increases. This is why *P* is often viewed as a property or propensity of the system generating the events. One practical trouble with frequentist conceptions of probability, of course, is that for most events of any interest we cannot be sure of the relevant population of trials or similar events.

Jamison E. Colburn, *Necessarily Unpredictable? Oil Spill Risks Beyond the Horizon*, 30 MISS. C. L. REV. 307, 328 (2011) [hereinafter Colburn, *Necessarily Unpredictable*].

IV. PROPOSED RESPONSES

While other scholars have not focused upon the two emergent rules that structure NEPA uncertainty doctrine, they have identified the problem of how to evaluate low-probability outcomes in NEPA analysis. Commentators advance two families of response to the administrative conundrum.

A. Embracing Lawful Arbitrariness

The first family of response may be characterized as a form of epistemic quietism. According to these responses, the varied terrain of judicial decisions reflects the reality that there is no comprehensive solution to dealing with uncertain environmental impacts, regulation is more art than science, and an ad hoc approach is inevitable. For example, one of the most sophisticated articulations of this position denies there can be a comprehensive one-size-fits-all method to analyze risks and uncertainties under NEPA.[206] Agencies are best situated to evaluate case-by-case what analytical method is appropriate because the determination will always depend on context.[207] Given the costs of information gathering and processing, agencies cannot examine every potentiality; the scope and depth of NEPA analysis must be circumscribed.[208] Across contexts, no one rule or decision process will suffice.[209] Rather than impose a rigid set of instructions, this view proposes agencies should be left to choose from a menu of potentially useful methods.[210]

More generally, agencies repeatedly encounter situations in which administrative decisions are underdetermined by the information available: "At the frontier of uncertainty, rationality simply runs out."[211] There is no simple answer to the antecedent question of what decision procedure should be used.[212] "[R]ational agencies may have good reason to decide in a manner that is inaccurate, nonrational, or arbitrary," acting in a lawfully arbitrary manner.[213]

The practical effect is for courts to increase deference to agencies and for agencies to accept policy mistakes—whatever their magnitude—as learning opportunities.[214] If case law were to develop at all, according to this view, heightened deference should displace independent assessment of expected impact–values in decisions like the Ninth Circuit's *San Diego*

206 Aagaard, *supra* note 43, at 121.
207 *Id.*
208 *Id.* at 110.
209 *Id.* at 121.
210 *Id.*
211 Jacob Gersen & Adrian Vermeule, *Thin Rationality Review*, 114 MICH. L. REV. 1355, 1386–87 (2016).
212 *Id.* at 1377, 1384–85.
213 *Id.* at 1356 n.9 (emphasis omitted).
214 *See* Aagaard, *supra* note 43, at 12. *See also* Gersen & Vermeule, *supra* note 211, at 1358–59.

Navy Broadcast Complex Coalition[215] decision, and the Third Circuit's *Limerick Ecology Action* decision.[216] Relatedly, agencies should be encouraged to engage in adaptive management practices in lieu of ex ante review. Adaptive management, a process in which an agency monitors the effects flowing from an action and continues to adjust agency policy to mitigate harmful effects where necessary, occurs through provisional determinations that an action's impacts will not be significant.[217] If impacts exceed expectation, a pre-set menu of mitigation measures will kick in to reduce impacts.[218] Adaptive management allows agencies to detect and correct errors and continually learn more about the environment.[219] Agencies learn from the management process itself and by treating the regulatory process as a laboratory to test competing theories regarding the unknown.[220]

The rational arbitrariness position is less convincing as applied to the NEPA context where the law requires fidelity to a procedural regime but defines no substantive decision rule.[221] The bureaucratic apparatus is not an omniscient god, but a composite of human agents acting on the basis of imperfect knowledge and bounded rationality—decisions are necessarily made by some human agent within the apparatus. The law should accordingly moderate expectations for administrative output. Agency officials are always only "satisficing," making contextually satisfactory rather than abstractly optimal decisions.[222] Therefore, the law should afford agencies latitude to make decisions without certainty, provided these decisions have been reached according to a rational decision rule. The operative question under NEPA should be whether the agency gathered and processed a sufficiently broad array of data before making a decision. The government's ultimate decision will be underdetermined, but it is not clear the law should cede the antecedent determination of what data is in fact "available" to an arbitrary flip of the

215 817 F.3d 653, 662 (9th Cir. 2016).

216 869 F.2d 719, 753–54. (3d Cir. 1989).

217 Ahjond S. Garmestani et al., *The Integration of Social-Ecological Resilience and Law*, *in* SOCIAL-ECOLOGICAL RESILIENCE AND LAW 365, 371 (Ahjond S. Garmestani & Craig R. Allen eds., 2014).

