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Corrected Comments submitted on January 7, 2014

**UNITED STATES OF AMERICA  
BEFORE THE NUCLEAR REGULATORY COMMISSION**

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In the Matter of )	
Proposed Rule: Waste Confidence – )	
Continued Storage of Spent Nuclear Fuel )	Docket No. 2012-0246
10 C.F.R. Part 51 )	
Draft Waste Confidence Generic )	
Environmental Impact Statement )	
_____ )	

**Comments by Environmental Organizations  
on Draft Waste Confidence Generic Environmental  
Impact Statement and Proposed Waste Confidence Rule**

**And**

**Petition to Revise and Integrate All Safety and Environmental Regulations  
Related to Spent Fuel Storage and Disposal**

**I. INTRODUCTION**

The following Organizations hereby submit comments on the Draft Waste Confidence Generic Environmental Impact Statement (“DGEIS”) and proposed revisions to NRC’s regulations for implementation of the National Environmental Policy Act (“NEPA”) regarding environmental impacts of spent fuel storage, 78 Fed. Reg. 56,776 (Sept. 13, 2013) (“proposed rule”): Alliance to Halt Fermi 3, Beyond Nuclear, Blue Ridge Environmental Defense League, Center for a Sustainable Coast, Citizens Allied for Safe Energy, Citizens’ Environmental Coalition, Don’t Waste Michigan, Ecology Party of Florida, Friends of the Coast, Friends of the Earth, Georgia Women’s Action for New Directions, Green State Solutions, Hudson River Sloop Clearwater, Missouri Coalition for the Environment, NC WARN, Nevada Nuclear Waste Task Force, New England Coalition, No Nukes Pennsylvania, Northwest Environmental Advocates, Nuclear Energy Information Service, Nuclear Information and Resource Service, Nuclear Watch South, Physicians for Social Responsibility, Public Citizen, Promoting Health and Sustainable Energy, Radiation and Public Health Project, Riverkeeper, SEED Coalition, San Clemente Green, San

Luis Obispo Mothers for Peace, Snake River Alliance, Southern Alliance for Clean Energy, and Vista 360.

These comments are supported by the Declaration of Dr. Arjun Makhijani (Dec. 20, 2013) (Exhibit A), the Declaration of David Lochbaum (Dec. 13, 2013) (Exhibit B), the Declaration of Dr. Gordon Thompson (Dec. 19, 2013) (Exhibit C), and the Declaration of Mark Cooper (Dec. 16, 2013) (Exhibit D).

This proceeding concerns the adequacy of NRC's response to the U.S. Court of Appeals' decision in *New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012), in which the Court vacated NRC safety findings regarding the availability of sufficient repository capacity for disposal of spent fuel and the safety of storing spent fuel in the interim. The Court concluded that the NRC lacked a lawful basis to rely on those safety findings to license and re-license nuclear reactors, because it had not analyzed, pursuant to NEPA, the reasonably foreseeable risk that sufficient repository capacity could not be found. 681 F.3d at 478.

Instead of supporting its reasonable assurance findings by conducting an appropriate environmental analysis of the probability of failing to site sufficient repository capacity and the consequences of such a failure, the NRC simply abandons those findings in the proposed rule. The words "reasonable assurance" — the key language of compliance with the Atomic Energy Act — do not appear in the proposed rule. Instead of predicting with "reasonable assurance" that spent fuel "will" be safely stored and disposed of, the NRC asserts — without any assurance — that it *can* be safely disposed of, *i.e.* that it is "feasible." These words confirm that, in the words of the Court of Appeals, "[t]he Commission apparently has no long-term plan other than hoping for a geologic repository."

But mere hope cannot satisfy the Atomic Energy Act. Under the Act and over thirty years of NRC and judicial interpretations, the proposed rule's failure to make reasonable assurance findings regarding the availability of a disposal solution for spent fuel deprives the NRC of any authority to license or re-license reactors. *See* 42 Fed. Reg. 34,391, 34,393 (July 5, 1977) ("The Commission would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely"); *Natural Resources Defense Council v. NRC*, 582 F.2d 166 (2nd Cir. 1978); *New York*, 681 F.3d at 474 (citing *Minnesota v. NRC*, 602 F.2d 412, 418 (D.C. Cir. 1979)); *Calvert Cliffs Nuclear Project, L.L.C. and Unistar Nuclear Operating Services, L.L.C.* (Calvert Cliffs Nuclear Power Plant, Unit 3), CLI-12-16, 76 NRC 63, 66 (2012).

Moreover, even if the NRC were to attempt to make reasonable assurance findings, it lacks any technical basis for such findings. The DGEIS contains no analysis of the probability that sufficient repository capacity will be available or unavailable when needed. Such an analysis would require an evaluation of the likelihood that spent fuel repositories could be found that meet the U.S. Environmental Protection Agency's standards for a repository and the capacity of various geologic sites to accommodate the quantity of spent fuel to be generated. The last study the NRC did of that issue was in the mid-1970s, and it is severely outdated. Similarly, in order to provide sufficient support for a reasonable assurance finding regarding the safety of storing spent fuel for many decades if a repository is delayed, the NRC would have to catch up on long-

delayed research regarding the long-term behavior of spent fuel in dry storage conditions. But the NRC is years away from obtaining adequate research results to make informed judgments about the safety of storing spent fuel for lengthy periods.

Without “reasonable assurance” safety findings regarding the availability of sufficient repository capacity or means of safely storing spent fuel for lengthy time periods -- or a technical basis for such findings -- the NRC has no authority under the Atomic Energy Act to continue licensing reactors to generate spent fuel. This failure to satisfy the Atomic Energy Act cannot be cured by the DGEIS, because a NEPA analysis cannot substitute for the safety findings that are independently required by the Atomic Energy Act.

Nor does the DGEIS satisfy NEPA. Even if the NRC could have made the reasonable assurance findings required by the Atomic Energy Act, the DGEIS is completely inadequate to support the licensing or re-licensing of reactors to generate spent fuel. In fact, the DGEIS flouts both NEPA and the Court’s application of NEPA in *New York*, 681 F.3d 481 (D.C. Cir. 2012) in multiple ways:

- In blatant violation of NEPA and the Court’s decision in *New York*, the DGEIS fails to examine the probability and consequences of failure to site a repository. Instead of examining the risk of failing to site a repository, the DGEIS rationalizes the risk away, by arbitrarily assuming that spent fuel will be protected by “institutional controls” for an infinite period of time at reactor sites. This assumption is not only absurd and inconsistent with the Nuclear Waste Policy Act (“NWPA”), but it also defeats the Court’s purpose of forcing NRC to reckon with the environmental consequences of its failure to site a repository.
- The DGEIS fails to acknowledge that the proposed rule is a licensing action, and therefore it distorts the statement of purpose and need for the proposed rule as relating to administrative rather than environmental concerns. As a result, the DGEIS also mischaracterizes the alternatives that must be considered. Instead of evaluating alternatives related to storage and disposal of spent fuel, the DGEIS examines alternatives related to the administrative question of how to prepare an environmental impact statement (“EIS”). The result is a farcical cost-benefit analysis that utterly fails to address alternatives for avoiding or mitigating the environmental impacts of storing spent fuel or siting a repository.
- The DGEIS’ analysis of the environmental impacts of extended spent fuel storage ignores the fact that NRC knows very little about the behavior of spent fuel in long-term or indefinite storage conditions, especially the potentially significant effects of long-term dry cask storage on high burnup fuel integrity. In violation of NEPA, the NRC makes no attempt to quantify these uncertainties.
- The DGEIS violates the Court’s decision in *New York* by failing to analyze the significance of past spent fuel leaks for future risks, by making unsupported assumptions about its future ability to detect leaks, and by relying on inapplicable or nonexistent regulatory requirements for future prevention of leaks.

- The DGEIS asserts that the environmental impact of pool fires is “SMALL,” *i.e.*, insignificant. In reaching this conclusion, the NRC uses a flawed concept of risk that is inappropriate to the consideration of potentially catastrophic environmental impacts. The DGEIS also ignores a range of pool fire causes, including the potential for an attack, the substantial cumulative frequency of fires, and the possibility that the risk environment will become more adverse in the future. If these factors are considered, the environmental impact of accident-induced pool fires is not SMALL, but LARGE.
- In violation of NEPA, the DGEIS makes no attempt to show how the environmental impacts associated with the proposed rule will be quantified and incorporated into cost-benefit analyses for nuclear reactors. Although spent fuel disposal and long-term storage costs are high enough to tip the balance of a cost-benefit analysis for reactor licensing away from licensing, nowhere does the NRC explain how it will take these costs into account in reactor licensing decisions.
- The NRC has splintered the analysis of environmental impacts associated with storage and disposal of spent fuel into an array of safety findings and environmental analyses. While the issues covered by these separate findings and analyses overlap and involve cumulative impacts, the NRC refuses to integrate them. The NRC also refuses to correct inconsistencies between them.

In order to comply with NEPA, the NRC must show that it has made a thorough assessment of the environmental risks of siting a repository and storing spent fuel for lengthy and perhaps indefinite periods. As discussed in the attached declarations by Dr. Arjun Makhijani, Dr. Gordon Thompson, and David Lochbaum, these impacts are significant. In addition, the DGEIS must show that it has quantified the risks and costs associated with siting a repository or failing to do so, including the risks and costs of maintaining spent fuel at reactor sites or away-from-reactor storage facilities for an indefinite period. The attached declaration of Mark Cooper shows that these costs are not only significant, but they may tip the balance of a cost-benefit analysis away from licensing or re-licensing reactors to energy efficiency and other energy alternatives.

Finally, the DGEIS must show how the significant risks and costs of siting a reactor or failing to do so, plus the risks and costs of spent fuel storage, will be integrated into the cost-benefit analyses for individual reactors. The proposed rule and DGEIS come at a critical juncture for the U.S. energy future. The costs of clean energy alternatives such as wind and solar are declining at the same time that costs of building new reactors and maintaining aging existing reactors are going up. Spent reactor fuel inventories, along with their storage costs and environmental risks, are also mounting at every U.S. reactor site -- and the prospect of a permanent repository grows more distant and costly with each passing decade. Under the circumstances, as demonstrated in the attached declaration of Mark Cooper, the costs of spent fuel management could tip the balance away from new or re-licensed nuclear reactors toward energy efficiency or clean alternative energy sources. Thus it is important for the NRC to ensure that these energy choices are well-informed by full consideration of environmental risks and a weighing of reasonable alternatives, as required by NEPA. But the NRC has not even acknowledged its obligation to make that analysis, let alone shown how it plans to carry it out.

In *Calvert Cliffs*, CLI-12-16, the NRC suspended all reactor licensing and re-licensing while it responded to the Court's order in *New York*. 76 NRC 63 (2012). As the Commission recognized, "[w]aste confidence undergirds certain agency licensing decisions, in particular new reactor licensing and license renewal." *Id.* at 66. The NRC has not satisfied the Court's order, NEPA, or the Atomic Energy Act. Therefore, licensing and re-licensing of reactors must remain suspended unless and until the NRC complies with the law.

### **Petition to Revise and Integrate All Safety and Environmental Regulations Related to Spent Fuel Storage and Disposal**

The Organizations respectfully request the NRC to revise and integrate all regulations that relate to the environmental impacts of spent fuel storage and disposal. Issues related to spent fuel storage and disposal impacts are now balkanized into separate rulemakings for spent fuel disposal impacts (Table S-3), safety and impacts of spent fuel storage and disposal from fuel generated during the license renewal period (Table B-1), safety and impacts of spent fuel storage after license termination (proposed 10 C.F.R. § 51.23), and safety and feasibility of siting a spent fuel repository (proposed 10 C.F.R. § 51.23).

While the NRC has divided consideration of environmental impacts into piecemeal decision-making, they are in fact related. By considering them separately, the NRC ignores the interaction of impacts, cumulative impacts, and inconsistencies in safety and environmental analyses conducted in the separate decision-making processes. In order to comply with NEPA, the NRC should conduct a comprehensive review of these regulations and environmental studies, revise them to be consistent with the current state of knowledge, and integrate them into one cohesive regulatory framework.

## **II. DESCRIPTION OF ORGANIZATIONS**

The following is a description of the commenter organizations. All of the organizations are neighbors of existing or proposed nuclear power plants, and most have either intervened or plan to intervene in NRC proceedings for the licensing or re-licensing of nuclear power plants.

The Alliance to Halt Fermi 3 ("ATHF3") is a union of concerned individuals and organizations dedicated to halting Detroit Edison from building Fermi 3, a proposed new nuclear reactor near Monroe, Michigan. ATHF3 is also committed to the shutdown of the existing Fermi 2 as soon as possible.

Beyond Nuclear is a national watchdog organization on the nuclear power and radioactive waste industries, as well as on the federal government agencies which are supposed to protect the public and the environment from the risks of radiation and radioactive waste to human health and ecosystems. Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abandon both to safeguard our future, including on the risks associated with the inevitable generation of radioactive waste by the nuclear industry. Beyond Nuclear advocates for an energy future that is sustainable, benign, and democratic. It is headquartered in Takoma Park, Maryland, a Nuclear-Free Zone.

The Blue Ridge Environmental Defense League (“BREDL”) is a 25-year-old regional, community-based non-profit environmental organization in the southeastern United States, whose founding principles are earth stewardship, environmental democracy, social justice, and community empowerment. BREDL encourages government agencies and citizens to take responsibility for conserving and protecting our natural resources. BREDL advocates grassroots involvement to empower whole communities in environmental issues. BREDL also functions as a “watchdog” of the environment, monitoring issues and holding government officials accountable for their actions.

The Center for a Sustainable Coast was established in 1997 to improve the responsible use, protection, and conservation of Georgia’s coastal resources – natural, historic, and economic. The Center for a Sustainable Coast works toward this objective by educating community members, collaborating with other groups, advising decision-makers and stakeholders, advocating legislation and scientific research, and taking legal action to prevent and control unwise activities that threaten to impair the quality, capacity, or diversity of the region’s resources.

Citizens Allied for Safe Energy (“CASE”) seeks to promote safe and sustainable energy production for Florida’s communities and to oppose energy production that is harmful to Florida’s communities’ economic well-being, public health, and the environment. CASE seeks to carry out this mission by educating and mobilizing the public.

Citizens’ Environmental Coalition (“CEC”) is a 35-year-old grassroots organization dedicated to eliminating toxic pollution and cleaning up hazardous sites. CEC advocates closure of New York State’s nuclear reactors and cleanup of the West Valley radioactive waste site. CEC also promotes clean sustainable energy and efforts to deal with climate change.

Don’t Waste Michigan is a state-based organization formed to stop Michigan from becoming a nuclear waste dumpsite.

Ecology Party of Florida is an independent party setting out to transform politics in the State of Florida, in part through environmental issue-oriented advocacy. The Ecology Party focuses on environmental issues concerning nuclear power in Florida.

Friends of the Coast is a Maine-based organization advocating for nuclear safety, safe storage of nuclear waste, and protection of the human environment from nuclear pollution. Friends of the Coast was the only environmental advocacy organization actively engaged in the decommissioning of Maine Yankee Atomic Power Station (1997-2005) and the only non-governmental organization involved in oversight of the Maine Yankee Independent Spent Fuel Storage Installation.

Friends of the Earth is a leader in climate and energy solutions and in protecting human communities from environmental harm. It is the U.S. voice of an influential international network that operates in 70 countries. In South Carolina, Friends of the Earth has intervened in

the NRC's licensing proceeding and the state regulatory proceeding for the V.C. Summer nuclear power plant.

Georgia Women's Action for New Directions ("WAND") is an independent grassroots, woman-led organization that seeks to direct women's voices into a powerful movement for social change. Georgia WAND promotes clean air, clean water, and a carbon-free, nuclear-free future through its environmental justice work. Georgia WAND monitors activities and policy decisions that affect the Savannah River Site and nuclear power plants.

Green States Solutions is an Iowa-based consulting firm specializing in advocacy, outreach, and campaign organization around climate change, renewable energy, energy efficiency, sustainability, and other environmental issues.

Hudson River Sloop Clearwater is a member-supported non-profit corporation whose mission is to preserve and protect the Hudson River, its tributaries, and related bodies of water. To achieve this, Clearwater works to provide innovative environmental programs, advocacy, and celebrations to inspire, educate, and activate the next generation of environmental leaders. Clearwater advocates for the closing of the Indian Point nuclear reactors in New York.

The Missouri Coalition for the Environment is an environmental advocacy organization, working on a variety of issues that affect human and environmental health. Missouri Coalition for the Environment focuses on issues surrounding clean water, clean air, clean energy and a healthy environment and uses education, public engagement, and legal action to achieve its goals.

Nevada Nuclear Waste Task Force was formed in the late 1980s and focuses its work on national nuclear waste policy and issues surrounding Yucca Mountain.

Since 1971, the New England Coalition ("NEC") has advocated for safe energy in New England and has provided education and resources for alternatives to nuclear power. NEC has also intervened in numerous NRC licensing proceedings involving the safety and environmental impacts of spent fuel storage at New England nuclear power plants.

No Nukes Pennsylvania is a Pennsylvania organization dedicated to fighting nuclear power.

North Carolina Waste Awareness and Reduction Network ("NC WARN") is a member-based non-profit tackling the accelerating crisis posed by climate change – along with the various risks of nuclear power – by watch-dogging Duke Energy practices and working for a swift North Carolina transition to energy efficiency and clean power generation. NC WARN partners with other citizen groups and uses sound scientific research to inform and involve the public on important environmental issues.

Northwest Environmental Advocates ("NWEA") promotes human health and environmental restoration in Oregon and Washington and on a national level. NWEA was founded in 1969 by citizens who were concerned about the imminent operation of the Trojan Nuclear Power Plant, located along the Columbia River at Rainier, Oregon. NWEA fought the Trojan plant

throughout its inception until its eventual closure in 1993. NWEA has also been active in challenging a number of other nuclear reactors.

Nuclear Energy Information Service (“NEIS”) is a non-profit organization committed to ending nuclear power. NEIS works to achieve this mission through educating, activating, and organizing the public on energy issues, building and mobilizing grass roots power and nonviolent opposition to nuclear power, and advocating for sustainable and ecologically-sound energy alternatives.

Nuclear Information and Resource Service (“NIRS”) is a non-profit corporation with over 12,000 members across the United States. NIRS has a mission to promote a nonnuclear energy policy and a concern for the health and safety of the people and ecosphere.

Nuclear Watch South (formerly Georgians Against Nuclear Energy) is a grassroots, direct-action environmental group dedicated to phasing out nuclear power plants, abolishing nuclear weapons, safeguarding nuclear materials; and establishing ethical social policies for nuclear waste management.

Physicians for Social Responsibility (“PSR”) has been working for over 50 years to create a healthy, just, and peaceful world for present and future generations. PSR uses its medical and public health expertise to prevent nuclear war and proliferation; slow, stop, and reverse global warming; protect the public from toxic chemicals; and eliminate the use of nuclear power.

Promoting Health and Sustainable Energy (“PHASE”) is a nonprofit organization that provides the public with information regarding safety, health impacts and sustainable energy.

Public Citizen is a national, nonprofit consumer advocacy organization with over 70,000 members nationwide. Public Citizen’s mission is to protect openness and democratic accountability in government and the health, safety, and financial interests of consumers. Public Citizen advocates for policies that will lead to safe, affordable and environmentally sustainable energy.

The Radiation and Public Health Project is the only U.S. organization whose mission is to conduct research and education on the health hazards posed by nuclear reactors. Group members have published 32 medical journal articles, 8 books, and 53 newspaper op-eds; have participated in 27 press conferences on findings; and testified to 19 government panels.

Riverkeeper is a non-profit, membership-supported environmental organization. Its mission is to protect the environmental, recreational and commercial integrity of the Hudson River and its tributaries, and safeguard the drinking water of nine million New York City and Hudson Valley residents.

San Clemente Green (“SCG”) is an informal group of over 5,000 citizens dedicated to sustainable living. SCG’s members are deeply concerned about the risks of living near the San Onofre Nuclear Generating Station (“SONGS”). SCG opposed the restart of SONGS and supports the safe decommissioning of the nuclear plant.

San Luis Obispo Mothers for Peace (“SLOMFP”) is a non-profit organization concerned with the risks and hazards connected with the Diablo Canyon Nuclear Power Plant and with the dangers of nuclear power, weapons and waste on national and global levels. An all-volunteer non-profit group, SLOMFP has challenged NRC licensing decisions within the NRC and in Federal Courts since 1973.

Sierra Club Nuclear Free Campaign works to promote an energy efficient world, powered by clean, renewable technologies, free from dirty, dangerous, costly nuclear power and its legacy of toxic waste. Sierra Club Nuclear Free Campaign works to stop proposed new nuclear power and license extensions of existing plants and to address the mounting problems associated with nuclear radioactive waste.

The Snake River Alliance is an Idaho-based grassroots group working through research, education, and community advocacy for peace and justice, the end to nuclear weapons, responsible solutions to nuclear waste and contamination, and sustainable alternatives to nuclear power. The Snake River Alliance is Idaho’s only grassroots nuclear watchdog and its leading advocate for clean energy.

The Southern Alliance for Clean Energy (“SACE”) is a coalition of environmental and citizen organizations promoting green energy in the southeastern United States. SACE has intervened in several NRC proceedings for the licensing of new nuclear power plants.

The Sustainable Energy and Economic Development (“SEED”) Coalition is a project of Texas Fund for Energy and Environmental Education, Inc., a statewide nonprofit organization with 5,000 members working for clean air and clean energy in Texas. The organization advocates for sustainable energy, including energy efficiency, renewable energy, and conservation.

Vista 360 is an independent Public Interest Leadership group of scientists, engineers, and business executives who engage in issues that potentially impact the public. Vista 360 is currently engaged in the Zion Decommissioning & Site Restoration Project (Zion Illinois 2010-2020) which is the largest decommissioning project in U.S. nuclear history.

### **III. BACKGROUND**

#### **A. Proposed Rule**

Proposed Section 51.23(a) makes the following predictions:

1. It is “feasible to safely store spent nuclear fuel following the licensed life for operation of a reactor” and
2. It is “feasible to have a mined geologic repository within 60 years following the licensed life for operation of a reactor.”

78 Fed. Reg. 56776, 56804 (September 13, 2013). The NRC states that these predictions are based on the DGEIS. *Id.*

Proposed Table B-1 makes the following findings regarding spent fuel storage and disposal impacts in license renewal cases:

The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated onsite with small environmental effects through dry or pool storage at all plants, if a permanent repository or monitored retrievable storage is not available.

\* \* \*

For the high-level waste and spent-fuel disposal component of the fuel cycle, the EPA established a dose limit of 15 millirem (0.15 mSv) per year for the first 10,000 years and 100 millirem (1.0 mSv) per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada.

The Commission concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.

78 Fed. Reg. at 56,805.

## **B. Draft GEIS**

### **1. Description and characterization of federal action**

On September 13, 2013, along with its proposed rule, the NRC also issued its Draft Waste Confidence Generic Environmental Impact Statement (DGEIS), NUREG-2157. *See* 78 Fed. Reg. 56621 (Sept. 13, 2013). The DGEIS purports to analyze “the environmental impacts of continued storage of spent fuel.” DGEIS at xxv.

The DGEIS describes the federal action to be evaluated as follows:

The Commission proposes to issue a revised Rule, 10 CFR 51.23, that generically addresses the environmental impacts of continued storage. This revision would adopt into regulation the environmental impact analyses in this draft GEIS. Further, the revision would state that because the impacts of continued storage have been generically assessed in this draft GEIS and codified in a Rule, NEPA analyses for future reactor and spent fuel storage facility licensing actions would not need to separately consider the environmental impacts of continued storage.

DGEIS at 1-5. The DGEIS acknowledges that the proposed rule is a major federal action. *Id.* at 1-3. But NRC denies that by generically resolving environmental issues with respect to reactor licensing, the proposed rule constitutes a licensing action:

**The Waste Confidence rulemaking is not a licensing action.** It does not permit a nuclear power plant or any other facility to operate or store spent fuel. Every nuclear power plant or specifically licensed spent fuel storage facility must undergo an environmental review as part of its site-specific licensing process.

DGEIS at xxvi (emphasis in original).

## **2. Description of purpose and need**

The DGEIS describe the purpose and need for the proposed action of codifying the environmental impacts of spent fuel storage and excusing their consideration in individual licensing cases as follows:

The purpose and need for the proposed action are threefold: (1) to improve the efficiency of the NRC's licensing process by generically addressing the environmental impacts of continued storage; (2) to prepare a single document that reflects the NRC's current understanding of these environmental impacts; and (3) to respond to the issues identified in the remand by the Court in the *New York v. NRC* decision. The NRC intends to codify the results of its analyses in this draft GEIS at 10 CFR 51.23. NRC licensing proceedings for nuclear reactors and ISFSIs will continue to rely on the generic determination in 10 CFR 51.23 to satisfy obligations under NEPA with respect to the environmental impacts of continued storage.

DGEIS at 1-6. In other words, the purpose and need for the proposed action, as described in the DGEIS, is to justify a generic approach to the analysis of the environmental impacts of spent fuel storage, in lieu of a reactor-specific analysis.

## **3. Identification and weighing of alternatives**

Guided by the DGEIS' methodology-focused definition of the purpose and need for the federal action, Chapter 7 sets forth an array of methodological alternatives for analyzing the environmental impacts of spent fuel storage. Instead of avoiding or diminishing physical environmental impacts of spent fuel, the alternatives considered in the DGEIS "provide different approaches that the NRC could apply to future licensing activities that can satisfy the agency's responsibility to consider the potential environmental impacts of continued storage in deciding whether to issue certain licenses." DGEIS at 7-1.

Thus, the DGEIS purports to analyze three methodological alternatives for evaluating environmental impacts of spent fuel storage and applying them in licensing decisions:

- First, the NRC could take no action and address the environmental impacts from continued storage in each of its nuclear power plant and ISFSI initial licensing and license renewal proceedings.
- Second, the NRC could develop a GEIS without incorporating the results into a rule. This approach would allow the NRC to adopt these draft GEIS findings into environmental reviews for future licensing activities, but without the binding effect of a rule.
- Third, the Commission could issue a policy statement. The policy statement would not bind licensees and applicants like a rule, but it would provide notice of the Commission’s intent to incorporate the findings of the GEIS into environmental reviews for future licensing activities.

DGEIS at 1-6.

The cost-benefit analysis in the DGEIS follows suit, comparing the administrative costs of preparing an EIS generically or on a site-specific basis. DGEIS at 7-2. Not surprisingly, given that none of these alternatives involves actual changes to the way nuclear reactors are operated or spent fuel is handled, the NRC reaches the conclusion that “[t]he alternatives considered in this chapter do not noticeably alter the environmental impacts from continued storage that the NRC addressed in Chapters 4, 5, and 6.” DGEIS at 7-1. The rationale offered by the DGEIS for failing to evaluate the costs of continued spent fuel storage is that this activity “will occur regardless of the alternative that the NRC selects to consider its impacts.” DGEIS at 7-1.

NRC analyzes the costs and benefits of NEPA review for the proposed action and each of its alternatives in terms of the actual cost of environmental review—i.e., site-specific review costs versus generic review costs. *See* DGEIS at 7-7–7-13. For example, the DGEIS asserts:

While the no-action alternative avoids the costs associated with a GEIS and rulemaking, site specific review costs are significantly higher than the avoided costs of the GEIS and rulemaking. The GEIS-only and policy-statement alternatives avoid the costs of rulemaking, but result in higher costs than the no action alternative because of their respective up-front costs.

DGEIS at 7-14. As a result, the DGEIS concludes that:

The primary benefit of the proposed action is that it eliminates the costs associated with site specific licensing reviews of issues related to the environmental impacts of continued storage.

DGEIS at 7-8.

#### **4. Evaluation of environmental impacts**

In Chapters 4, 5, and 6 and Appendices B, E, and F, the DGEIS evaluates the environmental impacts of spent fuel storage. Chapter 4 evaluates the environmental impacts of at-reactor spent fuel storage. Chapter 5 evaluates the environmental impacts of away-from-reactor storage.

Chapter 6 evaluates cumulative environmental impacts. The appendices provide more detailed analyses of the technical feasibility of continued spent fuel storage and repository availability (Appendix B), spent fuel pool leak risks (Appendix E), and spent fuel pool fire risks (Appendix F). In all cases, the NRC concludes that environmental impacts are insignificant.

The DGEIS analyzes environmental impacts in three separate time frames: short-term storage (60 years beyond a reactor's licensed life), long-term storage (160 years beyond a reactor's licensed life), and indefinite storage in the event a repository does not become available. DGEIS at xxix – xxx, 1-13. For the indefinite storage periods, the DGEIS assumes that institutional controls, *i.e.*, “the continued regulation of spent nuclear fuel,” will remain in effect. DGEIS at 1-14. According to the DGEIS:

This assumption avoids unreasonable speculation regarding what might happen in the future regarding Federal actions to provide for the safe storage of spent fuel. Although government agencies and regulatory safety approaches can be expected to change over long periods of time in the future, the history of radiation protection has generally been towards ensuring increased safety as knowledge of radiation and effectiveness of safety measures has improved. For the purpose of the analyses in this draft GEIS, the NRC assumes that regulatory control of radiation safety will remain at the same level of regulatory control as currently exists today.

DGEIS at 1-14 (emphasis added).

##### **5. Rationale for refusing to consider alternatives that would avoid or mitigate environmental impacts of spent fuel storage**

The DGEIS lists a set of alternatives, proposed for consideration by members of the public, that could avoid or mitigate the adverse environmental impacts of spent fuel storage, but the NRC refuses to analyze them in the DGEIS:

During the scoping period for the draft GEIS, the NRC received many suggested alternatives to the Waste Confidence rulemaking, including calls for halting NRC licensing activities and shutting down operating reactors or imposing new requirements on nuclear power plants, such as storing spent fuel in special hardened onsite storage, reducing spent fuel pool density, and accelerating the transfer of spent fuel from pools to dry casks. The NRC determined that halting NRC licensing and closing nuclear reactors would not meet the purpose and need of the proposed rulemaking action. The NRC also determined that additional requirements on spent fuel storage would not meet the purpose and need. Further, the draft GEIS is a NEPA review and not a licensing action; therefore, this draft GEIS would not be the appropriate activity in which to mandate new spent fuel storage requirements.

DGEIS at xxvi. The DGEIS provides the additional rationale that:

Although cessation of nuclear power plant licensing and operations would halt the future generation of spent fuel, other environmental impacts could result from the required development of replacement power sources or demand reductions. Even then, the environmental impacts of continued storage would not cease until sufficient repository capacity becomes available.

DGEIS at 1-9.

## COMMENTS

### **IV. THE PROPOSED RULE FAILS TO SATISFY ATOMIC ENERGY ACT REQUIREMENTS FOR LICENSING AND RE-LICENSING REACTORS**

#### **A. The Proposed Rule Violates the Atomic Energy Act by Eliminating Previous Safety Findings That Are Essential to Atomic Energy Act Compliance**

As the NRC conceded in its first waste confidence pronouncement (Denial of Petition for Rulemaking, 42 Fed. Reg. 34,391 (July 5, 1977)) and as affirmed by the U.S. Court of Appeals in *Natural Resources Defense Council v. NRC*, 582 F.2d 166 (2nd Cir. 1978), in order to satisfy the Atomic Energy Act, NRC reactor licensing decisions must include predictive reasonable assurance findings regarding (a) the availability of sufficient and safe spent fuel disposal capacity when it is necessary and (b) the safety of spent fuel storage in the meantime. *See also Minnesota v. NRC*, 602 F.2d 412 (D.C. Cir. 1979). As the NRC explained in 1977, in its first pronouncement on the issue:

The Commission would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely. The accumulating evidence as discussed below continues to support the Commission's implicit findings of reasonable assurance that methods of safe permanent disposal of high-level wastes can be available when they are needed. Given this, and the fact that at present safe storage methods are presently available and highly likely to remain so until a permanent disposal system can be demonstrated and licensed, the Commission sees no reason to cease licensing reactors.

42 Fed. Reg. at 34,393. While these reasonable assurance findings do not need to be as rigorous as other safety findings because they predict events far in the future, they must demonstrate a technical basis for a reasonable level of "confidence" that reactor fuel will be isolated from humans and the environment as long as it remains radioactive. 44 Fed. Reg. at 34,393.

Until the instant proposed rule, all NRC "waste confidence" decisions, since the first decision in 1984, have included "reasonable assurance" findings. For instance, Findings 2 and 4 of the 1984 waste confidence decision contained "reasonable assurance" findings regarding the same issues:

(2) The Commission finds *reasonable assurance* that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high level radioactive waste and spent fuel originating in such reactor and generated up to that time.

(4) The Commission finds *reasonable assurance* that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating license at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations.

49 Fed. Reg. 34,660 (Aug. 31, 1984) (emphasis added). Similarly, Findings 2 and 4 of the 1990 waste confidence decision contained "reasonable assurance" findings regarding the same issues:

(2) The Commission finds *reasonable assurance* that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and that sufficient repository capacity will be available within 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of any reactor to dispose of the commercial HLW and SNF originating in such reactor and generated up to that time.

(4) The Commission finds *reasonable assurance* that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin, or at either onsite or offsite ISFSIs.

55 Fed. Reg. 38,474 (Sept. 18, 1990) (emphasis added). Findings 2 and 4 of the 2010 waste confidence decision (subsequently vacated by the Court of Appeals on other grounds) also stated:

(2) The Commission finds *reasonable assurance* that sufficient mined geologic repository capacity will be available to dispose of the commercial high-level radioactive waste and spent nuclear fuel generated by any reactor when necessary.

(4) The Commission finds *reasonable assurance* that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and either onsite or offsite ISFSIs.

75 Fed. Reg. 81,037, 81,040 (Dec. 23, 2010) (emphasis added).

The proposed rule violates the Atomic Energy Act by completely eliminating any “reasonable assurance” safety findings regarding the safety of spent fuel storage or the availability of spent fuel disposal capacity. The only safety finding made in the proposed rule is a statement in the preamble that the NRC *lacks* confidence to make a reasonable assurance finding regarding the availability of a “disposal solution” at “the end of a reactor’s licensed life for operation.” 78 Fed. Reg. at 56,784.

While admitting in a footnote that “reasonable assurance” findings regarding an “offsite storage solution” and interim storage are required by law (78 Fed. Reg. at 56,778 n. 1 (citing *Minnesota*, 602 F.2d at 418)), the NRC asserts that the proposed rule’s only purpose is to codify the results of a NEPA analysis:

*B. Waste Confidence Rulemaking*

B1. What is the purpose of this Waste Confidence rulemaking? The NRC’s use of a rule to generically satisfy its NEPA obligations with respect to continued storage will enhance efficiency in individual licensing reviews by analyzing the environmental impacts of continued storage, which are the same or largely similar at each nuclear power reactor or storage site, and codifying the results of that analysis. Part of the environmental analysis for a nuclear power reactor or storage facility license includes a review of the impacts caused by the spent nuclear fuel generated in the reactor. That analysis must assess the impacts of the spent nuclear fuel from generation through disposal. If the Commission lacks reasonable assurance that a disposal solution will be available at the end of a reactor’s licensed life for operation, NEPA requires that the Commission assess the impacts of continued storage of the spent nuclear fuel pending disposal at a repository.

78 Fed Reg. 56,783-84. But the NRC’s complete substitution of NEPA findings for safety findings is unlawful. The NRC must comply with *both* the Atomic Energy Act *and* NEPA. *Limerick Ecology Action v. NRC*, 869 F.2d 719, 729 (3d Cir. 1989). The two statutes are independent and distinct in their requirements. The Atomic Energy Act establishes a minimum level of protection of public health and safety against radiological hazards. NEPA, on the other hand, requires disclosure and weighing of risks posed by licensing actions that are authorized by the NRC under the Atomic Energy Act; but it does not establish minimum standards. The two statutes do overlap. For example, NEPA requires the NRC to consider the reasonably foreseeable risk that siting sufficient repository capacity will not be feasible, and what would be the impacts if it is not feasible. But compliance with one statute does not excuse compliance with the other. *Limerick Ecology Action*, 869 F.2d at 729-30 (noting that case law “do[es] not suggest that NEPA can never require consideration of additional alternatives simply because there is some overlap in the considerations required by both statutes”). Moreover, while the Court of Appeals in *New York* focused on the NRC’s noncompliance with NEPA in promulgating the 2010 Waste Confidence Decision, nothing in the Court’s opinion could be read to reverse *Natural Resources Defense Council* or *Minnesota*’s holdings that the NRC must make waste confidence safety findings that comply with the Atomic Energy Act. In the absence of such reasonable assurance findings, the NRC has no lawful basis for issuing or re-issuing reactor

licenses. 42 Fed. Reg. at 34,393; *Natural Resources Defense Council*, 582 F.2d at 170; *Minnesota v. NRC*, 602 F.2d at 418.

**B. The Proposed Rule Violates the Atomic Energy Act by Removing the Previous Finding Regarding Sufficiency of Repository Capacity**

As discussed above, until the instant proposed rule, all NRC “waste confidence” decisions have included “reasonable assurance” findings. In addition, until the proposed rule, all “waste confidence” decisions have specifically addressed the question of whether the NRC has reasonable assurance that sufficient repository capacity will be available to accommodate spent reactor fuel when it is needed. This change can be seen by comparing the proposed rule with all of the quotations from Findings 2 and 4 in Section A above.

In contrast to these previous findings, the proposed rule finds only that it is “feasible” to “safely store spent nuclear fuel following the licensed life for operation of a reactor” and that it is “feasible” to “have a mined geologic repository within 60 years following the licensed life for operation of a reactor.” 78 Fed. Reg. at 56,804.<sup>1</sup> The NRC’s previous reasonable assurance finding regarding the availability of sufficient repository capacity for disposal of spent fuel *has completely disappeared from the NRC’s regulations*. Its disappearance is not explained. Neither the proposed rule nor the accompanying DGEIS gives any explanation as to why the proposed rule now fails to address the question of whether the NRC has a reasonable basis for confidence in the availability of sufficient repository capacity when it is needed. The closest the NRC comes to addressing the issue is by entitling a section in Appendix B “Repository Capacity will be Available to Dispose of Spent Fuel.” *Id.* at B-2. But the heading makes no reference to reasonable assurance or the sufficiency of capacity, and the text that accompanies that heading makes no assertion that the NRC has a technical basis for a finding of reasonable assurance that sufficient repository capacity will be available when it is necessary. Nor does the DGEIS contain any analysis of the risk that sufficient repository capacity will not become available when it is needed.