218 Karkkainen, *supra* note 25, at 932 (arguing for the use of "mitigated FONSIs").

219 *Id.* at 907–08 (arguing for adaptive management as an alternative to ex ante prediction).

220 Irene Weintraub, *supra* note 43, at 1597–98; Ahjond S. Garmestani et al., *The Integration of Social-Ecological Resilience and Law*, *in* SOCIAL-ECOLOGICAL RESILIENCE AND LAW *supra* note 217, at 365, 371; Thrower, *supra* note 19; Colburn, *supra* note 205, at 329; *cf*. Aagaard, *supra* note 43, at 122.

221 Idaho Wool Growers Ass'n v. Vilsack, 816 F.3d 1095, 1102, 1109 (9th Cir. 2016) ("[E]xplanations and acknowledgments are all that NEPA requires. Were that not the case, government actions affecting the environment, positively or negatively, could be hamstrung by the need for unattainable scientific certainty." (citations omitted)).

222 Herbert A. Simon, *Rational Choice and the Structure of the Environment*, 63 PSYCHOL. REV. 129, 136 (1956) (describing how an organism with "neither the senses nor the wits to discover an 'optimal' path—even assuming the concept of optimal to be clearly defined . . . find[s] a choice mechanism that will lead it to pursue a 'satisficing' path, a path that will permit satisfaction at some specified level of all of its needs.").

coin. In fact, as explained above, the law has developed two procedures—the tort causation rule and the expected impact–value rule—and applied them across widely varied contexts.[223]

Moreover, adaptive management, the practical proposal that follows from the rational arbitrariness position, is not a true solution to the knowledge problem. Like all knowledge, the agency's understanding of a decision and its effects is provisional. In contrast, decisions are final. Adaptive management does not improve ex ante analysis, even if it allows officials to learn when they get ex ante projections wrong.[224] Adaptive management offers little to inform decision making where the impacts are potentially irreversible.[225] Thus, case law requires analysis precede the agency's commitment and prohibits substitution of adaptive management for ex ante consideration of potentially significant impacts.[226]

B. Technocratic Management

A second family of response to the problem of low-probability outcomes embraces the capacity of the administrative state to arrive at correct answers given sufficient data. Interventions in this line understand NEPA review of low-probability outcomes as, in principle, remediable by more data. These interventions propose two principal ways to make improvements.

First, many reformist interventions imply that problems with low-probability outcomes are reducible to inadequate information-gathering processes. While NEPA requires agencies to consider available information, courts have not clarified how expansively agencies are to understand the category of "available information."[227] Reformers have proposed legal changes that would require an agency to gather more data, for example, by obliging them to solicit information from informed private actors. Professor Colburn has proposed agencies enter quid pro quo arrangements with regulated entities, under which agencies would expedite decisions in exchange for private information.[228] Along similar lines, Professors Barsa and Dana propose agencies include rescission

223 *See* discussion *supra* Part III.A.

224 *See* Ahjond S. Garmestani et al., *The Integration of Social-Ecological Resilience and Law*, *in* SOCIAL-ECOLOGICAL RESILIENCE AND LAW *supra* note 217, at 365, 370–71, 378 (recommending reforming environmental law to "[r]educe front-end decision making in law making and replace it with an iterative back-end process").

225 *See* Cass R. Sunstein, *Irreversible and Catastrophic*, 91 CORNELL L. REV. 841, 845 (2006).

226 *See, e.g.*, Nat'l Parks & Conservation Ass'n v. Babbitt, 241 F.3d 722, 733 (9th Cir. 2001) ("[T]he 'hard look' must be taken before, not after, the environmentally threatening actions are put into effect.").

227 Colburn, *Necessarily Unpredictable*, *supra* note 205, at 318; Michael Barsa & David A. Dana, *Reconceptualizing NEPA to Avoid the Next Preventable Disaster*, 38 BOS. ENV'T AFF. L. REV. 219, 221–25 (2011).

228 Colburn, *Necessarily Unpredictable*, *supra* note 205, at 327.

clauses when issuing permits, conditioning the authorization on the permittee's full disclosure of risks during NEPA review.[229] Under these proposals, regulated entities have incentives to provide information to the agency.[230]

Second, other commentators propose improving the institutional culture of agencies by injecting new intellectual energy into agency practice or compositional changes to the decision makers. These reformers argue that inadequate responses to remote risks often derive from administrative passivity and groupthink.[231] Professor Colburn, for example, proposes the cultivation of "imaginative speculation" in bureaucratic intellectual culture.[232] Similarly, Professor Doremus proposes external review of agency analysis.[233] Other reformers propose that decisions be democratized, not through the decentralization of decision making (i.e., private ordering), but by the agency itself constituting more democratic bodies to make decisions, for example: citizen juries.[234]