Instead, the DGEIS analyzes “scenarios” which assume the unavailability of repository capacity. That is a far cry from analyzing the question of whether the NRC has a technical basis for a reasonable assurance finding regarding the availability of sufficient repository capacity or an environmental risk analysis of the uncertainty surrounding such a prediction. As the Court ruled in *New York*, the NRC must evaluate the “likelihood of nonavailability” of repository capacity unless it is “remote and speculative.” 681 F.3d at 479. And a finding of technical feasibility is a far cry from a finding that sufficient repository capacity will actually be available.

The sufficiency of repository capacity is a crucially important consideration in determining whether it is safe for the NRC to continue to allow the generation of spent fuel in licensing

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<sup>1</sup> In previous waste confidence decisions, the NRC used the term “feasible” in reasonable assurance findings regarding high-level waste disposal. *See, e.g.*, Finding 1 of the 1990 waste confidence decision: “The Commission finds reasonable assurance that safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible.” 55 Fed. Reg. at 38,475 (1990).

decisions. Spent fuel is a highly radioactive substance that must be isolated for many thousands of years in order to protect public health and the environment. Generalizations about the technical feasibility of “a” repository do not answer the question of whether repository capacity will be sufficient to accommodate the spent fuel that will be generated in the future by reactors that have not yet been licensed or re-licensed. As discussed in the attached Makhijani Declaration (pars. 8.4 – 8.13), “[t]he proposed rule’s assertion of the feasibility of a repository does not guarantee that there will be a repository with sufficient capacity to accommodate all the spent fuel envisioned.”

In addition, the proposed rule’s failure to address the sufficiency of repository capacity is inconsistent with Congressional policy that disposal of spent fuel in a repository is the only safe means of protecting public health and the environment from spent fuel in the long run. *See* Section 11 of the Nuclear Waste Policy Act (“NWPA”), which establishes a national policy of disposing of spent nuclear fuel in a deep geologic repository. 42 U.S.C. § 10131 (1982).<sup>2</sup> In the proposed rule, the NRC appears to assume that no reasonable assurance finding regarding repository capacity is needed because of its opinion that spent fuel can be stored safely for the long-term or perhaps indefinitely at reactor sites or away-from reactor storage facilities. Aside from the fact that NRC’s opinion is essentially unsupported (*see* discussion in Section VI.A below), that assumption cannot be squared with the NWPA.

### **C. Lack of Sufficient Technical Support for Reasonable Assurance Findings**

Even if the NRC were to attempt to make “reasonable assurance” findings about the availability of sufficient repository capacity or the safety of extended interim storage of spent fuel as required by the Atomic Energy Act, NRC has demonstrated by its own actions that it lacks sufficient information to support such findings. The question of feasibility of spent fuel disposal cannot be evaluated without considering the probability that a repository will safely contain radioactivity for the hundreds of thousands of years required. In order to evaluate that probability, it is necessary to evaluate the environmental impacts of disposing of spent fuel in a range of geologic media. NRC cannot simply presume that a repository is feasible. Disposal impacts are relevant because they are part of the waste confidence finding that a mined geologic repository is feasible. By definition, a “feasible” repository must meet reasonable health and safety standards. Further, sufficient capacity at one or more such sites meeting safety criteria must be available to accommodate spent fuel from any and all commercial light water reactors that may be built. The DGEIS sets no upper limit on the amount of spent fuel to be disposed of. By failing to evaluate spent fuel disposal impacts and the sufficiency of repository capacity (if necessary at more than one site), the NRC has excluded a major part of the picture regarding the feasibility of spent fuel disposal. *See* Makhijani Declaration, pars. 8.2-8.24.

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<sup>2</sup> The NWPA also clearly distinguishes between storage and disposal. Storage is the “retention of . . . spent nuclear fuel . . . with the intent to recover such waste or fuel for subsequent use, processing, or disposal.” Section 2(25). Disposal is the “emplacement in a [deep geologic] repository . . . with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste.” Section 2(9), (18).

Nor does the NRC have a sufficient technical understanding of the risks of extended spent fuel storage to support a reasonable assurance finding. As discussed in the Organizations' comments on the scope of the DGEIS, NRC's own documents show that existing information is grossly inadequate to support any reasonable predictive findings about the safety of such long-term spent fuel storage.<sup>3</sup> There is no existing environmental or other study that has even attempted to predict the environmental impacts of storing spent fuel on site for hundreds of years, or perhaps indefinitely. Indeed, all other studies have been premised on the opposite conclusion – that a repository will be available in the relatively near future. NRC has commenced a study of the issue: the “Long-Term Waste Confidence Update Project,” in which the NRC proposes to assess the environmental impacts of storing spent fuel for 200 years after cessation of licensing. *See* 75 Fed. Reg. at 81,040.<sup>4</sup> But work on the Long-Term Waste Confidence Update Project had only just begun at the time of the D.C. Circuit's decision, and it is far from complete.

The NRC Staff has estimated that the Long-Term Waste Confidence Update Project EIS will take until 2019 to finish. COMSECY-12-0016, Memorandum from R.W. Borchardt to NRC Commissioners re: Approach for Addressing Policy Issues Resulting from Court Decision to Vacate Waste Confidence Decision and Rule at 3 (July 9, 2012) (“COMSECY-12-0016”). Two preliminary studies issued as part of the Project support the Staff's seven-year time estimate by demonstrating (a) the complexity of the issues raised by long-term and indefinite spent fuel storage and (b) the Commission's lack of knowledge on the subject. The first study, issued for comment in December 2011, sets forth a series of topics that must be addressed in the Long-Term Waste Confidence Update Project EIS, including the degree to which nuclear power will be used in the future, the nature of future dry cask storage and transportation technology, prospects for long-term maintenance of institutional and regulatory control, and accidents to be considered. Draft Report for Comment: Background and Preliminary Assumptions for an Environmental Impact Statement – Long-Term Waste Confidence Update (Dec. 2011) (the “Preliminary Assumptions Document”). While the NRC proposed, as a preliminary matter, to make assumptions about many of these topics, comments show that they may not be assumed and instead should be the *subject* of the EIS for the Long-Term Waste Confidence Update Project. *See* comments by Institute for Energy and Environmental Research, Blue Ridge Environmental Defense League, Natural Resources Defense Council, Riverkeeper, and Southern Alliance for Clean Energy on NRC Report Updating Preliminary Assumptions for an EIS on Long-Term Spent Fuel Storage Impacts (Feb. 17, 2012) (copy attached as Exhibit G).

The second study, issued for comment in May 2012, identifies an array of technical issues regarding dry storage and transportation impacts on which the NRC must collect additional data before it can evaluate dry cask long-term integrity and cask vulnerability to degradation and accidents. Draft Report for Comment: Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel (May 2012) (“Technical Needs Document”).

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<sup>3</sup> The Organizations' scoping comments and supporting declaration of Dr. Arjun Makhijani (“Makhijani Scoping Declaration”) are attached to these comments as Exhibits E and F, respectively.

<sup>4</sup> As the Court observed in *State of New York*, that rulemaking may address “some or all of the problems” that it remanded to the agency. 681 F.3d at 483.

Therefore, the NRC has years of research to do in order to gather sufficient data regarding spent fuel degradation and transportation and handling risks. It will take a long time, potentially well over a decade, to collect the data needed to make scientifically valid impact analyses for high burnup fuel stored for long periods. Necessary research tasks include development of a sound database for a scientifically valid evaluation of the environmental impacts of prolonged storage of spent fuel, including high burnup spent fuel up to 62.5 GWd/MTU and MOX spent fuel. In addition, there are essentially no data available for high burnup spent fuel that has been stored in dry casks for extended periods of time. The deficiencies in the NRC's understanding of spent fuel characteristics and behavior under long-term storage conditions are further addressed in the attached declaration of Dr. Arjun Makhijani, pars. 4.1-4.35.

The NRC attempts to rationalize its lack of support for a reasonable assurance finding about the safety of interim spent fuel storage by characterizing the finding as a "policy statement." 78 Fed. Reg. at 56,799. The characterization is fallacious and evasive of the NRC's responsibilities under the Atomic Energy Act. The Atomic Energy Act requires that safety must be assured by factual predictions that are based on technical evidence, not by policy statements. *Limerick Ecology Act*, 869 F.2d at 734-35.

Thus, the lack of reasonable assurance findings in the proposed rule renders them invalid as a matter of law for supporting the issuance of new reactor licenses or the re-issuance of existing licenses. The NRC cannot cure this fatal deficiency by inserting the "magic words" of "reasonable assurance." Instead, it must have a technical basis for such findings. As discussed above, it has no such basis. In light of the fatal deficiencies in the proposed rule, the NRC lacks lawful grounds for issuing or re-issuing any reactor licenses. *Calvert Cliffs Nuclear Project, L.L.C. and Unistar Nuclear Operating Services, L.L.C.* (Calvert Cliffs Nuclear Power Plant, Unit 3), CLI-12-16, 76 NRC 63, 66 ("Waste confidence undergirds certain agency licensing decisions, in particular new reactor licensing and license renewal.")

## **V. THE DGEIS VIOLATES NEPA BY MISSTATING THE PURPOSE AND NEED FOR THE PROPOSED RULE AND THEREBY PROVIDING A MEANINGLESS ALTERNATIVES AND COST-BENEFIT ANALYSIS**

In the DGEIS, the NRC purports to fulfill the key preliminary requirements for structuring the DGEIS and ensuring the completion of a meaningful analysis: defining the proposed action, describing the purpose and need of the proposed action, and identifying a range of alternatives to the proposed action. But the NRC taints the process by beginning it with the same legally erroneous premise rejected by the Court of Appeals in *New York v. NRC*: that proposed 10 C.F.R. § 51.23 is not a licensing action.

Leading from this faulty premise, the DGEIS makes the absurdly circular assertion that the purpose and need for the DGEIS is to decide whether to address the environmental impacts of spent fuel storage generically or on a site-specific basis. The NRC then compounds its legal error to an even more absurd effect, by identifying a range of alternatives for *thinking about* the environmental impacts of spent fuel storage. The NRC conducts a comically detailed comparison of the costs and benefits of these alternative methods for analyzing environmental

impacts of spent fuel storage, and finds that although none of these modes of thought have any adverse physical impacts on the environment, the generic mode of analysis is the “preferred alternative” for reasons of administrative efficiency. Thus, based on the NRC’s grossly erroneous structuring of the DGEIS, the DGEIS de-couples the environmental impacts of spent fuel from reactor licensing decisions and ensures that concerns about spent fuel storage or disposal impacts will never stop the issuance of a reactor license or result in the alteration of its terms. In short, the DGEIS is rendered meaningless.

In order to comply with NEPA, the NRC must correctly define the proposed action and its purpose and need, and must conduct a meaningful analysis of a reasonable array of alternatives. *See* 10 C.F.R. Part 51, App’x A (in an EIS, the NRC must “briefly describe and specify the need for the proposed action”), 10 C.F.R. § 51.71(d) (an EIS must include an analysis of “alternatives available for reducing or avoiding adverse environmental effects,” including “consideration of the economic, technical, and other benefits and costs of the proposed action and its alternatives”). *See also* 40 C.F.R. §§ 1502.13, 1502.14 (in an EIS, an agency must describe the “purpose and need for the proposed action” and “[r]igorously explore and objectively evaluate all reasonable alternatives”). These alternatives must include the option of denying new reactor license applications and license renewal applications for existing reactors, as well as alternatives for mitigating the adverse environmental impacts of spent fuel storage and disposal such as prohibition of the use of high burnup fuel. Whether the NRC performs this analysis in a generic EIS or reactor-specific EISs is a matter for the NRC’s discretion, but NEPA requires that it must be done. *Baltimore Gas & Elec. Co. v. NRDC*, 462 U.S. 87, 97-101 (1983).

#### **A. NEPA Requirements for Identification of the Proposed Action, Statement of Purpose and Need, and Alternatives Analysis**

As the courts have long recognized, the “linchpin” of an EIS is “the requirement for a thorough study and a detailed description of alternatives.” *Monroe County Conservation Council, Inc. v. Volpe*, 472 F.2d 693, 697-98 (2nd Cir. 1972) (internal citations omitted). The alternatives analysis is the linchpin of an EIS because it “ensure[s] that each agency decision maker has before him and takes into proper account all possible approaches to a particular project . . . which would alter the environmental impact and the cost-benefit analysis.” *Calvert Cliffs’ Coordinating Comm., Inc. v. Atomic Energy Comm’n*, 449 F.2d 1109 (D.C. Cir. 1971) (further noting this ensures “the most intelligent, optimally beneficial decision will ultimately be made”). The courts’ emphatic characterization of the importance of alternatives in an EIS is rooted in the Council of Environmental Quality regulations, which describe the alternatives requirement as the “heart” of the EIS. 40 C.F.R. § 1502.14; *see also* 10 C.F.R. Part 51, Subpt. A, App. A § 5. As such, the alternatives analysis required by 10 C.F.R. § 51.71(d) is a crucial component of the DGEIS. Alternatives that must be considered include the “no-action” alternative, a reasonable range of action alternatives, and mitigation alternatives. 10 C.F.R. § 51.71(d), 10 C.F.R. Part 51, Subpt. A, App’x A, §§ 5, 7.

The statement of purpose and need for the proposed action is crucially important to the adequacy of an EIS because it “delimit[s] the universe of the action’s reasonable alternatives.” *Citizens Against Burlington v. Busey*, 938 F.2d 190, 195 (D.C. Cir. 1991). *See also Wyoming v. U.S. Dep’t of Agric.*, 661 F.3d 1209, 1244 (10th Cir. 2011) (“how the agency defines the purpose of the proposed action sets the contours for its exploration of available alternatives.”). As the Court

observed in *Webster v. U.S. Department of Agriculture*, 685 F.3d 411, 422 (4th Cir. 2012), “[o]nly alternatives that accomplish the purposes of the proposed action are considered reasonable, and only reasonable alternatives require detailed study. . . .” Thus, in *Citizens Against Burlington*, the court warned that “[a]n agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency’s power would accomplish the goals of the agency’s action, and the EIS would become a foreordained formality.” 938 F.2d at 195.

**B. The DGEIS’s Description of the Proposed Action is Incomplete and Fails to Acknowledge that Proposed 10 C.F.R. § 51.23 is a Licensing Action**

The DGEIS provides only a partial description of the proposed regulatory action in 10 C.F.R. § 51.23. The DGEIS defines the proposed action as:

issu[ing] a revised Rule, 10 CFR 51.23, that generically addresses the environmental impacts of continued storage. . . . Further, the revision would state that *because the impacts of continued storage have been generically assessed in this draft GEIS and codified in a Rule, NEPA analyses for future reactor and spent fuel storage facility licensing actions would not need to separately consider the environmental impacts of continued storage.*

DGEIS at 1-5 (emphasis added). In other words, proposed Section 51.23 generically resolves, for individual reactor licensing and re-licensing decisions and spent fuel storage facility licensing decisions, the question of whether storage of spent fuel would have significant impacts on the environment.

While this definition of the proposed action is correct as far as it goes, it is incomplete. The DGEIS fails to acknowledge that the proposed rule makes other environmental findings generically applicable to all individual reactor licensing and re-licensing decisions and spent fuel storage facility licensing decisions. These findings are the following:

- Proposed 10 C.F.R. § 51.23 makes generic safety findings with respect to the feasibility of safely storing spent fuel for an indefinite period and the feasibility of siting a repository for spent fuel disposal within 60 years.
- Proposed Table B-1 makes an environmental impact finding that spent fuel disposal impacts are not large enough to require “that the option of extended operation under 10 CFR part 54 should be eliminated.”
- Proposed Table B-1 makes an environmental finding that the NRC “has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal.”

Equally important, the DGEIS fails to acknowledge that all of the provisions of proposed 10 C.F.R. § 51.23 and proposed Table B-1 listed above constitute licensing actions, because they enable the creation of spent fuel by resolving safety and environmental issues that are necessary to the licensing and re-licensing of reactors. As was true of the 2010 Waste Confidence Decision that was vacated by the U.S. Court of Appeals, the “action” of the 2013 proposed rule is to “allow the licensing of nuclear plants.” *New York v. NRC*, 681 F.3d 471, 478 (D.C. Cir. 2012). *See also id.* at 476 (finding that the waste confidence decision is a “pre-determined ‘stage’ of

each licensing decision”). There is no doubt that if carried out, these proposed actions will result in adverse impacts to the environment through the creation of spent reactor fuel.

Not only does the DGEIS fail to acknowledge the fact that the proposed regulations constitute licensing actions, it denies that fact:

**The Waste Confidence rulemaking is not a licensing action.** It does not permit a nuclear power plant or any other facility to operate or store spent fuel. Every nuclear power plant or specifically licensed spent fuel storage facility must undergo an environmental review as part of its site-specific licensing process.

DGEIS at xxvi (emphasis in original).

**C. The DGEIS’ Statement of Purpose Violates NEPA Because it Bears No Relationship to the Environmental Harm Caused by the Proposed Action**

Compounding the NEPA violation caused by the DGEIS’ defective description of the proposed action, the DGEIS’ description of the “purpose and need for the proposed action” strays even further off course into the realm of the utterly fallacious. The statement of purpose and need bears no relationship to any physical effects on the environment and absurdly contemplates the relative merits of *thinking and writing about* environmental impacts in different ways. According to the DGEIS:

The purpose and need for the proposed action are threefold: (1) to improve the efficiency of the NRC’s licensing process by generically addressing the environmental impacts of continued storage; (2) to prepare a single document that reflects the NRC’s current understanding of these environmental impacts; and (3) to respond to the issues identified in the remand by the Court in the *New York v. NRC* decision.

DGEIS at 1-6. Thus, instead of addressing the purpose and need for licensing decisions that allow harm to the environment through the generation of spent fuel, the DGEIS addresses the purpose and need for making a licensing decision generically instead of on a reactor-specific basis. But the question of how to prepare an EIS has no bearing on what will be the physical environmental impacts of the NRC’s decisions to allow reactors to generate spent fuel. Thus, the statement of purpose and need blatantly violates NEPA.

The DGEIS’ additional statement that the purpose and need for the proposed action is “to respond to the issues identified in the remand by the Court” does not bring the NRC any closer to complying with NEPA, because elsewhere the DGEIS clearly rejects the Court’s decision that the safety and environmental findings in 10 C.F.R. § 51.23 constitute a licensing decision. As discussed above, the DGEIS asserts that “the Waste Confidence Rulemaking is not a licensing action.” DGEIS at xxvi. Indeed, this repudiation of the Court of Appeals’ decision is written in bold and placed in a text box for emphasis.

Thus, the DGEIS’ statement of purpose and need is impermissible under NEPA, because it fails to address the purpose or need for NRC to allow the environmental harm that would be permitted

by the proposed action. *See Baltimore Gas & Elec. Co. v. NRDC*, 462 U.S. 87, 96 (1983) (“The key requirement of NEPA . . . is that the agency consider and disclose the actual environmental effects in a manner that will ensure that the overall process . . . brings those effects to bear on decisions to take particular actions that significantly affect the environment.”). As a result, as further discussed below, the environmental harm caused by generation of spent fuel is “foreordained” and the DGEIS becomes a mere “formality.” *Citizens Against Burlington*, 938 F.2d at 195.

**D. The DGEIS Violates NEPA by Failing to Identify or Compare the Costs and Benefits of Reasonable Alternatives to Avoid or Mitigate the Adverse Environmental Impacts of Spent Fuel Generation**

Not surprisingly, because the DGEIS’ purpose and need statement bears no relationship to the actual physical environmental impacts of the proposed action, the range of alternatives identified in the DGEIS also bears no relationship to the physical impacts of the proposed action or their avoidance or mitigation. The NRC’s failure to identify a meaningful array of alternatives violates NEPA. *Calvert Cliffs*, 449 F.2d at 1128 (“NEPA requires that an agency must -- to the fullest extent possible . . . consider alternatives to its actions which would reduce environmental damage.”).

Instead of considering alternatives for avoiding or mitigating the environmental impacts of spent fuel that will be generated as a result of future licensing decisions, the NRC presumes that spent fuel production will continue and then considers alternative methods for analyzing the impacts of this spent fuel production. *See* DGEIS at 7-1 (each alternative “provides a means for the NRC to address, in its environmental review documents, the environmental impacts of continued spent fuel storage (continued storage) at a reactor site or at an away-from-reactor storage facility.”). Thus, the two main alternatives considered in the DGEIS are whether to prepare a generic impact analysis or a set of reactor-specific impact analyses. DGEIS at 1-6. The NRC observes, without irony, that neither of these alternatives “noticeably alter the environmental impacts from continued storage.” DGEIS at 7-1. In fact, the NRC’s failure to identify any actual physical environmental effects from these alternatives is just the “foregone conclusion” of the NRC’s faulty analysis. *Citizens Against Burlington*, 938 F.2d at 195.

The NRC admits that commenters demanded consideration of actual alternatives to the proposed action, but the NRC refused, relying on its misplaced purpose and need statement:

During the scoping period for the draft GEIS, the NRC received many suggested alternatives to the Waste Confidence rulemaking, including calls for halting NRC licensing activities and shutting down operating reactors or imposing new requirements on nuclear power plants, such as storing spent fuel in special hardened onsite storage, reducing spent fuel pool density, and accelerating the transfer of spent fuel from pools to dry casks. *The NRC determined that halting NRC licensing and closing nuclear reactors would not meet the purpose and need of the proposed rulemaking action.* The NRC also determined that additional requirements on spent fuel storage would not meet the purpose and need. Further, the draft GEIS is a NEPA review and not a licensing action; therefore, this draft

GEIS would not be the appropriate activity in which to mandate new spent fuel storage requirements.

DGEIS at xxvi (emphasis added).<sup>5</sup> And further, the NRC admitted that not licensing and re-licensing nuclear power would stop the production of waste. However, NRC shied away from consideration of a no-action alternative that would stop licensing, by stating:

Although cessation of nuclear power plant licensing and operations would halt the future generation of spent fuel, other environmental impacts could result from the required development of replacement power sources or demand reductions. Even then, the environmental impacts of continued storage would not cease until sufficient repository capacity becomes available.

DGEIS at 1-9. This statement is simply irrational, and reflects a complete lack of analysis. The fact that other energy sources may have environmental impacts does not render them unworthy of consideration. NEPA requires that the entire array of reasonable alternatives must be analyzed. *Calvert Cliffs*, 449 F.2d at 1128. In addition, consideration of the no-action alternative of not licensing and re-licensing reactors that would generate spent fuel is explicitly required under NEPA and NRC implementing regulations. *See* 10 C.F.R. § 51.71(d), 10 C.F.R. Part 51, Subpt. A, App'x A, §§ 5, 7; *see also* 40 C.F.R. § 1502.14.

Compounding the absurdity of the DGEIS' identification of alternatives as a choice among analytical methods, the DGEIS' cost-benefit analysis consists of meticulous cost estimates and comparisons of the human hours and quantity of paper required for each method. DGEIS at 7-3, H-2. The results are absurd, giving no information whatsoever about the relative costs and benefits of measures to avoid or mitigate the environmental impacts of the spent fuel that will be generated through future licensing decisions. These impacts are potentially significant and the costs of mitigating them are potentially great, as discussed in Sections V.F, VI.E, and VII below.

**E. In Violation of NEPA and *New York v. NRC*, the DGEIS Assumes that NRC Will Continue to License Reactors to Generate Spent Fuel, and that the Proposed Rule is Unrelated to Those Decisions**

The DGEIS also indicates that the NRC has made a pre-conceived determination that reactors *will* be licensed and re-licensed, and that the DGEIS is a mere formality. In Section 7, the NRC claims to have considered whether to include one set of physical impacts in its cost-benefit analysis, *i.e.*, the costs and benefits related to “the environmental impacts of continued storage.” DGEIS at 7-2. But the NRC explains that the DGEIS omits such an analysis because “continued storage [is] an activity that will occur regardless of the alternative that the NRC selects to consider its impacts.” DGEIS at 7-1. This assertion can only be true if the decision to allow the future generation of spent fuel is “foreordained.” *Citizens Against Burlington*, 938 F.2d at 195. Thus, the DGEIS effectively confirms that consideration of the environmental impacts of spent

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<sup>5</sup> This quotation also falsely suggests that NRC could apply 10 C.F.R. § 51.23 to order the shutdown of licensed operating reactors. Section 51.23 is, on its own terms, a licensing regulation. The NRC should have clarified that the proposed rule would not allow the shutdown of operating reactors and therefore it is not a viable alternative for consideration under NEPA.

fuel generation will not affect reactor licensing or re-licensing decisions in any way. This is a blatant violation of NEPA and the Court's decision in *New York v. NRC* that the NRC's evaluation of the environmental impacts of spent fuel generation is "not separate" from licensing decisions for nuclear reactors. 681 F.3d at 476.

**F. The NRC Must Evaluate a Reasonable Array of Alternatives for the Avoidance or Mitigation of Spent Fuel-Related Environmental Impacts, Either in the DGEIS or Reactor-Specific EISs**

NEPA requires that the NRC must analyze a reasonable set of alternatives for the avoidance or mitigation of the significant impacts of generation of spent fuel, and integrate those considerations into individual licensing decisions. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351 (1989) (explaining that the "requirement that an EIS contain a detailed discussion of possible mitigation measures flows both from the language of the Act and, more expressly, from CEQ's implementing regulations"); *see also* 10 C.F.R. § 51.71(d) (an EIS must include an analysis of "alternatives available for reducing or avoiding adverse environmental effects"). Whether the NRC performs that analysis generically or on a reactor-specific basis is entirely up to the NRC's discretion. *Baltimore Gas & Electric*, 462 U.S. at 96. But NEPA requires that it must be done.

First and foremost, the NRC must consider the no-action alternative, *i.e.*, the alternative of not permitting further generation of spent fuel through the licensing of new reactors and the re-licensing of existing reactors. *Calvert Cliffs*, 449 F.2d at 114 (the alternatives requirement "seeks to ensure that each agency decision maker has before him and takes into proper account all possible approaches to a particular project (including total abandonment of the project) which would alter the environmental impact and the cost-benefit analysis"). As demonstrated in the attached declarations of Dr. Arjun Makhjani (Exhibit A), Dr. Gordon Thompson (Exhibit C), and David Lochbaum (Exhibit B), spent fuel storage and disposal have significant environmental impacts, and measures for mitigation of those impacts involve significant costs. As further demonstrated in the attached declaration of Mark Cooper (Exhibit D), the costs of managing spent fuel could be great enough to tip the balance against reactor licensing or re-licensing. NEPA requires a full analysis of the environmental impacts of spent fuel generation, as well as a weighing of the relative costs and benefits of alternative energy sources in relation to the significant costs associated with nuclear power generation and spent fuel management. NEPA requires such an analysis before the NRC can promulgate a final version of 10 C.F.R. § 51.23.

The NRC must also consider the relative costs and benefits of mitigation alternatives to reduce adverse environmental impacts. For instance, numerous options are available to reduce the radiological risk arising from management of spent fuel, including options for providing enhanced protection of ISFSIs from attacks. Thompson Declaration, par. XI-8. Use of such options at ISFSIs across the United States would also support a national strategy of protective deterrence. *Id.* Whether these alternatives are considered generically or in individual licensing cases, they must be carried out under NEPA.

**VI. THE DGEIS VIOLATES NEPA BECAUSE IT DOES NOT FULLY CONSIDER THE REASONABLY FORESEEABLE IMPACTS OF THE PROPOSED RULE**

**A. The Proposed Rule’s Finding Regarding the Technical Feasibility of a Repository Is Not Supported by the DGEIS**

In *New York*, the Court concluded that the NRC’s “reasonable assurance” finding that a repository will be available is insufficient to satisfy NEPA because it does not show that the “likelihood of nonavailability” is “remote and speculative.” 681 F.3d at 479. Therefore the Court ordered NRC to conduct a “full analysis” of “the potential environmental effects” of storing spent fuel onsite at nuclear plants “on a permanent basis.” 681 F.3d at 479. The Court stated quite clearly that the EIS must address the impacts of a “failure to secure permanent storage.” *Id.*

Under NEPA’s rule of reason standard, the analysis of the risk of failure to secure permanent storage for spent fuel must include the following: the risk that sufficient repository capacity that meets NRC’s Part 63 standards for containment will not be found; the risk that even if sufficient repository capacity is found it will not be licensed before substantial environmental harm has occurred; and the nature of the harm that could occur if interim measures to protect spent fuel from exposure to the environment fail. But the DGEIS contains no such analysis. The DGEIS completely ignores the issue of the probability that sufficient repository capacity will be available in a timely way. *See* Makhijani Declaration, pars. 8.1-8.24. Moreover, instead of analyzing the environmental impacts that could occur if spent fuel remains undisposed of for many decades and escapes to the environment, the NRC assumes those impacts will not happen because they will be prevented by the indefinite maintenance of “institutional controls.” *See* DGEIS at 1-14 (stating the assumption that “[i]nstitutional controls, i.e., the continued regulation of spent nuclear fuel, will continue”).

**B. The DGEIS’ Assumption of Indefinitely Effective Institutional Controls Violates NEPA**

Instead of complying with NEPA and the Court’s decision in *New York* by examining the risk of failing to site a repository, the DGEIS rationalizes the risk away by arbitrarily assuming that spent fuel will be protected by “institutional controls” for an infinite period of time at reactor sites or away-from-reactor storage sites. This assumption is not only absurd and inconsistent with the NWA, but it flouts the Court’s requirement to reckon with the environmental consequences of its failure to site a repository.

**1. NRC’s assumption of indefinitely effective institutional controls violates NEPA because it is inconsistent with the NWA and NRC regulations**

NRC’s determination that spent fuel can be safely stored for an indefinite amount of time above-ground is inconsistent with the NWA and NRC’s own regulations. As discussed above in Section V, the NWA establishes a national policy of disposing of spent nuclear fuel in a deep geologic repository. By labeling the consideration of permanent on-site storage of spent nuclear fuel as “indefinite storage” the NRC seeks to avoid the necessary conclusion that when on-site storage becomes permanent it becomes disposal. This assumption of de facto above-ground disposal directly violates the NWA.

The DGEIS' assumption of indefinite institutional controls is also inconsistent with the NRC's own regulations. For instance, the NRC's low-level waste disposal regulations assume that active controls will fail after 100 years, and intruder barriers will fail around 500 years. 10 CFR § 61.7 (b)(4) & (b)(5). To state that institutional controls are likely to fail in the NRC's regulations, and then assume throughout this DGEIS that institutional controls will last forever is inconsistent and irrational.

And the NRC's assumption is inconsistent with general federal policy regarding containment of hazardous materials. When reviewing the Department of Energy's ("DOE") cleanup plans for legacy waste sites, the NRC required the DOE to assume that "contamination isolation barriers and stewardship measures at sites where wastes are left in place will eventually fail." National Research Council, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources. *Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites* (Washington, DC: National Academy Press, 2000), available at <http://www.nap.edu/catalog.php?record id=9949>. This directly contradicts the assumption of forever continuing institutional controls relied upon by the NRC in the DGEIS.

Finally, as a matter of law, the NRC may not assume the effectiveness of institutional controls to prevent radiological releases to the environment during the extended period of spent fuel storage. As the Court held in *New York*, "merely pointing to [a] compliance program is in no way sufficient to support a scientific finding." 481 F.3d at 481. The question of whether institutional controls will remain in place for hundreds or thousands of years must be addressed as an element of risk.

**2. NRC's assumption of indefinitely effective institutional controls violates NEPA and *New York v. NRC* because it arbitrarily assumes the nonexistence of an impact instead of analyzing it**

The NRC asserts that a loss of institutional controls is so remote and speculative that its consideration is outside the requirements of the National Environmental Policy Act ("NEPA"). *Id.* at 1-15, fn. 2. Given the many examples in history of loss of institutional controls, it is the NRC's assumption that institutions will remain intact and capable of caring effectively for spent fuel over an indefinite period of time that is more fairly characterized as remote and speculative. Makhijani Declaration, pars. 6.4, 10.3. As Dr. Makhijani discusses in Section 6 of his declaration, this assumption in the DGEIS flies in the face of facts, history and common sense. For instance, the U.S. has been in two world wars in less than 100 years. Just over a decade ago, the financial capital of the U.S. suffered a devastating attack that could have targeted a nuclear power plant. There have been a dozen government shutdowns since 1981. In the most recent shutdown, in October 2013, some waste management functions – even for "visible" facilities – almost came to a halt. For instance, the Fernald Preserve, which includes a large visible mound of radioactive waste from the Fernald uranium plant that was part of the nuclear weapons complex was closed. Had the government shutdown lasted much longer, the pump and treat operations that are a mandated part of water quality objectives, would have come to a halt. Makhijani Declaration, par. 6.7 – 6.8.

The NRC asserts that the purpose of its assumption of continued institutional controls is to “avoid unreasonable speculation regarding what might happen in the future regarding Federal actions to provide for the safe storage of spent fuel.” DGEIS at 1-14. Admitting a lack of information satisfies the first obligation for agencies faced with uncertainties in an EIS, but the NRC fails to complete any of the remaining three obligations under the CEQ regulation for incomplete or unavailable information. 40 C.F.R. § 1502.22(b). After admitting uncertainty, under section 1502.22(b) the agency must include within the EIS:

(2) [A] statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency’s evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.<sup>6</sup>

40 C.F.R. § 1502.22(b).

**C. The Proposed Rule’s Determination that it is Feasible to Safely Store Spent Fuel for an Indefinite Period Violates NEPA Because it is Devoid of Valid Technical Support and Fails to Consider a Range of Factors Affecting the Long-Term Safety of Spent Fuel Storage**

The DGEIS asserts that spent fuel can be stored safely and without significant impacts for an indefinite period of time. DGEIS at xlv-xlv, lv, 8-2 – 8-3. But the NRC’s findings on this issue are almost devoid of valid technical support. Makhijani Declaration, par. 4.1 et seq. The studies cited by the NRC do not support the broad generalizations in the DGEIS. For instance, the DGEIS relies on a pilot study that was never intended to be used for regulatory purposes; and it relies on other studies that are limited to short time frames. Makhijani Declaration, pars. 4.2–4.5. But even the short-term studies show evidence of spent fuel degradation during storage. Makhijani Declaration, par. 4.5.

As discussed in Dr. Makhijani’s declaration, the DGEIS assumes that spent fuel bundles can be stored for millennia and repeatedly transferred hundreds of times from one cask to another without large releases of radioactivity. But the DGEIS contains almost no information about spent fuel characteristics that could cause adverse safety risks and environmental impacts in case

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<sup>6</sup> The Supreme Court has held that Council on Environmental Quality regulations for the implementation of NEPA “impose a duty on all federal agencies.” *Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 372 (1989). The NRC is a federal agency and therefore must answer this call to duty. “Reasonable forecasting and speculation is thus implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as ‘crystal ball inquiry’.” *Scientists’ Inst. For Pub. Info. v. Atomic Energy Comm’n*, 481 F.2d 1079, 1086 (D.C. Cir. 1973).

of long-term or indefinite storage, both during storage and during the many transfers that must take place. Makhijani Declaration, par. 4.6. The DGEIS contains no analysis of how spent fuel characteristics may contribute to the risk of an accidental release of radioactivity during extended storage of dry casks; or how these factors may contribute to accident risks during the many transfers that would take place over an extended period of time, *i.e.*, transfers between pools and casks, transfers between storage casks, transfers between storage and transportation casks, and transfers between transportation casks and casks used for ultimate disposal of spent fuel. *Id.*

The DGEIS cites just one study (Billone et al. 2013) that has evidence about the deterioration of high burnup spent fuel during drying and subsequent storage. DGEIS at B-13. Even so, the lessons contained in this study, such as the implications of degradation for accident consequences or the differences between risks of various zirconium alloys used as cladding material are not discussed in the DGEIS. Makhijani Declaration, par. 4.7.

The DGEIS omits any mention of the fact that elsewhere, the NRC has acknowledged that it has a serious lack of information about the behavior of spent fuel stored for long periods. Makhijani Declaration, par. 4.8. In May 2012, the NRC published a *Draft Report for Comment: Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel* (“Draft Report on Technical Information Needs” or “Draft Report”). This report catalogs what is known, as well as the gaps in knowledge, of spent fuel degradation mechanisms. Some of the gaps will require extensive new data and a considerable amount of time to fill.

The Draft Report on Technical Information Needs was based on a number of prior reports, data from physical examination of some “lower burnup” spent fuel, and extrapolation from this data to 80 years. Based on this data, the Draft Report concluded:

....The current regulatory framework supports at least the first 80 years of dry cask storage (*i.e.*, a 40-year initial licensing term, followed by a license renewal for a term of up to 40 years, although many of the existing facilities were licensed for an initial term of 20 years under the regulations in place at the time).

The technical basis for the initial licensing and renewal period is supported by the results of a cask demonstration project *that examined a cask loaded with lower burnup fuel* (approximately 30 GWd/MTU [gigawatt-days per metric ton uranium] average; all fuel burnup in this paper is given as peak rod average value). Following 15 years of storage, the cask internals and fuel did not show any significant degradation (Einziger et al., 2003). The data from this study can be extrapolated to maintain a licensing safety finding that *low burnup SNF* can be safely stored in a dry storage mode for at least 80 years with an appropriate aging management program that considers the effects of aging on systems, structures, and components (SSCs).

Makhijani Declaration, par. 4.8 (emphasis added). Note that the existing licensing and license extension procedures are based on examination of a single cask of relatively low

burnup uranium dioxide spent fuel that had been in dry storage for only 15 years. The Draft Report lists data extensive requirements for extending this analysis to:

- high burnup spent fuel that would be stored from 120 years to 300 years;
- spent fuel burnups up to about 62.5 GWd/MTU;
- mixed oxide (MOX) spent fuel (which has plutonium-239 instead of uranium-235 as the fissile material that sustains the chain reaction); and
- new cladding, fuel compositions, and assembly designs that have been and will continue to be put into use.

Makhijani Declaration, par. 4.9 & Table 6-1. In the Draft Report, the NRC proposed to undertake a seven-year study of the phenomena identified in the Draft Report; but the plan was deferred when resources were diverted to the preparation of the Waste Confidence DGEIS. Makhijani Declaration, par. 4.12.

As Dr. Makhijani observes, the NRC's failure to mention in the DGEIS the agency's own previously expressed concerns about the data gaps essential to understanding high burnup and MOX spent fuel and spent fuel with new cladding materials is an egregious technical omission. The missing data are critical to assessing the health and environmental impacts of spent fuel; gathering the data will need extensive additional research. Whenever a scientist lacks sufficient information to evaluate an issue, it is essential to identify the missing information and, at the very least, conduct an uncertainty analysis. Neither of those steps was taken by the NRC in the DGEIS. On the contrary, the one study that the NRC cited to justify its conclusion that impact accident consequences would be low explicitly did *not* consider uncertainties. The NRC's failure to mention its own documented concerns about spent fuel characteristics seriously compromises the scientific integrity of the DGEIS. Makhijani Declaration, par. 4.12.