Often, commentators propose reforms with recent failures in mind, for example: retroactively identifying flaws in the Minerals Management Service's oversight of what became the Deepwater Horizon disaster. In criticizing the Minerals Management Service's NEPA analysis associated with the Deepwater Horizon disaster, critics point out the agency lowballed spill rates and overlooked that drilling in deeper water—and in previously untapped, unsettled shale formations—posed bigger risks.[235] Retrospectively, it appears regulators overemphasized hurricane risk in the wake of Hurricane Katrina and underemphasized the dangers of well blowout and catastrophic spills in deep water.[236] Commentators save some criticism for outside reviewers and environmental groups, who also failed to isolate the risks of well blowout in advance of the Deepwater Horizon disaster.[237]

Of course, it is easy to define the Minerals Management Service's actions as "failures" retroactively. Perhaps these commentators, standing in the shoes of the Minerals Management Service officials, would have had the foresight to identify the perils of well blowouts and deep-water spills before 2010. This is possible. Even if the Minerals Management Service had addressed each problem the critics identify, however, the

229 Barsa & Dana, *supra* note 227, at 239–40.

230 *Id.* at 243.

231 Barsa & Dana, *supra* note 227, at 227.

232 Colburn, *Necessarily Unpredictable*, *supra* note 205, at 329–30.

233 Holly Doremus, *Through Another's Eyes: Getting the Benefit of Outside Perspectives in Environmental Review*, 38 BOS. ENV'T AFF. L. REV. 247, 252 (2011).

234 *See, e.g.*, Kenta Tsuda, *Making Bureaucracies Think Distributively: Reforming the Administrative State with Action-Forcing Distributional Review*, 7 MICH. J. ENV'T & ADMIN. L. 131, 171 (2017) (describing democratizing proposals).

235 Colburn, *Necessarily Unpredictable*, *supra* note 205, at 317–18, 321.

236 *Id.* at 322.

237 Doremus, *supra* note 233, at 261, 264; Colburn, *Necessarily Unpredictable*, *supra* note 205, at 321 n.77.

agency would not have done so with premonitions of the particualr Deepwater Horizon disaster.[238] Hindsight analysis involves projecting counterfactual pasts, and for this reason, involves all the uncertainties associated with forecasting generally.[239] Had the agency focused on deepwater spills, other problems would still remain (perhaps they remain even now).[240] Commentators fault the agency for failing to "separate out" the risk of a well blowout and spill, but these may not have been the only large-scale risks the agency faced.

Indeed, the commentary's retroactive emphasis on well blowout to the exclusion of other high-magnitude risks may illustrate its own availability bias: "There is nothing in the language or the history of NEPA to suggest that its scope should be expanded 'in the wake of' any kind of accident."[241] Others have identified a similar mistake in the context of financial regulation: There too, recent catastrophes are "lagging indicators of a problem . . . while we repeatedly make faulty assumptions (like underestimating unprecedented risks), we never make the same faulty assumption twice—once we have experienced a national decline in housing prices, we can imagine it happening again."[242]

While more information may be desirable, there should be no expectation that broadening the informational net will prevent prediction failure.[243] For example, Professor Colburn's speed-for-info, quid pro quo proposal,[244] might conceivably exacerbate, rather than mitigate, the information asymmetries it intends to address: Regulated entities would have an incentive to maintain secrecy, withholding information as cards to be played in their negotiations with the regulator. The regulator could not expect private actors to openly announce they were withholding relevant information; the regulator would thus strategically drag out decisions to flush out disclosures. And strategic excuses for delay might provide cover for agencies to indulge one of the most pervasive vices of bureaucratic governance: Torpor.[245]

Likewise, the efficacy of Professors Barsa and Dana's permit rescission clause proposal[246] is questionable. In order for rescission to matter, the agency must be able to enforce the terms of a permit.[247]

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238 Colburn, *Necessarily Unpredictable*, *supra* note 205, at 324; Doremus, *supra* note 233, at 261.

239 Douglas A. Kysar & Thomas O. McGarity, *Did NEPA Drown New Orleans? The Levees, the Blame Game, and the Hazards of Hindsight*, 56 DUKE L.J. 179, 233 (2006).

240 *Id.* at 235 (criticizing the agency's narrow focus on a single parameter of complex natural and human systems).

241 *Metro. Edison Co.*, 460 U.S. 766, 779 (1983).

242 *Id.*

243 W.R. Freudenburg, *Two Decades Later: Progress and Paradox in Socioeconomic Impact Assessment*, *in* ENVIRONMENTAL ANALYSIS: THE NEPA EXPERIENCE 228, 238 (Stephen G. Hildebrand & Johnnie B. Cannon eds., 1993).

244 *See* discussion *infra* Part IV.B.

245 Elena Kagan, *Presidential Administration*, 114 HARV. L. REV. 2245, 2263 (2001).

246 *See* discussion *infra* Part IV.B.

247 Barsa & Dana, *supra* note 227, at 241 (discussing the need for "protections against the agencies sitting on their rights to rescind").

Realization of the deterrent (i.e., an actual recission) requires the agency discover the permittee's undisclosed secret—but there is no systematic way for this to happen. Presumably, the deterrence mechanism would only succeed where a permittee expects regulators to serendipitously stumble upon the undisclosed information regulators had been unable to discover during the actual information gathering process.

Lastly, the proposals to revolutionize bureaucratic culture[248] are unlikely to succeed because they underemphasize the structural nature of the problem. Creative, contrarian, public-spirited thinking is doubtlessly beneficial to the decision-making process; the administrative state would be even more effective if staffed only by da Vincis, Gandhis, that is, the most competent and motivated officials. But these individuals would still face the knowledge problem.[249] Personnel changes or changes to intellectual practices, without structural changes to decision making, are unlikely to banish catastrophic prediction failure from the administrative state.

V. ADMINISTRATIVE BULKHEADS IN NEPA REVIEW

A. NEPA and Administrative Skepticism

One trenchant critique of the NEPA regime argues that NEPA "reflects the characteristic expectation of the comprehensive rationality model of bureaucratic decision-making in vogue at the time of its enactment."[250] In the late 1960s, according to this view, legislators expected agencies to aggregate "all the information germane to an informed policy decision expeditiously and at little or no cost, and then factor it into their decision-making."[251] It comes as no surprise that these expectations were not met.[252] Uncertainty results from a fundamental problem in the NEPA scheme, critics argue, namely that NEPA demands the impossible.[253]

It is incorrect to present the NEPA regime as a naive exercise in centralized governmental management. The statute was not predicated upon "faith in comprehensive bureaucratic rationality."[254] Quite the contrary: NEPA was passed in what has been described as the "environmental republican moment" of the late 1960s,[255] a political

248 *See* discussion *infra* Part IV.B.

249 *See* DON LAVOIE, NATIONAL ECONOMIC PLANNING: WHAT IS LEFT? 52 (1985).

250 Karkkainen, *supra* note 25, at 911–12 (internal quotation marks omitted).

251 *Id. See also* Daniel R. Mandelker, *The National Environmental Policy Act: A Review of Its Experience and Problems*, WASH. U. J.L. & POL'Y, 2010, at 293, 294 (discussing the difficulties associated with implementing regulations regarding the environment).

252 Mandelker, *supra* note 251, at 294; DAVID SCHOENBROD ET AL., BREAKING THE LOGJAM: ENVIRONMENTAL PROTECTION THAT WILL WORK 3 (2010).

253 Karkkainen, *supra* note 25, at 906; Aagaard, *supra* note 43, at 88.

254 *But see* Karkkainen, *supra* note 25, at 925–27.

255 Daniel A. Farber, *Politics and Procedure in Environmental Law*, 8 J.L. ECON. & ORG. 59, 66–67 (1992).

conjuncture characterized not only by concern about environmental degradation,[256] but also by distrust of administrative agencies.[257] Where centralized coordination is exogenously directed (i.e., by other statutes), the NEPA regime provides tools to mitigate the knowledge problem and correct misaligned incentives.[258] NEPA also turns the bureaucracy's attention to concerns that might otherwise go unconsidered.[259] The statute compels analysis, while preserving the agency's flexibility with respect to substantive decisions.[260] Simultaneously, it opens policy making to civil society. Citizens organizations, NGOs, and public interest groups gain a process in which to participate and around which to organize:[261] scientists, civil society organizations, and regulated industry have developed practices to mobilize for and against administrative action and to provide information to the agencies.[262] Collectively, agencies' anticipation of NEPA analysis, scrutiny of this analysis by the public (in fact, mostly interest groups), and, in the last instance, the threat of intervention by the courts have improved agency practice.[263]

B. The Bulkhead Rule

Emergent legal rules fail to explain how an agency is to determine the scope and depth of NEPA analysis required for impacts with uncertain probabilities or magnitudes. Commentators cede this terrain to agency discretion, contravening NEPA's mandate to constrain the

256 *See* RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 61, 79 (2004) (detailing the increased awareness regarding "catastrophic environmental consequences").

257 *See* Tsuda, *supra* note 234, at 156–58 (illustrating events such as the "huge fish kill in the Mississippi River, DDT contamination, the burning of Cuyahoga River . . . the Santa Barbara oil spill," and the passage of environmental laws to address resulting agency reliability concerns); RICHARD N.L. ANDREWS, MANAGING THE ENVIRONMENT, MANAGING OURSELVES: A HISTORY OF AMERICAN ENVIRONMENTAL POLICY 211–21, 238 (2d ed. 2006) (recounting (1) the public's growing distrust resulting from agencies' personally and politically driven endorsement of fluoride in water, nuclear weapons, herbicides, insecticides, and fertilizers; and (2) the proposed solutions to counter the distrust); LAZARUS, *supra* note 256, at 58, 87 (analyzing the growing public fears in the mid- to late-1960s as a result of things like nuclear weapons and radioactive fallout, and how concerns over pollution and public distrust contributed to the modern environmental movement).