The NRC's failure to acknowledge the amount of information that is lacking regarding spent fuel behavior over the long-term is all the more disturbing in light of the fact that the Nuclear Waste Technical Review Board ("NWTRB") has expressly acknowledged the dearth of information regarding spent fuel integrity and degradation. Makhijani Declaration, par. 4.13. NWTRB confirms that at present no U.S. data are available for high burnups (up to 62.5 GWd/MTU) for any of the NRC's storage scenarios, or for periods of storage anywhere comparable to the long timeframe of hundreds of years that the NRC will have to consider in its Waste Confidence EIS in one or more scenarios. Predictions, estimates or projections that the NRC may make of the effects of high burnup spent fuel storage, particularly over long-term periods, in its Waste Confidence EIS cannot be validated with scientific data or observations with presently available information. Such validation is essential for reliable and scientifically acceptable estimates of the environmental and health impacts of long-term storage and transportation. Makhijani Declaration, par. 4.13.

The NWTRB also commented on the lack of information about interactions between different degradation mechanisms as well as the possible effect of high burnup on those interactions:

These [degradation] mechanisms and their interactions are not well understood. New research suggests that the effects of hydrogen absorption and migration, hydride precipitation and reorientation, and delayed hydride cracking may degrade the fuel cladding over long periods at low temperatures, affecting its ductility, strength, and fracture toughness. *High-burnup fuels tend to swell and close the pellet-cladding gap, which increases the cladding stresses and can lead to creep and stress corrosion cracking of cladding in extended storage.* Fuel temperatures will decrease in extended storage, and cladding can become brittle at low temperatures.<sup>7</sup>

Makhijani Declaration, par. 4.14 (quoting NWTRB Report, p. 11, italics added). Hence, high burnup could possibly combine with other factors to create conditions that would result in severe, if not catastrophic, releases of radioactivity. This possibility must be studied. *Id.*

Besides the NRC staff's 2012 proposal, the NWTRB has also proposed an extended research program to address the problem of the lack of data. The NWTRB research and development recommendations include:

- Understanding the ultimate mechanical cladding behavior and fuel-cladding degradation mechanisms potentially active during extended dry storage, including those that will act on the materials introduced in the last few years for fabrication of high-burnup fuels
- Understanding and modeling the time-dependent conditions that affect aging and degradation processes, such as temperature profiles, in situ material stresses, quantity of residual water, and quantity of helium gas
- Modeling of age-related degradation of metal canisters, casks, and internal components during extended dry storage
- Inspection and monitoring of fuel and dry-storage systems to verify the actual conditions and degradation behavior over time, including techniques for ensuring the presence of helium cover gas
- Verification of the predicted mechanical performance of fuel after extended dry storage during cask and container handling, normal transportation operations, fuel removal from casks and containers, off-normal occurrences, and accident events
- Design and demonstration of dry-transfer fuel systems for removing fuel from casks and canisters following extended dry storage

Makhijani Declaration, par. 4.15.

Dr. Makhijani also points out that other institutions have also analyzed the critical data gaps regarding high burnup degradation and its implications for storage, transport and disposal. For instance, a 2012 paper published by the National Academy of Engineering noted the following:

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<sup>7</sup> NWTRB 2010, p. 11, italics added.

Based on its assessment, the study board concluded that the technical basis for the spent fuel currently being discharged (high utilization, burnup fuels) is not well established and that the possibility of degradation mechanisms, such as hydriding, will require more study. The NWTRB recommended periodic examinations of representative amounts of spent fuel to ensure that degradation mechanisms are not in evidence.

Makhijani Declaration, par. 4.16 (quoting Kadak 2012). Of equal concern as the serious data gaps identified by the National Academy of Engineering is the fact that as recently as 2012, neither the NRC nor the nuclear power industry had implemented the periodic examinations of spent fuel recommended by the NWTRB in 2010. *Id.*

Without this basic information, the NRC has an inadequate foundation for any predictive safety finding regarding the behavior of spent fuel in long-term storage conditions. And any EIS that is prepared to discuss these matters should acknowledge and analyze the considerable uncertainty that exists.

In his declaration, Dr. Makhijani lists a number of spent fuel degradation phenomena that could affect the safety of spent fuel during long-term storage. Safety parameters that could be compromised include confinement, criticality, retrievability, shielding, structural, and thermal. Makhijani Declaration, par. 4.18. Impacts of spent fuel degradation could be serious enough to result in environmental releases during spent fuel inter-cask transfer and could result in more severe impacts in cases of accidents. *Id.*

For instance, little is known about the extent to which microbiologically induced corrosion could corrode seals and/or the cask body that affect containment. Laboratory work and examination of spent fuel of different levels of burnup stored for long periods in spent fuel pools followed by long-term storage in dry casks is needed. Makhijani Declaration, par. 4.19. Other phenomena that may cause degradation include stress corrosion cracking, delayed hydride cracking, and low temperature creep. The NRC Draft Report on Technical Information Needs notes that “All three mechanisms depend on a source of stress that would come from pellet swelling. If the stress is not present, the mechanisms become benign. If operative, these mechanisms could increase the source term and increase cladding stress. The latter could affect containment, especially if other degradation processes have compromised the canister.” Makhijani Declaration (quoting Draft Report at 6-2).

In other words, the NRC does not know at present whether corrosion of seals or the canister body may occur to an extent that compromises containment. Damage to canisters could set the stage for severe releases either during inter-cask transfer or because the canister itself degrades. Makhijani Declaration, par. 4.20.

Dr. Makhijani also observes that high burnup fuels tend to build up much thicker levels of oxide during the in-reactor period as well as much higher levels of hydrogen in the cladding. Figure 2 of Dr. Makhijani’s declaration shows that the typical increase in outer oxide layer thickness increases from about 20 microns at 30 GWd/MTU to about 100 microns at about 62 or 63 GWd/MTU at discharge from the reactor. Moreover, the spread in the oxide layer thickness

increases with burnup, indicating that some fraction of fuel rods may be at a much greater risk of failure. Makhijani Declaration par. 4.21 (citing NWTRB 2010, Figure 20).

The NWTRB has issued the following caution about prolonged spent fuel pool storage:

Cladding may already have some small defects like tiny holes or hairline cracks, internal and external corrosion that has decreased the original metal wall-thickness, absorbed hydrogen, and hydride precipitation; however, it is very rare that new defects are detected while in the pool. Significant cladding defects can be detected during wet storage by monitoring stack off-gas for fission product gas leaks; if leaks are found, then assemblies are further inspected and breached fuel-rods are canned if necessary. Generally, a visual inspection is made of assemblies to identify fuel assemblies that may need to be classified as damaged and require special handling. If the cladding is functionally undamaged, there is an insignificant risk of expected fuel oxidation [at the time of transfer to dry storage]. Given undamaged cladding and the visible transfer of assemblies into and out of wet storage, the fuel-assembly containment criterion is deemed satisfied. Thus, during wet pool storage, used fuel is not expected to experience significant deterioration before dry storage. *If pool storage of fuel is continued for an extended period, it will be necessary to assess and evaluate the effects on intact or damaged fuel.*<sup>8</sup>

Makhijani Declaration, par. 4.23 (citing NWTRB 2010, p. 60). Although the DGEIS assumes that pool storage could continue for periods approaching 140 years (the first spent fuel discharged during 80 years of licensed operation, plus 60 years of post-operating license storage), it has not included any uncertainty analysis relating to impacts of damage that may occur in some fraction of the spent fuel during such prolonged storage. *Id.*

The NWTRB has identified hydriding, creep and stress corrosion cracking to be “[t]he most significant potential degradation mechanisms affecting the fuel cladding during extended storage.” Makhijani Declaration, par. 4.25 (quoting NWTRB 2010, p. 10). These phenomena can lead to “failed fuel” under certain conditions. Fuel failure occurs when there is a rupture in the fuel cladding, allowing fuel pellets direct contact with the environment around the fuel, the reactor coolant, spent fuel pool water, the canister environment, or the general environment during inter-cask transfer of failed fuel. If detected during cask loading, failed fuel is normally put in a “can,” which is a special sleeve, prior to loading into the cask. But if failure occurs after dry storage commences, some fuel pellets could be exposed to the environment during transfer. The NRC has refused to state how it would transfer failed spent fuel. It plans to figure it out when the problem arises. Makhijani Declaration, par. 4.24.

The DGEIS concludes that the phenomena leading to failed fuel (*i.e.*, hydriding, creep and stress corrosion cracking) are unlikely to cause significant problems in the “short-term.” DGEIS at B-13. With respect to long-term storage, the NRC claims to be ignorant of any studies “that would cause it to question the technical feasibility of continued safe storage of spent fuel in dry casks.”

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<sup>8</sup> NWTRB 2010, p. 60, italics in the original.

*Id.* But the Draft Study of Technical Needs admits that the level of knowledge regarding galvanic corrosion, stress corrosion cracking, low-temperature creep and propagation of existing flaws is “low”; and that knowledge of delayed hydride cracking is only “medium.” The NRC’s amnesia regarding its own study undermines the credibility and integrity of the DGEIS. Makhijani Declaration, par. 4.25.

Incredibly, the only explicit mention of failed fuel in the DGEIS is in the context of spent fuel pool leaks:

Impacts from spent fuel pool leakage occur from radionuclide contaminants present in spent fuel pool water. The sources of radionuclide contaminants in spent fuel pool water are activation products and fission products. Activation products are elements formed from the neutron bombardment of a stable element and fission products are elements formed as a byproduct of a nuclear reaction and radioactive decay of other fission products. *The sources of activation products are corrosion and wear deposits (including corrosion films on the fuel bundle surfaces).* Fission products come from bundles with rods that failed in-reactor or from intact bundles that adsorbed circulating fission products.<sup>9</sup>

DGEIS at E10 (emphasis added). The NRC’s limitation of its consideration of failed fuel to short-term storage conditions is grossly insufficient, given that the principal long-term risks are likely to arise after prolonged storage has resulted in serious fuel degradation of some fraction of the fuel rods, notably in the case of high burnup spent fuel. Makhijani Declaration, par. 4.26.

The NRC’s failure to address the effects of failed fuel on safety and environmental risk is all the more remarkable in the context of the NRC’s own admission that it does not yet know how it will transfer such failed spent fuel. The NRC has no experience in transferring failed fuel from one cask to another. By NRC’s own admission, it has not even developed the procedures to do so. Makhijani Declaration, par. 4.27.

The NRC also has no basis in data or experience in estimating how much additional damage could be done to failed fuel by transferring it between casks. This would apply even to damaged medium burnup fuel stored for short or moderate periods of time (up to two or three decades) in dry casks. It is *a fortiori* true of high burnup spent fuel that has been stored for many decades or even a few hundred years, given the considerations about such spent fuel discussed in the rest of this section. Makhijani Declaration, par. 4.28.

Indeed, in this context, Dr. Makhijani observes that no spent fuel bundle, damaged or not, has ever been transferred from one dry cask to another. Further, while the DGEIS postulates a Dry Transfer System for fuel inspection, repackaging and transfer, such a facility has never been built in the United States. The NRC even refuses to say how it would handle and repackage failed fuel. This makes the lack of discussion of the impacts of the transfer of failed spent fuel bundles even more problematic since the NRC lacks sufficient empirical basis for estimating the

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<sup>9</sup> DGEIS at E-10 (emphasis added).

probabilities and consequences of the spread of radioactivity during transfers in the normal case. Makhijani Declaration, par. 4.29.

In failing to address the issue of failed spent fuel inter-cask transfers, the NRC also has ignored the fact that failed spent fuel bundles are already stored in dry casks, but have never had to undergo inter-cask transfers. For instance, there are 95 failed spent fuel bundles stored in 15 dry casks at San Onofre Nuclear Generating Station alone. Makhijani Declaration, par. 4.30.

As discussed above, NWTRB has proposed an extended research program to address the lack of data regarding spent fuel characteristics. It is also important to have dry storage performance data on the newer cladding materials that have been developed to enable high fuel burnup, which is a relatively recent practice (since about the turn of the century). There are practically no such data. Indeed, even the research has been focused mainly on in-reactor behavior of high burnup fuels rather than on degradation during prolonged storage. Makhijani Declaration, par. 4.31.

Safety and environmental risks of storing other forms of spent fuel are ignored or tossed off with scant attention in the DGEIS. For instance, the U.S. is building a MOX plant to convert weapons grade plutonium into commercial reactor fuel. There is no significant experience with irradiation of such MOX fuel in a commercial reactor in the United States. Only lead test assemblies have been irradiated. Therefore there is essentially no experience with storage of commercial MOX spent fuel in the United States in wet or dry storage for any length of time. France, which has the most experience with MOX spent fuel, stores it in pools and has no dry storage. The DGEIS simply assumes away the problem of MOX spent fuel with the following statement:

Because the MOX fuel that would be generated at the Mixed Oxide Fuel Fabrication Facility is substantially similar to existing light water reactor fuel and is, in fact, intended for use in existing light water reactors in the United States, MOX fuel from this project is within the scope of this draft GEIS.<sup>10</sup>

Contrary to the claim in the DGEIS MOX fuel is decidedly *not* “substantially similar to existing light water reactor fuel.” In the former the fissile material is plutonium, which has different nuclear characteristics (a smaller delayed neutron fraction, for instance) than current low-enriched uranium reactor fuel. Even more importantly for the present purposes, the characteristics of the spent fuel will be different. For instance, uranium spent fuel from a PWR with initial 4.25 percent enrichment and burnup of 50 GWd per metric ton would have about 1 percent plutonium isotopes in it at discharge, including about half-a-percent plutonium-239. For the same burnup MOX fuel would typically have 8.46 percent total plutonium to start with. The spent fuel from a PWR would have about five times as much total plutonium, and about three-and-half-times as much plutonium-239. Makhijani Declaration, par. 4.32.

In the example provided (50 GWd per metric ton burnup in a PWR), the MOX spent fuel would have about six-and-half-times the amount of plutonium-241 as the uranium spent fuel. Plutonium-241 decays into americium-241 relatively rapidly with a half-life of just 14.4 years.

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<sup>10</sup> DGEIS at 2-8.

Americium-241 has a half-life of 432 years.<sup>11</sup> Unlike plutonium-239 and plutonium-241, americium-241 is a powerful gamma radiation emitter; it would pose special problems during spent fuel transfer, long after the main gamma-emitting fission product, cesium-137 (half-life about 30 years), would have decayed away. These problems associated with americium-241 gamma radiation dose would extend to post-accident recovery in case of release of radionuclides from the spent fuel. Makhijani Declaration, par. 4.33.

It stretches credulity that the NRC staff is not aware of these critical differences that would make a significant difference between impacts of MOX spent fuel and uranium spent fuel. In any case, the DGEIS assertion that there the two are substantially similar is wrong. A specific impact analysis is needed for MOX spent fuel. Makhijani Declaration, par. 4.34.

Similarly, the DGEIS pays little heed to the environmental impacts of extended storage of stainless steel fuel cladding. As Dr. Makhijani points out, stainless steel was used as fuel cladding early in the history of U.S. commercial reactors. By 1994, only one reactor had any stainless steel clad fuel in its core. By 1992, a total of 679 metric tons of spent fuel (uranium heavy metal content) had been generated from the stainless steel clad fuel. Further, the use of stainless steel cladding was discontinued partly because of in-reactor degradation of stainless steel cladding. For instance, the stainless steel cladding in the Connecticut Yankee reactor “experienced a number of fuel element failures” between 1977 and 1980, even though it had performed well in this regard prior to that time. The degradation characteristics of stainless steel fuel are different than zircaloy fuel and needed to be explicitly considered in the DGEIS. The DGEIS catalogs the amount of stainless steel spent fuel but does not discuss the failed fuel or its transfer from one dry cask to another. It does not discuss whether accidents involving such failed fuel would have more or less severe consequences than failed zircaloy-clad fuel. Makhijani Declaration, par. 4.35.

Thus, the DGEIS fails to provide an adequate technical basis for a reasonable assurance finding regarding the safety of long-term or indefinite spent fuel storage. Worse, the DGEIS ignores a wealth of studies concluding that much more study of spent fuel behavior is required before it is possible to reach informed conclusions about its behavior under extended storage conditions. Finally, the DGEIS ignores the safety and environmental risks posed by variations in spent fuel about which it has little knowledge. Not only has the NRC failed to obtain the information it needs to make a safety finding, but it has not even analyzed the uncertainty created by the lack of information.

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<sup>11</sup> Properties of radionuclides, including half-lives and dose conversion factors can be found in FGR 13 CD 2002.

**D. The Proposed Rule’s Determination That Spent Fuel Can Be Safely Stored in Pools for an Indefinite Period is Not Based on an Adequate Environmental Analysis of Spent Fuel Pool Leaks**

NRC’s analysis of spent fuel pool (“SFP”) leaks in the DGEIS violates NEPA. NEPA requires agencies to take a “hard look” at all reasonably foreseeable impacts of the proposed action. 42 U.S.C. 4332(2)(C); *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (quoting *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n. 21 (1976)); *see also* 40 C.F.R. §§ 1502.1, 1502.8 (agencies must include a “full and fair discussion” of direct, indirect, and cumulative environmental impacts). As the Court concluded in *New York v. NRC*, this means “[u]nder NEPA, an agency must look at both the probabilities of potentially harmful events and the consequences if those events come to pass.” 681 F.3d at 478-79 (citing *Carolina Env’tl. Study Grp. v. U.S.*, 510 F.2d 796, 799 (D.C. Cir. 1975)). Only if the probability of an environmental impact is so low as to be “remote and speculative,” can an agency avoid analyzing the impacts of an action. *Id.* (citing *City of New York v. Dep’t of Transp.*, 715 F.2d 732, 738 (2d Cir. 1983) (“The concept of overall risk incorporates the significance of possible adverse consequences discounted by the improbability of their occurrence.”)). Thus, the Court held that the NRC must evaluate both the probability and the consequences of environmental impacts resulting from SFP leaks before finalizing the Waste Confidence Decision.

In reaching this conclusion, the Court in *New York v. NRC* found NRC’s previous analysis of SFP leaks underlying the 2010 waste confidence decision lacking. The Court faulted the NRC for failing to “look *forward* to examine the effects of the additional time [spent fuel will be held] in storage [pools],” and failing to “examin[e] past leaks in a manner that would allow the Commission to rule out the possibility that those leaks were only harmless because of site-specific factors or even sheer luck.” 681 F.3d at 481. The Court went on to fault the NRC for relying on untested improvements to SFPs to conclude leak impacts would be insignificant and relying entirely on monitoring and compliance programs as a buffer against pool degradation. *Id.* The Court then reached the seemingly obvious conclusion, that “[a] study of the impact of thirty additional years of SNF storage must actually concern itself with the extra years of storage.” *Id.*

Regrettably, the NRC’s new SFP leaks analysis in the DGEIS suffers from the same flaws as the vacated 2010 waste confidence decision. Seemingly without regard to NEPA or the *New York v. NRC* Court’s decision, the NRC concludes SFP leaks will not have significant impacts without conducting the requisite analyses required by the remand and NEPA.