258 Tsuda, *supra* note 234, at 163.

259 *Id.*

260 *Id.*

261 *Id.*

262 *Id.*; LYNTON K. CALDWELL, SCIENCE AND THE NATIONAL ENVIRONMENTAL POLICY ACT: REDIRECTING POLICY THROUGH PROCEDURAL REFORM 110–13 (1982).

263 Richard Lazarus, *The National Environmental Policy Act in the U.S. Supreme Court: A Reappraisal and a Peek Behind the Curtains*, 100 GEO. L.J. 1507, 1518–19 (2012). *See also* Oliver A. Houck, *Is That All? A Review of* The National Environmental Policy Act, An Agenda for the Future, *by Lynton Keith Caldwell*, 11 DUKE ENV'T L. & POL'Y F. 173, 190–91 (2000); *NEPA Litigation: The Causes, Effects and Solutions: Hearing Before the H. Comm. on Res.*, 109th Cong. 3–4 (2005) (statement of Hon. Tom Udall, Member, H. Comm. on Res.) [hereinafter *NEPA Hearing*].

agencies.[264] Alternatively, commentators urge further information gathering, a Sisyphean endeavor.[265] But, true to NEPA's animating spirit, the solution should arise from a disenchanted view of agency capacity. Such an approach is not only justified by the general awareness of the knowledge problem but also follows from the empirical record of agency forecasting, which is not encouraging.[266] Officials cannot abrogate their responsibility to make decisions when so directed, but they should be imbued with skepticism regarding their abilities to forecast.

Agencies' approach to uncertain impacts under NEPA should be governed by what this Article calls a "NEPA bulkhead rule." This rule addresses the two key thresholds under the statute: analytical scope and impact significance. Under the NEPA bulkhead rule, potential, non-localized impacts to natural systems would be per se in the scope of NEPA review and would be subject to a rebuttable presumption of significance—in other words, they would be due full administrative scrutiny, with attendant public notice and comment. The rationale is that non-local impacts must be scrutinized more deeply unless the agency can establish a rational basis for excluding the possibility that the impacts would threaten general environmental resilience.[267] Institutionally, the rule would require agencies to identify environmental values that could be plausibly affected by the agency action (excluding via intervening third-party acts). The plausible causal pathways from action to value would include plan failures and agency mistakes. The agency would then separate potential, localized impacts affecting natural systems from broader, non-localized impacts that would degrade or destroy natural systems on a larger (regional, national, or global) scale. "Local" in this context—like almost every category in the body of NEPA common law—would be a category fleshed out by the courts via application in varied particularized contexts. However, it would primarily be a spatial category: an archetypal non-localized impact would be anthropogenic atmospheric warming, whereas an impact that is localized would be an impact spatially circumscribed, perhaps to the project area (the impact of felling trees to make space within the footprint of a project staging area, for example). Agencies would deem potential impacts to systemic values as within the scope of NEPA analysis and proceed to evaluate them subject to a rebuttable presumption of significance. (Of course, localized

264 *See* discussion *supra* Part IV.A.

265 *See* discussion *supra* Part IV.B.

266 W.R. Freudenburg, *Two Decades Later: Progress and Paradox in Socioeconomic Impact Assessment*, *in* ENVIRONMENTAL ANALYSIS: THE NEPA EXPERIENCE, *supra* note 243, at 238 (citation omitted) ("In a study that examined the accuracy of demographic projections in 225 EISs prepared during the 1970s, [investigators] found that the average absolute error had been over 50%."). *See also* Karkkainen, *supra* note 25, at 928 (describing the lack of predictive accuracy of NEPA environmental impact statements); Farber, *Confronting Uncertainty*, *supra* note 36, at 28 (discussing how EIS evidence of predictive accuracy is faulty).

267 *See* Ahjond S. Garmestani et al., *The Integration of Social-Ecological Resilience and Law*, *in* SOCIAL-ECOLOGICAL RESILIENCE AND LAW, *supra* note 217, at 365, 373 (discussing how slow environmental variables impact resilience).

impacts are not necessarily out of scope or insignificant—they will be subject to other existing NEPA rules.) In an environmental assessment, the agency will bear the burden of overcoming the presumption with a rational explanation that potential impacts on the systemic value are not significant. Where the burden is carried, the agency will issue a finding of no significant impact. Otherwise, it will continue to the fuller analysis in an environmental impact statement.

The concept analogizes to the bulkhead structure within a ship: a bulkhead is a structure vertically partitioning and compartmentalizing the hull with watertight separations to prevent flooding in the event of a breach.[268] Just as a bulkhead caps the downside risk of a breach at any one particular location in a vessel's hull, so the NEPA bulkhead rule would mandate deeper consideration of risks to large-scale values, pushing agencies toward actions with only localized impacts.[269] The bulkhead rule strikes a desirable balance between lowering barriers to socially beneficial administrative actions and improving policy through ex ante analysis. The administrative costs and political pressure resulting from the rule would likely lead agencies to forego some socially beneficial actions they would otherwise have pursued. Additionally, costs might be distorted by irrational reactions to the disclosure of systemic risks, allowing public hysteria to blow risks out of proportion.[270] But these regulatory deadweight losses cannot be considered in isolation. Administrative failure—blindly advancing into an ostensibly low-probability catastrophe—also has costs.

The bulkhead rule accounts for uncertain impacts without the morass of agency forecasting. Prediction would still be required. But instead of developing detailed hypotheticals, prediction would serve only to identify values that could be affected without specious precision in characterizing the causal pathways or effects. NEPA is procedural, and so the bulkhead rule's effects are also procedural. Practically, however, the procedural changes would likely trigger substantive ones. The rule raises the administrative costs and accountability associated with systemically risky actions, likely making agencies inclined to avoid systemically risky paths. Its net effect would likely be to downsize the scale of risks an agency is willing to run and possibly lead agencies to shift agendas closer to an array of numerous smaller actions—which

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268 *See, e.g.*, *Bulkhead*, NAUTICAL DICTIONARY 60 (2d ed. 1863) (defining bulkhead as "a partition in particular, the boarding which separates one part or cabin of a vessel from another. . . . Some vessels . . . are divided into compartments by athwart ship water-tight bulkheads, so that a leak sprung in any compartment may not communicate with the rest of the ship.").

269 W.R. Freudenburg, *Two Decades Later: Progress and Paradox in Socioeconomic Impact Assessment*, *in* ENVIRONMENTAL ANALYSIS: THE NEPA EXPERIENCE, *supra* note 243, at 242 ("[C]ases demonstrate anew the time-honored prudence of the principle that it is unwise to have most of one's eggs in one basket.").

270 STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION 48–51 (1993) (describing irrational agency actions resulting from public reactions to uncertainties).

could proceed relatively swiftly—and further from megaprojects. The approach is not only consistent with adaptive management, but also optimizes the conditions for it. Because actions with uncertain outcomes would largely be confined to those with localized impacts, the agency would be able to treat discrete actions as experiments. Smaller-scale actions with only localized impacts would become "laboratories of environmental policy."[271] Over the long run, because the cost of any one prediction failure had been localized and capped, an agency's protection of natural systems becomes more robust, even developing elements of antifragility: Small mistakes allow regulators to learn without destroying the natural systems to which they will apply their experience.[272]

C. Legal Basis

Neither NEPA's text nor CEQ-implementing regulations expressly state a bulkhead rule. For this reason, the most straightforward way to implement the rule would be via legislation or a CEQ rulemaking. But read in the light of relevant NEPA common law, statutory and regulatory text imply the bulkhead rule. In other words, courts could articulate it today.

First, the rule comports with courts' proximate causation rule. As the Supreme Court explained in *Metropolitan Edison* and again in *Public Citizen*, and in keeping with proximate causation doctrine in private law, legal recognition of a causal nexus is determined by the policy considerations inherent in NEPA.[273] In *Metropolitan Edison*, the Court determined the scope of NEPA review by reference to the statute's underlying policy of enabling agencies to protect the environment and economizing resources to this end.[274] In *Public Citizen*, the Court looked to the statute's policy of mandating analysis to improve decisions.[275] Impacts the agency lacked discretion to change were beyond the scope of analysis; for example, the impact from an exogenous presidential decision.[276]

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271 *See New State Ice Co.*, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting) ("It is one of the happy incidents of the federal system that a single courageous state may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.").

272 *See* TALEB, *supra* note 14, at 8.

273 *Metro. Edison Co.*, 460 U.S. 766, 774–79 (1983); *Pub. Citizen*, 541 U.S. 752, 767 (2004) ("[I]nherent in NEPA and its implementing regulations is a 'rule of reason,' which ensures that agencies determine whether and to what extent to prepare an EIS based on the usefulness of any new potential information to the decisionmaking [sic] process. Where the preparation of an EIS would serve 'no purpose' in light of NEPA's regulatory scheme as a whole, no rule of reason worthy of that title would require an agency to prepare an EIS." (citation omitted)). *See also* W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS 264 (5th ed. 1984) (proximate cause analysis turns on policy considerations and considerations of the "legal responsibility" of actors).