First, the NRC again fails to evaluate the relevance of past leaks to future risks, other than to say past leaks were not large enough to adversely impact public health. This is exactly the kind of backward-looking thinking the Court disapproved in *New York v. NRC*. As the Court unequivocally provided, “the harm of past leaks—without more—tells us very little about the potential for future leaks or the harm such leaks might portend.” *See id.*

Second, the NRC again inappropriately relies almost exclusively on compliance programs to support its scientific finding that significant impacts will not occur. *See* DGEIS at E-9, 4-26 (The NRC states that “stainless-steel liners and leakage-collection systems . . . and . . .

monitoring and surveillance of SFP water levels[,] make it unlikely that a leak will remain undetected long enough to exceed any regulatory requirement . . .” and further asserts that required groundwater monitoring provides an additional layer of protection.). As the Court warned the agency in *New York v. NRC*, “merely pointing to the compliance program is in no way sufficient to support a scientific finding that spent-fuel pools will not cause a significant environmental impact during the extended storage time.” *See* 681 F.3d at 481 (The NRC cannot merely assert that “leaks will not occur because the NRC is ‘on duty.’”).

Third, the NRC again fails to consider the impacts of additional storage time, as required by the Court. *See id.* (The NRC “must actually concern itself with the extra years of storage.”). This shortfall is even more concerning because the DGEIS contemplates indefinite storage – and not merely storage for an additional 30 years. The proposed rule also lacks any time limit for environmental and safety findings regarding pool storage of spent fuel.

The DGEIS also violates NEPA. It fails to consider many reasonably foreseeable impacts, including off-site impacts that do not exceed the NRC’s radiological exposure limits, on-site impacts, and certain social and economic factors including licensee longevity, property devaluations, and cleanup costs. It also fails to fully evaluate cumulative impacts. *See generally Robertson*, 490 U.S. at 350. In addition, the NRC conducts a generic analysis using bounding parameters that are not broad enough to cover a number of site-specific concerns. *See New York v. NRC*, 681 F.3d at 480-81 (NRC must conduct a “thorough and comprehensive” analysis using “conservative bounding parameters.”). And, it fails to consider impacts of storage of spent fuel in pools for longer than 60 years, although such storage is reasonably foreseeable and indeed contemplated by certain NRC regulations, including the proposed rule 10 C.F.R. § 51.23 (which has no time limit on extended storage) and existing rule 10 C.F.R. § 50.82 (which allows for decommissioning beyond 60 years under certain circumstances). *See Robertson*, 490 U.S. at 350; *see also Potomac Alliance*, 682 F.2d at 1035-36 (J. Bazelon, concurring) (noting that NRC may not simply ignore reasonably foreseeable possibilities).

For all these reasons, which are discussed more fully below and in the accompanying declaration of David Lochbaum (incorporated herein by reference), the analysis of SFP leak impacts in the DGEIS fails to satisfy NEPA.

- 1. The NRC’s SFP leaks impact analysis violates NEPA and the Court’s decision in *New York v. NRC* because it does not evaluate the relevance of past leak events to the probability and consequences of future leaks**

In its SFP leak impacts analysis, the NRC must “examin[e] past leaks in a manner that would allow the Commission to rule out the possibility that those leaks were only harmless because of site-specific factors or even sheer luck.” *New York v. NRC* 681 F.3d at 481. Without such an examination, the NRC cannot rely on “a finding that past leaks have been harmless [to reach] a conclusion that future leaks at all sites will be harmless as well.” *Id.* But this is exactly what the NRC attempts to do in its DGEIS – it provides a list of past leaks without meaningfully evaluating the circumstances surrounding leak detection or the leak impacts. And, the list is incomplete: the NRC fails to mention significant past SFP leaks at the Yankee Rowe nuclear

plant and Brookhaven National Laboratories (“BNL”) that grossly exceeded the U.S. Environmental Protection Agency (“EPA”) drinking water standard of 20,000 picocuries per liter (pCi/l) for tritium. Lochbaum Declaration, pars. 4.3-4.6, 4.7-4.17. The occurrence of these leaks not only undermines the NRC’s conclusion that past SFP leaks were “harmless,” but the fact that such large leaks progressed undetected for years undermines the NRC’s assurances that all future SFP leaks will be detected before causing harm, based on the assumption that existing regulatory requirements are sufficient to meet this goal. NEPA requires a more complete evaluation of the relevance of past leak events to the probability and consequences of future leaks.

**a. NRC’s analysis of past leaks in Tables E-4 and E-5 is incomplete**

As discussed above, the NRC must look at both the probability and consequences of SFP leaks. *New York v. NRC*, 681 F.3d at 478-79 (citing *Carolina Env’tl. Study Grp. v. U.S.*, 510 F.2d 796, 799 (D.C. Cir. 1975)). To do this, the NRC claims to have looked at past leaks to “establish a baseline for the analysis of future impacts and provide context to those impacts.” DGEIS at E-19. Information about the occurrence of past leaks is contained entirely within Table E-4 in the DGEIS, which lists 16 past leaks at 13 reactor sites. DGEIS at E-20. However, this table is incomplete, and fails to discuss the BNL and Yankee Rowe nuclear plant SFP leaks. Without assessing these leaks, the DGEIS underestimates the prevalence of past leaks and thus the likelihood of future leaks. *See* Lochbaum Declaration, par. 4.2. These omitted leaks have important implications (discussed below) and must be considered.

NRC also fails to discuss the actual probability of past leaks in its analysis of future leaks. NRC asserts that SFP leaks “seldom occur due to stringent design features and operational controls.” DGEIS at E-9. This is blatantly false. SFP leaks occur often, as demonstrated by NRC’s own chart acknowledging that at least 16 leaks have occurred at 13 reactor sites (out of approximately 100), and also by the above discussion of several leaks that NRC failed to consider. *See* DGEIS at E-20. Basic math tells us that more than 10-15% of SFPs in the United States have already leaked. And those are just the leaks that have been detected. As discussed in the following subsection it is clear that many leaks go undetected for long periods of time and as such, it is reasonably likely that additional leaks are occurring or have occurred at operating reactors that are currently unknown to the NRC.

**b. NRC does not discuss the circumstances and implications of past leaks**

Not only does the NRC fail to fully consider the probability of future SFP leaks as noted above, but the NRC also fails to properly assess the circumstances within which past leaks were detected, and the environmental and economic impacts of past SFP leaks (including those leaks listed in Table E-4, the BNL leak, and the Yankee Rowe leak). NEPA requires such consideration. *See New York v. NRC*, 681 F.3d at 478-79 (citing *Carolina Env’tl. Study Grp. v. U.S.*, 510 F.2d 796, 799 (D.C. Cir. 1975)). “Only if the harm in question is so ‘remote and speculative’ as to reduce the effective probability of its occurrence to zero may the agency dispense with the consequences portion of the analysis.” *New York v. NRC*, 681 F.3d at 482 (citing *Limerick Ecology Action, Inc. v. NRC*, 869 F.2d 719, 739 (3d Cir. 1989)).

As is more fully set forth in the accompanying Lochbaum Declaration, many past leaks directly refute the NRC's underlying conclusion in the DGEIS that leaks will be detected promptly and not cause significant harm. For example, the Yankee Rowe and Salem nuclear plant leaks demonstrate how a leak of over 100 gallons per day (gpd) can occur for long periods of time without detection. Lochbaum Declaration, pars. 4.3-4.7, 4.18-4.23. Each of these leaks caused harm. Lochbaum Declaration, pars. 4.3-4.7, 4.18-4.23 (at Yankee Rowe "approximately two million gallons of radioactively contaminated water leaked for perhaps as long as three years before [the leak] was detected," with nearby surface water having tritium concentrations of over 1,000,000 pCi/L) (the Salem leak leached into surrounding soil and groundwater below the reactor site, causing the need for a massive cleanup in which, so far, "over 28 million gallons of groundwater have been recovered and processed"). Leaks at BNL and Indian Point demonstrate that smaller leaks can likewise go undetected and contaminate the environment. Lochbaum Declaration, pars. 4.7-4.17, pars. 4.24-4.31 (the BNL leak went undetected for 12 years and contaminated groundwater, causing tritium levels between 2 and 32 times the federal drinking water standard) (at Indian Point, a leak went undetected, leaching into the soil and groundwater for about 2 years and resulting in exceedances of drinking water standards for tritium and strontium-90). The NRC failed to consider the consequences of these, or any other leaks listed in Table E-4, in its SFP leaks analysis.

Moreover, the NRC does not describe how the leakage was ultimately detected for any of the SFP leak events listed on Table E-4 in the DGEIS. Lochbaum Declaration, pars. 4.3-4.17. As noted in the Lochbaum Declaration, several of the SFP leaks (including Salem, BNL, and Indian Point) were detected by "sheer luck." Lochbaum Declaration, pars. 4.7-4.17, 4.18-4.23, 4.24-4.31 (at Salem, because of a clog in the leak detection system, a 100 gpd leak went undetected until water from the leak seeped through concrete and formed a puddle on the floor of an adjacent building at the reactor site) (at BNL, despite discovering contamination in the groundwater in the 1980s, a SFP leak was not detected in four inspections or through water level monitoring for 12 years; eventually, during a fifth test in 1997, the leak was discovered) (at Indian Point, a SFP leak that started in the 1990s went undetected for years until it was discovered during the investigation of a subsequent leak in 2005; the 2005 leak was only discovered when workers noticed moisture forming on a concrete wall during construction related excavation).

Before concluding that future leaks will not cause significant environmental impacts, the NRC was required to consider the impacts of past leaks and describe how past leaks were detected. It failed to do so. And, because of that failure it could not then assess whether past detection methods can ensure that future leaks will likewise be detected. In fact, as described above, many past leaks were discovered literally by accident, or due to random occurrences that were entirely unconnected to NRC regulatory requirements and controls in place at the time. Common sense dictates that the thorough, careful analysis of past leaks required by NEPA must necessarily examine how the past leaks were detected, in order to determine whether existing and future controls are sufficient. Because the NRC cannot reasonably rely on luck, NEPA requires it to analyze impacts of future leaks that go undetected. Without such an analysis, the DGEIS violates NEPA and the Court's order in *New York v. NRC*.

**2. The NRC’s SFP leak impacts analysis violates NEPA and the Court’s decision in *New York v. NRC* because it inappropriately relies almost entirely on compliance programs to support its scientific finding that significant impacts will not occur**

In the DGEIS, the NRC concludes that leaks will be prevented and detected before causing significant impacts. DGEIS at xxxvii, 4-26, E-9–10, E-15–16. To reach this conclusion, (a) the NRC claims that all leaks of greater than 100 gallons per day will be promptly detected, and (b) the NRC relies on inapplicable leak detection regulations, voluntary programs, and programs that are substantially reduced in scope after reactors shut down.

NRC cannot, without more, simply assert that “leaks will not occur because the NRC is ‘on duty.’” *New York v. NRC*, 681 F.3d at 481. Relying almost entirely on monitoring and regulatory compliance programs, many of which are inapplicable once a reactor shuts down, to conclude that future leaks will be detected before causing significant impacts is not sufficient. *See id.* (Despite NRC’s enforcement and inspection efforts, “merely pointing to the compliance program is in no way sufficient to support a scientific finding that SFPs will not cause a significant environment[al] impact during the extended storage period.” This is especially true when the NRC’s predictions span nearly a century at certain facilities.). NEPA requires the NRC to consider the reasonably foreseeable impacts that could result if these monitoring and regulatory compliance programs fail to detect a significant leak.

**a. The NRC fails to explain the importance and usefulness of its 100 gallon per day leak detection threshold**

In the DGEIS, the NRC claims that leaks equal to or greater than the average evaporation rate, 100 gallons per day (gpd), will be promptly detected—100 gpd is the average SFP evaporation rate. DGEIS at E-10 (According to the DGEIS, “[t]o go undetected, a leak would need to be less than the fluctuations in water level of a SFP lost to evaporation.”). This assumption, however, is simply not true. As noted above in Section VI.D.1.B, leaks great than 100 gpd have gone undetected by monitoring systems in the past for long periods of time (e.g., the Yankee Rowe leak, which went undetected for somewhere between 1 and 3 years, and released 2 million gallons of contaminated SFP water; the Salem leak which went undetected for a long period of time due to a clog in the telltale drain of the leak detection system). Lochbaum Declaration, pars. 4.4-4.5, 4.21. And, the NRC did not even evaluate leaks less than 100 gpd. As described above, past leaks of less than 100 gpd have also gone undetected for long periods of time (e.g., the Indian Point leaks went undetected for long periods of time, including one for over 2 years in the 1990s; the BNL leak went undetected for 12 years despite abnormally high tritium levels in the groundwater and repeated SFP tests). Lochbaum Declaration, pars. 4.17, 4.25.

The NRC’s claim that it is on duty and that it will promptly detect leaks of over 100 gpd and that lesser leaks will not cause significant impacts is unsupported. Because past leaks have occurred both above and below the threshold, it is reasonably foreseeable that similar leaks could occur in the future. NEPA requires the NRC to analyze the impacts of such future leaks in its DGEIS.

**b. The NRC improperly relies on inapplicable regulations, voluntary programs, and programs that are greatly reduced in scope after reactors shut down**

In concluding that all leaks will be detected before causing significant impacts, the NRC repeatedly relies on inapplicable and voluntary compliance and monitoring programs. *See* Lochbaum Declaration at Sections VI and VII.

For example, the NRC claims SFP water levels are being “constantly measured by instrumentation.” DGEIS at E-10. This is false. Water level instrumentation is not required to be in pools at all times; rather, it is required only during the short time when spent fuel is being moved. Lochbaum Declaration, par. 6.19. The NRC also claims that licensees are required to perform groundwater monitoring at reactor sites for support of its conclusion that leaks are unlikely to migrate off site. DGEIS at E-10. This is also false. The NRC has no general groundwater monitoring requirements, either for operating reactors or decommissioning reactors. Lochbaum Declaration, par. 6.40. To support its claim, the NRC relies on the Decommissioning Planning Rule (DGEIS at E-5, E-8); however, that rule allows licensees to choose whether or not to conduct groundwater monitoring. Lochbaum Declaration, Section VI.D, par. 6.41. And the NRC relies on the Groundwater Protection Initiative as support for its conclusions about SFP leaks. DGEIS at E-6. Unfortunately, the Groundwater Protection Initiative is voluntary and as such, cannot be relied upon to ensure future leaks will be promptly detected. Lochbaum Declaration, pars. 6.42-6.44 (noting further that this voluntary program has only been audited at operating reactors, never at shutdown reactors). Further, there is no requirement that licensees analyze a postulated leak of any magnitude of contaminated water from a SFP, even though that type of NRC requirement exists in other contexts (e.g., during the licensing process for the liquid waste management system).<sup>12</sup> Lochbaum Declaration, pars. 6.25-6.30. Because these programs are voluntary or inapplicable, NRC has no basis for relying on them to conclude that leaks will be detected before causing significant impacts.

In support of its conclusion, NRC also assumes that current monitoring requirements, oversight procedures, and other programs will remain effective after reactors shut down. DGEIS at 1-15, 1-17, E-4. This assumption is unsound because the scope of many of these requirements, procedures, and programs will be greatly reduced. Lochbaum Declaration, par. 7.2. For example, shut down reactor licensees do not receive important safety communications and enforcement orders that are issued to operating reactor licensees. Lochbaum Declaration, Pars. 7.3-7.10 (e.g., after the March 2011 Fukushima disaster in Japan, an order requiring installation of monitoring equipment at SFPs was sent to reactor licensees, but no record of the order exists for the shutdown Zion nuclear power reactors). Similarly, NRC relies upon the Maintenance Rule to ensure leak detection. DGEIS at E-5. However, it is greatly reduced in scope after reactors shut down. Lochbaum Declaration, pars. 7.20-7.21 (Under the Maintenance Rule, “licensees can and do legally omit structures, systems, and components needed to detect and

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<sup>12</sup> Not only should the NRC have included a postulated leak analysis, it should have quantified that analysis. The NRC must conduct a quantitative analysis to the extent practicable. *See* 10 C.F.R. § 51.71(d). A discussion of how a quantitative analysis could have been conducted can be found in the Lochbaum Declaration, pars. 6.32 to 6.34.

mitigate SFP leaks . . . from the scope of their maintenance programs.”). NRC also relies on its aging management program to ensure SFPs remain structurally sound during storage. DGEIS at E-5. However, that program, like so many others, is reduced in scope after reactors shut down. Lochbaum Declaration, pars. 7.37-7.43 (explaining that aging management is only required during the period of extended operation, not throughout the entire 60-year storage period). The NRC’s analysis fails to evaluate how this reduction in aging management protects against the bathtub curve effect—demonstrating an increase in failure rate over time. Lochbaum Declaration, par. 7.42.

In conducting a sufficient NEPA analysis, the NRC should have analyzed examples of shut down reactors and the regulatory scheme that applies to them. For example, the Zion and Dresden Unit 1 nuclear plants are shut down and have greatly reduced regulatory programs. Lochbaum Declaration, pars. 7.22-7.36 (At the shutdown Zion nuclear plant, works or inspectors “seeking to ascertain whether ‘spent fuel in a safe condition’ is reasonably assured . . . need only evaluate whether protections against a fuel handling accident and a significant reduction in SFP water inventory are adequate.”) (At the shutdown Dresden reactor the licensee turned off the SFP cooling and cleanup system in 1983 and the owner had no leak detection program or water level inventory program.).

The NRC’s claims that leaks will be detected before significant impacts are caused because it is “on duty” not only violate NEPA and the Court’s decision, but they are also untrue. The NRC should have conducted an analysis that discussed regulations and programs that are in place throughout the storage period. And, the NRC should have analyzed the impacts of SFP leaks should these limited regulations and programs not result in prompt leak detection.

**3. NRC’s SFP leaks impact analysis violates NEPA and the Court’s decision in *New York v. NRC* because it fails to meaningfully consider the impacts of additional storage time**

“[A] proper analysis of the risks [of SFP leaks] would necessarily look forward to examine the effects of the additional time in storage . . .” because the “WCD . . . seeks to extend the period of time for which pools are considered safe for storage.” *New York v. NRC*, 681 F.3d at 481. In vacating the 2010 waste confidence decision, the court held that “[a] study of the impact of thirty additional years of SNF storage must actually concern itself with the extra years of storage.” *Id.* An analysis of the extra storage time is especially relevant, “when the period of time covered by the Commission’s predictions may extend to nearly a century for some facilities.” *Id.* In the proposed rule 10 C.F.R. § 51.23, there is no delineated time frame for storage (“it is feasible to safely store spent nuclear fuel following the licensed life for operation of a reactor”), and as such, it could be indefinite. Regardless of whether NRC claims fuel will only be in pools for 60 years or indefinitely, NRC has not considered the impacts of the additional time in pool storage.

While implementation of aging management programs is required by the NRC during a facility’s operating life, and period of extended operation, there is no such requirement during the 60 year post –shutdown period, or beyond. Lochbaum Declaration, pars. 7.37-7.43. As a result, further aging degradation in the absence of such programs will eventually cause an increase in the

failure rate of certain plant structures or systems, including SFPs, based on the use of the “bathtub curve.” See Lochbaum Declaration, pars. 7.37, 7.42. The NRC’s SFP leaks analysis fails to explain the increase in failure rate or provide support for its conclusion that extra time in storage will not cause significant impacts if and when future leaks occur. As such, it flies in the face of NEPA and the Court’s decision.

**4. NRC’s analysis violates NEPA because it fails to consider certain reasonably foreseeable significant impacts altogether**

As discussed at the outset of this Section, the NRC must take a “hard look” at all reasonably foreseeable impacts of the proposed action. 42 U.S.C. 4332(2)(C); *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (quoting *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n. 21 (1976)). Further, as the *New York v. NRC* Court noted, this goes beyond merely looking at human health impacts. 681 F.3d at 481 (noting that “near-term health effects are not the only type of environmental impacts”). NRC’s analysis violates NEPA because it fails to evaluate certain significant impacts altogether and fails to fully consider cumulative impacts related to SFP leaks.

As explained in greater detail in the Lochbaum Declaration, the NRC fails to evaluate offsite impacts from leaks when the contamination does not exceed federal radiological standards, onsite leak impacts, and social and economic impacts related to property devaluation and licensee longevity. See generally Lochbaum Declaration, Section VIII. For example, in the DGEIS, the NRC considers radiological impacts “small” if releases do not exceed standards in NRC’s regulations. DGEIS at 4-64, E-18. However, significant environmental impacts can and do occur even with contamination below NRC’s radiological standards. See Lochbaum Declaration, pars. 8.2-8.7 (explaining that while the contamination from the Salem nuclear plant SFP leak has not violated federal standards for drinking water, it resulted in a sizable cleanup cost; and noting an effluent pipe leak at Braidwood nuclear plant in Illinois had significant consequences even though it did not exceed offsite radiological standards—e.g., bottled water was provided to about 420 homeowners and the licensee purchased contaminated property and reimbursed some 14 property owners for devaluations from the leak). The NRC also excludes any analysis of onsite impacts from SFP leaks. DGEIS at E-8 (asserting that onsite impacts are outside the scope of the DGEIS). But significant impacts, such as costly cleanups, could occur onsite for SFP leaks, and should be analyzed in the DGEIS. Lochbaum Declaration, pars. 8.2-8.7 (e.g., an underground pipe leak at New Jersey’s Oyster Creek nuclear plant cost millions of dollars to cleanup even though it remained onsite).

SFP leaks, and the extensive cleanups associated with them, also may cause property devaluation. See Lochbaum Declaration, pars. 8.6, 8.9 (noting that a pipe leak at Braidwood caused property devaluation for at least 15 property owners and the licensee either purchased the contaminated property outright or reimbursed landowners for their losses). The NRC fails to consider this impact. And, it also fails to consider the likelihood of increased impacts that will occur over time. From a socioeconomic perspective, given the typical lifespan of a corporation, an owner no longer receiving revenue from a permanently retired nuclear plant may not survive for six decades to clean up the leaks from its SFPs. Lochbaum Declaration, par. 8.10.

NRC's narrow framework for assessing SFP leak impacts has resulted in an "analysis" which fails to adequately consider other relevant environmental impacts as well. Particularly, NRC's consideration of the impacts posed by SFP leaks on surface water resources is severely wanting and inadequate under NEPA as well as the court's decision. NRC acknowledges that SFP leaks can discharge to offsite surface waters, but then indicates that "dilution ensures that radionuclides" would be "diluted well below EPA safe drinking-water limits." DGEIS at E-17. This limited focus on drinking water-related impacts boils down to a consideration from a public health aspect, and ignores other relevant potential environmental impacts to surface waters, namely impacts to aquatic ecology. Importantly, NRC's restricted consideration of impacts to surface waters is precisely what was deemed by the Circuit Court as insufficient. 681 F.3d at 481. Yet, the DGEIS contains no meaningful analysis of how SFP leaks may impact nearby aquatic habitats and organisms.<sup>13</sup>

NRC must fully analyze the extent to which SFP leaks may contaminate surface waters and the foreseeable impact of such contamination on the aquatic ecology of such waters. Such an assessment cannot be limited to NRC dose calculation methodology, but rather must focus more broadly on impacts to aquatic organisms, with regard for other Federal, State, and/or local standards and requirements. The DGEIS must consider the length of time surface waters will be contaminated by, and thus, aquatic ecology exposed to, radiological contamination (with due consideration for the fact that SFP leaks may admittedly occur for long periods of time undetected) and the various ways in which different radionuclides have the potential to bioaccumulate in the environment, e.g. in river sediments, sub-aquatic vegetation, shellfish, and finfish. NRC must determine the extent to which aquatic organisms may be impacted over long-periods of time. An evaluation of the impacts of bioaccumulation and long-term exposure to low levels of radioactivity should be conducted by the NRC. NRC should focus attention on long-term exposure impacts to varying fish populations, as well as impacts to individuals within populations. NRC should not assume that a lack of impacts to date (at plants where SFP leaks have already contaminated surface waters) means that no future impacts will occur. *See New York v. NRC*, 681 F.3d at 481. Rather, NRC must fully evaluate the foreseeable future impacts to aquatic organisms that may occur as a result of SFP leaks. In addition, an assessment of the foreseeable impacts of SFP leaks on surface waters must also consider the potential for such leaks to interfere with recreational enjoyment of such waters (such as swimming, fishing, boating, etc.), with regard to the fact that such waters may be legally designated as suitable for such purposes by State agencies.

Moreover, NRC's assessment of the impacts of SFP leaks on public health is likewise improperly narrow. That is, NRC focuses only on whether releases would "exceed permissible levels set by the NRC and the EPA." DGEIS at E-18. However, it is appropriate and necessary under NEPA to assess all *foreseeable* impacts, and not to only focus on certain narrow standards. Thus, given the court's directive to NRC to assess potential future harm to the public and "the effect of the *additional* time in [pool] storage," (*New York*, 681 F.3d at 481 (emphasis added)),

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<sup>13</sup> In fact, despite the fact that one of the purported focuses of the DGEIS is SFP leaks, the NRC's only consideration of impacts to aquatic ecology focuses on cooling water intake structure impacts, with no meaningful discussion of impacts of radioactive waste storage on such resources. *See* DGEIS at § 4.10, at pages 4-35-4-41.

NRC's DGEIS must include a comprehensive evaluation of the risks to public health posed by potential future SFP leaks and long-term exposure to such leaks, and in this regard, NRC should examine the long-term impacts from low-level exposure to SFP leaks in light of the conclusion of the Biological Effects of Ionizing Radiation VII report that every exposure to radiation, regardless of how small, and no matter what pathway, produces a corresponding increase in the likelihood of cancer.<sup>14</sup>

Further, the NRC fails to fully evaluate cumulative impacts in its DGEIS. The Court of Appeals explained that "a proper analysis of the risks [of SFP leaks] would necessarily look *forward* to examine the effects of the additional time in storage, *as well as examining past leaks.*" *New York*, 681 F.3d at 481 (first emphasis in original; second emphasis added). Under NEPA, the NRC must consider the "impact on the environment that results from the incremental impact of [its] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-federal) or person undertakes such other actions." 40 C.F.R. § 1508.7; *see also* 10 C.F.R. § 51.45(c); *see also* 10 C.F.R. § 51.75, 10 C.F.R. § 51.45. This is because cumulative impacts "can result from individually minor but collectively significant actions taking place over a period of time." *See* 40 C.F.R. § 1508.7. As numerous courts have explained, a meaningful cumulative impact assessment must therefore identify (1) the affected area, (2) the expected impacts of the project, (3) other past, present, proposed, and reasonably foreseeable actions that are expected to have impacts in the same area, (4) the impacts or expected impacts from such other actions, and (5) the overall expected impact in light of the accumulation of the individual impacts. *See Grand Canyon Trust v. FAA*, 290 F.3d 339, 345-46 (D.C. Cir. 2002). In other words, the agency "cannot treat the identified environmental concern in a vacuum." *Id.* at 346.

However, NRC has demonstrably failed to fully assess cumulative impacts in relation to SFP leaks. To begin with, the NRC does not consider impacts from multiple SFP leaks in close proximity (e.g., sites such as Turkey Point where there are multiple SFPs) or impacts from combined contamination of groundwater in areas where other waste sites are nearby (e.g., Plant Vogtle is located just across the Savannah River from the Savannah River Site, which contains a large amount of nuclear waste).

In addition, NRC has failed to analyze the cumulative impacts that may result from past, present, and reasonably foreseeable future radiological leaks from *non*-SFP systems, structures, and components. It can logically be expected that future (and/or existing) leaks and contamination from SFPs will interact with and cause cumulative impacts with any past, current, and likely future leaks from other, non-SFP components. As one NRC licensing board has aptly explained, "if releases from SFP leaks encounter groundwater, then the radionuclides would co-mingle and coalesce with any impacts that might be present from other sources" and "it is unlikely" that "concentration levels" in groundwater "can be parsed into relative contributions from the separate sources that contribute to the overall groundwater contamination at the site, and that

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<sup>14</sup> National Research Council, *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2* (2006), *available at*, [https://download.nap.edu/catalog.php?record\\_id=11340](https://download.nap.edu/catalog.php?record_id=11340) (finding that the risk of cancer is linear with dose and that there is no level of exposure below which there is no proportional risk).

“[b]y necessity”, “the impacts to groundwater from SFP leaks and the subsequent discharges into” adjacent surface waters must be considered “on a site-wide basis.” In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3), Docket Nos. 50-0247-LR and 50-286-LR, ASLBP No. 07-858-03-LR-BD01, Order (Granting in Part and Denying in Part Applicant’s Motions *in Limine*) (March 6, 2012), at 29, ADAMS Accession No. ML12066A170. Thus, such cumulative radiological leakage impacts must be fully assessed in NRC’s DGEIS.

Non-SFP leaking plant components at facilities around the country have already contaminated on-site and off-site groundwater and public waterways.<sup>15</sup> As of June 2011, NRC reported that 42 of 65 reactor sites, i.e., 65%, have experienced problems with radiological leaks.<sup>16</sup> The trend of accidental radiological leaking can be expected to continue and even increase as America’s original nuclear fleet continues to age. Indeed, the basic engineering principle of the “bathtub” curve (*see* Lochbaum Declaration, pars. 7.37-7.43) indicates that as these aging nuclear plants reach the end of their operating lives, problems, such as component degradation and resulting leaks, can be expected to sharply increase. Historically, U.S. nuclear power plants have had leakage problems with difficult to inspect buried pipes and components. The United States Government Accountability Office (“GAO”) conducted a study that concluded in 2011 that, “[t]he occurrence of leaks at nuclear power plants from underground piping systems is *expected to continue* as nuclear power plants age and their piping systems corrode.”<sup>17</sup> GAO confirmed that because “underground piping systems tend to corrode” and are “largely inaccessible and difficult to inspect,” the “*severity of leaks could increase* without mitigating actions.”<sup>18</sup> Plant owners’ aging management programs and more recent industry initiatives that allegedly are designed to “handle” leaks from the miles and miles of buried and inaccessible buried components fall far short of providing the necessary assurances the radiological leaks will be properly detected and prevented in the future.<sup>19</sup> The NRC must consider and account for this in

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<sup>15</sup> *See generally* Liquid Radioactive Release Lessons Learned Task Force Final Report, September 1, 2006, *available at*, ADAMS Accession No. ML062650312 ; *see also* Riverkeeper and Hudson River Sloop Clearwater Initial Statement of Position Regarding Consolidated Contention RK-EC-3/CW-EC-1 (Spent Fuel Pool Leaks) (December 22, 2011), at 41-43, *available at* ADAMS Accession No. ML12335A617 (describing various non-SFP component leaks that have occurred at Indian Point).

<sup>16</sup> *See* Leaks and Spills of Tritium at U.S. Commercial Nuclear Power Plants, Rev 9 (June 7, 2012), ADAMS Accession No. ML101270439; *see also* Union of Concerned Scientists, *Groundwater Events Sorted by Date*, September 27, 2010, *available at*, [http://www.ucsusa.org/assets/documents/nuclear\\_power/Groundwater-Events-Sorted-by-Date.pdf](http://www.ucsusa.org/assets/documents/nuclear_power/Groundwater-Events-Sorted-by-Date.pdf); Jeff Donn, Radioactive tritium leaks found at 48 US nuke sites (June 21, 2011), *available at*, [http://www.msnbc.msn.com/id/43475479/ns/us\\_news-environment/t/radioactive-tritium-leaks-found-us-nuke-sites/](http://www.msnbc.msn.com/id/43475479/ns/us_news-environment/t/radioactive-tritium-leaks-found-us-nuke-sites/) (last visited Dec. 13, 2012).

<sup>17</sup> Liquid Radioactive Release Lessons Learned Task Force Final Report, September 1, 2006, at 22 *available at*, ADAMS Accession No. ML062650312 (emphasis added).

<sup>18</sup> *Id.* at 1.

<sup>19</sup> Plant programs and industry initiatives are simply not designed to identify or stop *all* potential radiological leaks; alleged “enhanced” inspection commitments still only cover a small fraction of total amounts of onsite buried piping. *See, e.g.*, In the Matter of Entergy Nuclear Operations,

its DGEIS. In addition, accidental spills and releases caused by human error have also resulted in releases of radioactivity to the environment at nuclear power plants.<sup>20</sup> Such incidents will likely continue to occur, and NRC must consider cumulative impacts that may result from such accidental spills and releases.

It is reasonably foreseeable that non-SFP components will continue to contaminate the environment around U.S. nuclear power plants prior to as well as during post-operation timeframes, and it is patent that such other radiological leaks may affect the nature and impact of any future SFP leak, i.e., result in cumulative impacts. NRC must fully analyze such cumulative impacts.

Because the NRC's analysis fails to consider several reasonably foreseeable impacts, it directly violates NEPA.

**5. NRC's analysis violates NEPA because it fails to consider relevant measures to mitigate adverse environmental consequences of SFP leaks**

NEPA mandates that in undertaking environmental reviews, agencies must "discuss the extent to which adverse effects can be avoided" so that "the agency [and] other interested groups and individuals can properly evaluate the severity of the adverse effects." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989) (citations omitted).<sup>21</sup> Without such a

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Inc. (Indian Point Nuclear Generating Units 2 and 3), ASLBP # 07-858-03-LR-BD01, Docket # 05000247, 05000286, Exhibit # NYS000164-00-BD01, Pre-Filed Written Testimony of Dr. David J. Duquette, Ph.D Regarding Contention NYS-5, ADAMS Accession No. ML12334A699 (explaining deficiencies in the "aging management program" at Indian Point for preventing and detecting corrosion of buried pipes and components).

<sup>20</sup> Liquid Radioactive Release Lessons Learned Task Force Final Report, September 1, 2006, at 34, *available at*, ADAMS Accession No. ML062650312; Riverkeeper and Hudson River Sloop Clearwater Initial Statement of Position Regarding Consolidated Contention RK-EC-3/CW-EC-1 (Spent Fuel Pool Leaks) (December 22, 2011) at 42, 53, *available at* ADAMS Accession No. ML12335A617; GZA, GeoEnvironmental, Inc. Final IPEC Quarterly Long-Term Groundwater Monitoring Report, Quarter Two 2010 (Report No. 10) (February 15, 2011), IPEC00227561, at p.1-2, ADAMS Accession No. ML12275A555 (hereinafter "GZA IPEC Quarter 2 Groundwater Report") (Entergy's vendor describing a spill from a Reactor Waste Storage Tank ("RWST"), that resulted in a marked increase in the tritium plume present at the Indian Point site that Entergy attributes to the Unit 2 SFP leaks; this spill resulted in an increase in radionuclide levels in the groundwater that lasted for many months).

<sup>21</sup> *See also id.* ("One important ingredient of an EIS is the discussion of steps that can be taken to mitigate adverse environmental consequences. . . Implicit in NEPA's demand that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided should the proposal be implemented,' is an understanding that the EIS will discuss the extent to which adverse effects can be avoided. More generally, omission of a reasonably complete discussion of possible mitigation measures would undermine the 'action forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups and

discussion, it is patent that the agency has failed to take the requisite “hard look” at the environmental consequences of a proposed action. *See id.* Regulations implementing NEPA are likewise instructive. In particular, federal regulations require that reviewing agencies consider and assess mitigation measures in an EIS. 40 C.F.R. § 1508.25(b)(3); *see also* 10 CFR Part 51, Subpart A, App. A (“appropriate mitigating measures of the alternatives will be discussed”). These regulations define mitigation as:

- (a) Avoiding the impact altogether by not taking a certain action or parts of an action.
- (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- (e) Compensating for the impact by replacing or providing substitute resources or environments.

40 C.F.R. § 1508.20; *see also* 10 C.F.R. § 51.71 (requiring consideration of “alternatives available for reducing or avoiding adverse environmental effects”).

Yet, the DGEIS fails to include an assessment of all relevant measures that may mitigate adverse environmental consequences of future SFP leaks and any contamination of the environment resulting therefrom. Various feasible measures are available that could avoid, minimize, rectify, reduce, or eliminate the environmental impacts of future radiological SFP leaks and contamination associated with such leaks. The EIS should include an assessment of the feasibility and efficacy of all reasonable measures to mitigate the impacts of future SFP leaks on the environment, including, but not limited to, the following:

- *Immediate clean-up activities associated with groundwater contamination resulting from SFP leakage.* NRC must fully consider the degree and extent to which immediate clean-up activities may reduce environmental impacts of future SFP leakage. In particular, NRC must assess the feasibility and efficacy of extracting (via extraction wells) any contaminated groundwater, treating and/or excavating any contaminated soil, and any other remedial clean-up measures that could address contamination resulting from future SFP leaks. For example, NRC must analyze the degree to which groundwater extraction may prevent the migration of radiological contamination into adjacent surface waters and thereby avoid impacts to aquatic ecologies. Notably, NRC should not simply accept, or draw conclusions based upon, activities licensees may have

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individuals can properly evaluate the severity of the adverse effects. . . . Recognizing the importance of such a discussion in guaranteeing that the agency has taken a ‘hard look’ at the environmental consequences of proposed federal action, CEQ regulations require that the agency discuss possible mitigation measures in defining the scope of the EIS, in discussing alternatives to the proposed action, and consequences of that action, and in explaining its ultimate decision.”)

(or have not) already taken in response to previous radiological leakage and groundwater contamination circumstances. Instead, NRC should evaluate the efficacy of groundwater extraction, soil remediation, and other clean-up measures on an independent basis.

- Mandatory comprehensive groundwater monitoring. NRC must assess the efficacy of *mandatory* groundwater monitoring for minimizing the environmental harm of any future SFP leaks. NRC currently has no plans to impose any such mandatory requirements, but instead continues to rely on a purely voluntary industry program.<sup>22</sup> The benefits of mandatory monitoring are patent. Mandatory, as opposed to voluntary, monitoring can potentially assist in minimizing the impacts of potential future SFP leaks, and, therefore, must be fully considered in the DGEIS.
- Preventative measures to proactively find SFP leaks before they occur and potentially cause measureable environmental impacts. The degree to which licensees are currently committed to, or will be required to, inspect SFPs is suspect. See Lochbaum Declaration at Paragraphs 6.38-6.44, 7.13-7.25, 7.33-7.35, 9.6. NRC must assess the feasibility and efficacy of mandatory regular inspections of SFPs during the post-operation pool storage timeframes. NRC should consider the practicality and usefulness of physical/mechanical inspections of SFP liners, walls, floors, transfer canals, and other portions, at recurring frequencies. To the extent spent fuel is too densely packed to allow for full inspection, NRC must assess the feasibility and efficacy of reducing the density of pools to allow for such full inspections.
- Measures to prevent initiation or exacerbation of future SFP leaks. NRC should analyze the feasibility and efficacy of measures that could be undertaken to enhance the integrity or robustness of SFP structures and prevent the initiation or exacerbation of SFP leaks. NRC should consider newer technologies, materials, or “upgrades” that may minimize the potential for SFP leaks and environmental contamination as a result thereof. For example, NRC should consider whether existing SFPs have “tell-tale” drain collection systems that prevent environmental harm, and, to the extent SFPs do not have such systems, the efficacy of retrofitting SFPs with such systems. NRC should also consider the impacts of new seismological information on the integrity of SFPs in the event of earthquakes in the future and available “upgrades” to account for such circumstances.
- Preventative measures to proactively prevent future leaks from leaking non-SFP components. NRC must assess the steps that it could take to prevent or reduce future leaks from non-SFP components (e.g., other plant systems, structures, and components such as buried pipes), which, if not addressed are likely to result in cumulative environmental impacts in conjunction with future SFP leaks. NRC should also consider all reasonable measures that licensees could take to reduce or minimize the likelihood of future component leaks and impacts to groundwater, such as the feasibility and efficacy

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<sup>22</sup> SECY-11-0019, Policy Issue, Senior Management Review of Overall Regulatory Approach to Groundwater Protection, (February 9, 2011), available at, <http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2011/2011-0019scy.pdf>, at 3-4.

of moving buried pipes and structures above-ground so as to be able to better monitor such components, and substantially increasing the number of inspections of components that are known to be prone to leakage.