274 *Metro. Edison Co.*, 460 U.S. at 774.

275 *Pub. Citizen*, 541 U.S. at 766–67.

276 *Id.*

The bulkhead rule adheres to the tort law rule that proximate causation scales to the magnitude of the risk posed by the defendant's act. Lower courts have also read NEPA's causation requirement to include the tort doctrine of intervening third-party acts to sever the causal nexus between action and impact.[277] In tort law, the legal responsibility of an actor is a function of the social value of the interests that the actor imperils as well as the extent of the resulting harm.[278] The legal responsibility of the actor scales to the social value of the imperiled interest,[279] and thus the court will find a sufficient causal nexus more easily the greater that social value.[280] Likewise, the greater the extent of potential harm from an action, the greater the actor's legal responsibility.[281] For example, the *Second Restatement on Torts* states that "[h]igher duties of care are imposed in the use of land or chattels or the doing of an act where carelessness is likely to lead to some catastrophe which will involve in one common destruction a number of persons rather than a single person."[282] The larger an action's consequences, the greater the radius of legal responsibility, and—since scope of legal responsibility informs the proximate causation analysis—the more readily the court will find a sufficient causal nexus.[283] The scope of NEPA inquiry scales to the magnitude of the potential risk: Where the scale of the potential risk is systemic, it will be deemed per se in scope.[284]

Along with general policies of protecting the environment by informing agency decisions, NEPA specifically mentions the need for

277 *See* discussion *supra* Part III.A.1.

278 *See* RESTATEMENT (SECOND) OF TORTS § 293 (AM. L. INST. 1965) ("In determining the magnitude of the risk for the purpose of determining whether the actor is negligent, the following factors are important: (a) the social value which the law attaches to the interests which are imperiled . . . *(c) the extent of the harm likely to be caused to the interests imperiled*; (d) the number of persons whose interests are likely to be invaded if the risk takes effect in harm." (emphasis added)).

279 *Id.* § 293 cmt. a ("As the social value of the interest imperiled increases, the magnitude of the risk which is justified diminishes. Conduct which would be unreasonable if it created a risk of harm to life or limb might be justified if it should imperil only some property interest of merely dignitary or slight tangible value.").

280 *Id.* § 291.

281 *Id.* § 293 cmt. c, d ("If the act is one which involves only a risk of some very slight harm to even an important interest, it may be justified, although a similar likelihood of a more serious harm would make the risk unreasonable. . . . Higher duties of care are imposed in the use of land or chattels or the doing of an act where carelessness is likely to lead to some catastrophe which will involve in one common destruction a number of persons rather than a single person.").

282 *Id.* § 293 cmt. d.

283 *Id.*

284 The bulkhead rule's categorization is necessarily rougher and less precise than tort law's categorization of harms within or without the scope of risk created by the tortfeasor's conduct. This is because until a court's adjudication of tort case ex post facto, NEPA analysis is a purely prospective analytical exercise that cannot directly benefit from hindsight. *Cf. Id.* § 281 cmt. g ("In determining whether [particular harms or hazards] are within the [the scope of the risk created by the actor's conduct], the courts have been compelled of necessity to resort to hindsight rather than foresight.").

agency solicitude for high-magnitude problems.[285] The statute refers to analysis of significant impacts.[286] At section 102(2)(F), it also mandates agencies "recognize the worldwide and long-range character of environmental problems."[287] The statute does not similarly emphasize consideration of localized impacts. As discussed above, NEPA case law has developed an expected impact–value rule to guide agencies where an action has several potential outcomes with varying probabilities.[288] The case law does not yet, however, provide a clear rule for situations in which probabilities are unknown and the expected value calculation is impossible.

Meanwhile, CEQ's NEPA-implementing regulations describe the significance of an impact as a function of both the context and likely magnitude of impacts.[289] With regard to context, the regulation states that "[s]ignificance varies with the setting of the proposed action."[290] To illustrate, the regulation describes that, "in the case of a site-specific action, significance would usually depend upon the effects in the local area."[291] Cases could be misunderstood to interpret the regulation to scale significance to an agency's level of analysis, which the agency is free to choose.[292] This is a misreading. Significance, to be meaningful (i.e., to define a subset of impacts warranting fuller consideration), cannot be defined relative to an arbitrarily selected level of analysis. At a sufficiently low level of analysis, all impacts are significant (i.e., the felling of a single tree is significant, relative to that tree). Similarly, at a sufficiently high level of analysis no impact is significant (i.e., obliteration of the planet would not register on the scale of the galaxy). Interpreting the regulation to scale significance to the level of analysis, would level distinctions among impacts—creating analytical requirements for all or none—and contradict NEPA's purpose of targeting governmental

285 National Environmental Policy Act of 1969, 42 U.S.C. § 4332 (2018).

286 *Id.* § 4332(D)(iv).

287 *Id.* § 4332(F).

288 *See* discussion *supra* Part III.A.2.

289 *See* discussion *supra* Part III.A.2.

290 40 C.F.R. § 1501.3(b)(1) (2020).

291 *Id.*

292 *Kentuckians for the Commonwealth*, 746 F.3d 698, 707 (6th Cir. 2014) ("[T]he regulations allow substantial flexibility in delimiting which subsets of effects are relevant."); *Tri-Valley CAREs II*, 671 F.3d 1113, 1126–27 (9th Cir. 2012) ("[Plaintiff] contends that the DOE's analysis is deficient because . . . the DOE must assess the risk of terrorist theft and release in the context of the Livermore locale. We disagree. Although 40 C.F.R. § 1508.27(a) suggests that site-specific actions are generally evaluated in the context of a project locale, nothing in the regulation prohibits the DOE from exercising its discretion to apply a nationwide analysis when appropriate."); *but see Middle Rio Grande Conservancy Dist.*, 294 F.3d 1220, 1229 (10th Cir. 2002) ("[T]he context of the designation is such that its effects will be felt locally in the Middle Rio Grande valley. . . . [E]ven a loss of 2,000 acres of irrigated farmland is significant."); *Barnes*, 655 F.3d 1124, 1139–40 (9th Cir. 2011) ("Building a new runway at HIO is a site-specific project. . . . [T]he effect of greenhouse gases on climate is a *global* problem. . . . [The impact at issue] does not translate into locally-quantifiable environmental impacts given the global nature of climate change, [so] the EA's discussion of the project's in terms of percentages is adequate.").

resources and attention on at least some important environmental harms.[293]

CEQ's "affected area" regulation conveys that significance is a function of the scale of the value affected.[294] This would mean that, holding all else equal, the larger the natural system affected, the more likely the agency finds the impact "significant." Such a reading would conform to—if not directly follow from—the Supreme Court's understanding of the animating purpose of the NEPA regime.[295] A non-localized impact upon a natural system is a prime target for focused agency attention and analytical resources. On the other hand, where actions threaten only localized impacts—barring other reasons for deeming the impacts significant—agencies might be more discriminating in committing to fuller impact analysis.

In other words, CEQ's regulations should be understood to create something like a two-step order of operations in determining significance. In the first step, the agency defines which natural systems are potentially affected by an action and defines their scale. Where the impacts to a system are not narrowly localized, potential impacts are presumptively significant, and unless the presumption is rebutted, the agency proceeds to full analysis in an environmental impact statement. In a second step, where only localized natural systems are potentially affected, the agency considers the degree, on both long- and short-time horizons.

The bulkhead rule could be articulated within the courts' reading of CEQ's section 1501.3 regulation. Additionally, the bulkhead rule follows from an interpretation of CEQ's NEPA-implementing regulations in fidelity to the policy animating the statute itself. Courts have granted substantial deference to CEQ's understanding of the statute,[296] where these regulations align with courts' understanding of the statute's underlying policies.[297] CEQ's "significance" regulation does not expressly articulate a clear rule. However, the bulkhead rule interpretation gives the regulation an effect defining NEPA preliminary analysis by prioritizing important impacts, in keeping with the statute's animating policy.

VI. CONCLUSION

Decision-making under conditions of uncertainty has, in the past, resulted in catastrophic regulatory failures with an unspeakable ecological, economic, and social toll. It is imperative to recognize these failures and the inevitability of the underlying ignorance that bred them.

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293 *Metro. Edison Co.*, 460 U.S. 766, 774 (1983).

294 40 C.F.R. § 1501.3(b).

295 *See infra* notes 273–276 and accompanying text.

296 *Andrus*, 442 U.S. 347, 358 (1979) ("CEQ's interpretation of NEPA is entitled to substantial deference."); *Hanly*, 471 F.2d 823, 838 (2d Cir. 1972) (Friendly, J., dissenting).

297 Merrill & Hickman, *supra* note 41, at 894–95, 895 n.296 (arguing that CEQ NEPA-implementing regulations are entitled to *Skidmore* deference).

The bulkhead rule proposed above is domain-specific; it emerges from a particular constellation of NEPA's statutory text, regulatory language, and case law. However, the general approach of analysis by anticipated failure, as opposed to regulating by hypotheticals, suggests a generalizable means of limiting the magnitude of administrative prediction failures.

To the extent that such a rule leads agencies to scale down their decisions and to exercise ecological caution by reducing the scale of their undertakings, it also creates scenarios in which agencies can learn from small failures, and do so without destabilizing precious, natural systems far too complex for any collection of bureaucrats and experts to understand.