- Measures to mitigate impacts to aquatic ecologies in adjacent affected waterways. NRC must give due consideration to the fact that aquatic ecosystems may be exposed to contamination from SFP leaks for centuries. Even low levels of any such contamination may result in impacts over time. Therefore, NRC must fully assess all measures that will minimize environmental harm to aquatic ecologies resulting from radiological SFP leaks. This includes, but is not limited to, an assessment of the feasibility and efficacy of enhanced/robust environmental monitoring of the impacts of future SFP leaks to these ecosystems. NRC cannot simply assume that existing NRC radiological effluent and environmental monitoring programs are adequate to capture all environmental impacts that may occur as a result of future SFP leaks. NRC should consider the degree to which enhanced programs will be able to more accurately detect any impacts, and, therefore assist in minimizing environmental harm. NRC should consider a wide portfolio of monitoring measures that licensees may not currently undertake, including, but certainly not limited to, the analysis of fish bone and shellfish shells in order to monitor for certain “bone seeking” radionuclides such as strontium-90, the sampling of benthic organisms, sampling at additional control locations, sampling of specific species as opposed to only opportunistic sampling, sampling more frequently, and sampling of additional analyses to ensure detection of particular radionuclides.

- Measures to increase public access to information concerning future SFP leaks and groundwater contamination that occurs as a result. NRC must fully analyze the extent to which more openness and transparency regarding SFP leaks and groundwater contamination will reduce environmental impacts. That is, an assessment of the significance of an environmental impact includes the degree to which it is highly controversial. 40 C.F.R. § 1508.27(b). To the extent SFP leaks may be considered controversial,<sup>23</sup> they are “significant” as contemplated by NEPA. Thus, measures to alleviate public concern would assist in minimizing the overall impacts of any future SFP leaks. Accordingly, NRC should consider mitigation measures related to openness and transparency in relation to SFP leaks. For example, NRC should consider the feasibility and efficacy of full and regular public disclosure and publication of licensee radiological groundwater monitoring results to keep the public fully informed of existing circumstances. This is in relation to any results that are not already currently made publicly available via NRC’s ADAMS. NRC should contemplate the usefulness of such disclosures as results are generated, i.e., on a monthly or quarterly basis, depending on specific circumstances. In addition, measures to provide the public with easier access to site-specific annual radiological monitoring reports, which are available in NRC’s document system, ADAMS, should also be considered.

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<sup>23</sup> For example, since leaks at Indian Point were “discovered,” there has been a high level of public concern, which continues today. See Liquid Radioactive Release Lessons Learned Task Force Final Report, September 1, 2006, at ii, *available at*, ADAMS Accession No. ML062650312.

NRC has the unequivocal obligation to *consider and discuss* relevant mitigation options that are available, and to weigh the costs and benefits of such options. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989). Thus, pursuant to the basic tenets of NEPA, NRC must assess the foregoing measures, as well as any and all other relevant potential mitigation measures.

**6. NRC’s SFP leaks impact analysis violates NEPA and the Court’s decision in *New York v. NRC* because the bounding parameters used by NRC are not broad enough to cover a number of site-specific concerns**

Although the Court in *New York v. NRC* found that a generic analysis of environmental impacts of spent fuel storage may be appropriate, whether generic or site-specific, the analysis must be “thorough and comprehensive.” *New York v. NRC*, 681 F.3d 471, 481 (D.C. Cir. 2012). The Court accepted the NRC’s bounding assumptions in the 2010 waste confidence rule, considering them to be “conservative” and finding the risks associated with the waste confidence decision to be “essentially common.” *Id.* at 480. However, in the DGEIS, the NRC fails to use conservative bounding assumptions and as a result, the NRC fails to fully consider several site-specific concerns.<sup>24</sup>

NRC’s generic analysis of radioactive contamination in groundwater from spent fuel pool leaks is deficient because that issue is most appropriately addressed in a site-specific manner as explained in the recently finalized update to the License Renewal Generic Environmental Impact Statement. There, the NRC determined that impacts surrounding “radionuclides in groundwater” should be addressed as a *site-specific*, rather than generic basis because:

This new Category 2 issue evaluates the potential contamination and degradation of groundwater resources resulting from inadvertent discharges of radionuclides into groundwater from nuclear power plants. Within the past several years, there have been numerous events at power reactor sites which involved unknown, uncontrolled, and unmonitored releases of radionuclides into the groundwater. The number of these events and the high level of public controversy have made this issue one that the NRC believes needs a “hard look” as required by NEPA.

*As a voluntary action, NEI 07-07 [Industry Ground Water Protection Initiative—Final Guidance Document; NEI 2007] cannot be enforced by the NRC. As such, no violations can be issued against a licensee who fails to comply with the guidance in NEI 07-07. Furthermore, the NRC cannot rely on a voluntary*

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<sup>24</sup> Bounding estimates are especially important here, where in its proposed rule, NRC states that site-specific concerns regarding future reactor and SFP storage facilities cannot be brought up during individual licensing actions. *See* Waste Confidence- Continued Storage of Spent Nuclear Fuel 78 Fed. Reg. 56804 (Sept. 13, 2013) (amending 10 C.F.R. pt. 51); *see also* Proposed Regulation 10 C.F.R. § 51.23(b).

*initiative as a basis to ensure that the nuclear power industry will have adequate information available for the NRC to determine whether a documented leak or spill does or does not have an adverse impact on groundwater resources.*

Regarding the magnitude of impact, the NRC bases its determination of SMALL to MODERATE impact on a review of existing plants have had inadvertent releases of radioactive liquids. Even though the NRC expects impacts for all plants to be within this range, a conclusion of LARGE impact would not be precluded for a future license renewal review based on new and significant information if the data support such a conclusion. As reflected in the final GEIS and rule, “Radionuclides released to groundwater” remains a Category 2 issue.

Generic Environmental Impact Statement for License Renewal of Nuclear Plants, at 1-24, NUREG-1437, Volume 1, Revision 1 (June 2013) (emphasis added).<sup>25</sup> But here, in the DGEIS, NRC relies on that same voluntary initiative in support of its generic determination that SFP leaks will not cause significant impacts. DGEIS at E-5-E-7. NRC provides no explanation of why it deems the issue of radionuclides in groundwater site-specific in the license renewal context, but not in the waste confidence assessment of spent fuel pool leaks into groundwater and its generic treatment here is inconsistent with its recent License Renewal GEIS and illogical.

And further, the NRC should have considered a number of other site-specific concerns that fall outside of its current bounding estimates. For example, it should consider SFP sites where multiple reactors and SFPs exist (e.g., Turkey Point nuclear plant in Florida). The NRC should have also considered SFP sites where other nuclear facilities or waste sites are in close proximity, such as Plant Vogtle and its proximity to the Savannah River Site. In addition, the NRC should have considered sites that are particularly vulnerable to flooding, such as the Oconee and Fort Calhoun nuclear plants. Dam Failures and Flooding at U.S. Nuclear Plants, Union of Concerned Scientists (October 2012); Perkins, Richard, et al., Screening Analysis Report for the Proposed Generic Issue on Flooding of Nuclear Power Plant Sites Following Upstream Dam Failures (July 2011).

Generally, in order to assess the probability of future SFP leaks, a consideration of site-specific factors is critical. For example, particular sites’ susceptibility to natural disasters including earthquakes, hurricanes, floods, etc., may affect the integrity of SFPs, and the probability that such events may occur can lead to or exacerbate existing SFP degradation and leaks. That is, NRC must take into account current information regarding seismicity in regions where nuclear

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<sup>25</sup> Additionally, this provides another example of how NRC’s reliance on inappropriate, inapplicable, and voluntary programs fails to satisfy NEPA as discussed in Section VI.D.2.b of these comments. While in its June 2013 License Renewal GEIS, NRC found that reliance on a voluntary program could not serve as a basis for ensuring information will be available for NRC to determine whether a leak did or did not have significant impacts, here, in its waste confidence DGEIS, NRC relied on that exact same document to support the conclusion that leaks will not have significant impacts. *See* DGEIS at E-5–E-6. This is completely illogical and at a minimum, NRC must explain this discrepancy.

power plants are located,<sup>26</sup> as well as the most current scientific knowledge regarding sea level rise and other impacts of climate change, including the increased frequency of severe weather events that result in storm surges, flooding, and extended power outages that could compromise safe storage of spent fuel at reactor sites.<sup>27</sup> Site-specific review related to these kinds of external circumstances is necessary since new information reveals such issues can be problematic and since different regions in the U.S. face different geological conditions and weather patterns.

Moreover, in relation to foreseeable impacts to surface waters from SFP leaks NRC should consider the following: the nature of the affected surface water (that is, is it an estuary that flows back and forth versus a static man-made pond?); the presence of nearby significant habitats and endangered species in surface waters affected by SFP leaks; the relevant status of the aquatic ecology in a given waterway, such as whether the waterway is already degraded or contains stressed fish populations, such as the Hudson River;<sup>28</sup> the degree to which already existing

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<sup>26</sup> In 2007, the NRC began examining new earthquake hazard information and found that various seismic hazard estimates have increased and required further analysis; NRC is currently continuing to update earthquake risk hazard estimates for U.S. nuclear power plants in light of newer information and seismic models. *See* Generic Issue 199 (GI-199), Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants: Safety/Risk Assessments, August 2010, ADAMS Accession No. ML100270639; Memo from P. Hiland to B. Sheron Re: Results of Safety/Risk Assessment of Generic Issue 199, September 2, 2010, ADAMS Accession No. ML100270598. Site-specific consideration of such new information and analyses concerning regional seismology and hazards posed therefrom is necessary for determining risks of future SFP leaks at particular nuclear power plants. For example, a study by Columbia University seismologists in 2008 concluded that the area surrounding the Indian Point nuclear plant was not, as previously thought, an area of low seismic activity, and that, in fact, it was “quite possible” the region could experience upwards of a 7.0 magnitude earthquake, which the owner of the plant has admitted Indian Point is not designed to withstand. *See* Lynn R. Sykes, John G. Armbruster, Won-Young Kim, & Leonardo Seeber, Observations and Tectonic Setting of Historic and Instrumentally Located Earthquakes in the Greater New York City–Philadelphia Area, *Bulletin of the Seismological Society of America*, Vol. 98, No. 4, pp. 1696–1719, August 2008; The Earth Institute, Columbia University, “Earthquakes May Endanger New York More than Thought, Says Study: Indian Point Nuclear Power Plant Seen as Particular Risk,” Press Release Posted on The Earth Institute website, August 21, 2008, *available at*, <http://www.earth.columbia.edu/articles/view/2235> (last visited December 13, 2012). Any such new information must be considered in relation to the risk of future SFP leaks at particular plants as waste is stored in such pools during post-operation timeframes.

<sup>27</sup> *See, e.g.*, NRC Event Notification Report #48452 for Oyster Creek (October 29, 2012), *available at*, <http://www.nrc.gov/reading-rm/doc-collections/event-status/event/2012/20121030en.html> (Notice of unusual event declared due to high intake structure water level).

<sup>28</sup> For example, in the Hudson River, which is adjacent to the Indian Point nuclear facility, study has shown that 10 out of 13 critical fish species are in long-term decline, largely as a result of entrainment, impingement, and thermal impacts from power plant cooling water intake structures. *See* The Status of Fish Populations and the Ecology of the Hudson, Pisces

radiological contamination of surface waters resulting from prior SFP leaks may affect the level and degree of exposure to future SFP leaks; how site-specific susceptibility to severe weather events and earthquakes, may affect the behavior, fate, and effect of radiological contamination in surface waters resulting from future SFP leaks; and the degree to which radiological contamination of surface waters “threatens a violation of Federal, State, or local law or requirements,” (40 C.F.R. § 1508.27(b); 10 C.F.R. § 51.71(d)) such as whether and the extent to which radiological contamination of surface waters results in violations of applicable state water quality standards adopted pursuant to the Clean Water Act or state environmental protection laws (including prohibitions and limitations on the discharge of radiological materials to State surface waters,<sup>29</sup> designated best usages of surface waters, and other established surface water standards.)<sup>30</sup>

In relation to foreseeable impacts to groundwater resources, NRC should consider site-specific factors as they bear upon the likely behavior, fate, and effect of radiological contamination plumes resulting from future SFP leaks, including the following: the varying geological landscapes underlying reactors and SFPs at different sites (e.g., the nature of the bedrock and the hydraulic gradient underneath and surrounding the site); the nature of nearby resources (including the presence of significant habitats and endangered resources); the degree to which already existing groundwater contamination resulting from past radiological leaks may affect the behavior, fate, and effect of any new groundwater contamination resulting from new SFP leaks;

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Conservation Ltd., April 2008, available at, <http://www.riverkeeper.org/wp-content/uploads/2009/06/Status-of-Fish-in-the-Hudson-Pisces.pdf>; NYSDEC Hudson River Power Plants FEIS (June 25, 2003), Public Comment Summary at 57, [http://www.dec.ny.gov/docs/permits\\_ej\\_operations\\_pdf/FEISHRPP5.pdf](http://www.dec.ny.gov/docs/permits_ej_operations_pdf/FEISHRPP5.pdf). NRC must consider how long-term exposure to radiological contamination from SFP leaks may impact already troubled fish populations.

<sup>29</sup> For example, New York State law contains a provision that prohibits discharges of high-level radioactive waste as well as any discharges not permitted by NYS rules and regulations. See New York State Environmental Conservation Law § 17-0807(1), (4).

<sup>30</sup> For example, it is common for designated best usages established pursuant to the CWA to include recreational activities such as swimming, fishing, boating, etc.; in New York, the Hudson River directly adjacent to the Indian Point nuclear power plant has been designated as suitable for recreational activities, including swimming and boating; State standards require that the discharge of deleterious substances shall not impair the waters for such best uses. 6 NYCRR § 701.11; 6 NYCRR § 700.1(a)(49); 6 NYCRR 700.1(a)(56); 6 NYCRR § 703.2. NRC must consider the degree and extent to which future SFP leaks may interfere with such designated uses of impacted surface waters. In this regard, NRC cannot narrowly examine compliance with NRC dose limits; as such limits do not necessarily reflect the pathways of exposure contemplated by water protection standards. For example, at Indian Point, the plant owner only considers one exposure pathway, i.e., the consumption of fish and invertebrates from the Hudson River, when calculating NRC-doses. Entergy Nuclear Operations, Inc. (Indian Point Unit 1, 2, and 3 Nuclear Power Plants Docket Nos. 50-03, 50-247, and 50-286), Radioactive Effluent Release Report: 2010, at page 33 of 49, available at, ADAMS Accession No. ML11124A031 (“Liquid offsite dose calculations involve fish and invertebrate consumption pathways *only*”) (emphasis added). This fails to capture exposure resulting from recreational uses of the waterway.

and how site-specific susceptibility to severe weather events and earthquakes, may affect the behavior, fate, and effect of radiological contamination plumes resulting from future SFP leaks. In addition, NRC must consider whether and the extent to which radiological groundwater contamination results in violations of applicable state water quality standards adopted pursuant to the Clean Water Act (“CWA”) or state environmental protection laws. *See* 40 C.F.R. § 1508.27(b); 10 C.F.R. § 51.71(d). This includes designated best usages of state groundwaters,<sup>31</sup> and any other established groundwater standards.

Because NRC’s bounding parameters are not broad enough to encompass a number of site-specific concerns NRC’s DGEIS is insufficient.

**7. NRC’s SFP leaks impact analysis violates NEPA because it does not consider impacts from SFP storage beyond 60 years, even though longer storage in SFPs is contemplated by the proposed regulation 10 C.F.R. § 51.23 and by 10 C.F.R. § 50.82**

NRC assumes that spent fuel will be stored in pools for no more than 60 years after the licensed life of a reactor, and thus, only looks at SFP impacts in the 60-year short-term timeframe. DGEIS at 1-14. NRC bases its assumption on one of its decommissioning regulations which states that “[d]ecommissioning will be completed within 60 years of permanent cessation of operations.” 10 C.F.R. § 50.82(a)(3); *see also* DGEIS at xxix. This assumption is problematic in at least three ways.

First, the language of the proposed rule itself is not limited to 60 years of storage in pools. The new proposed 10 C.F.R. § 51.23(a)(2) puts no time limit on the NRC’s finding that it is feasible to safely store spent fuel. (*Compare* the proposed 10 C.F.R. § 51.23(a)(2) “it is feasible to safely store spent nuclear fuel following the licensed life for operation of a reactor” *with* the 2010 regulation, “spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation.”). The time period for storage contemplated by the proposed regulation is therefore indefinite. Given the indefinite time period of the safety finding in proposed 10 C.F.R. § 51.23(a)(2), the DGEIS wrongly assumes that spent fuel will be stored in pools for only 60 years.

Second, the decommissioning regulation contemplates storage beyond 60 years in certain circumstances. 10 C.F.R. § 50.82(a)(3). In determining whether decommissioning beyond 60 years is appropriate, NRC considers several factors, including the “unavailability of waste disposal capacity.” 10 C.F.R. § 50.82(a)(3). In light of the current unavailability of a repository or disposal site, it is reasonably likely that some licensees could seek Commission approval to extend the decommissioning time period, including wet storage of spent fuel, beyond the 60 year

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<sup>31</sup> For example, the State of New York has designated the best use of the groundwater beneath the Indian Point nuclear power plant to be “as a source of potable water supply,” and requires that the discharge of deleterious substances shall not impair the groundwaters for such best uses. *See* 6 NYCRR § 701.18; 6 NYCRR § 701.15; 6 NYCRR § 703.2. This is regardless of whether such groundwaters are *actually* used for potable purposes.

timeframe. In order to comply with NEPA, the NRC must assess the potential impacts of wet storage beyond 60 years.

Third, the NRC's Decommissioning GEIS contemplates pool storage for more than 60 years in the ENTOMB alternative. Decommissioning GEIS, Supplement 1, NUREG-0586 (2002). The Decommissioning GEIS presents three decommissioning alternatives: SAFSTORE, DECON, and ENTOMB. As the NRC explains: "During the short-term storage timeframe, the pools will be used to store fuel until a licensee decides to remove the spent fuel as part of implementing either the SAFSTOR or DECON decommissioning option." DGEIS at 2-25. The ENTOMB scenario, however, contemplates storage of spent fuel in pools for up to 100 years. *Id.* at 3-25–26. However, the NRC ignores the third option for decommissioning, the ENTOMB scenario. *See* Decommissioning GEIS, Supplement 1, NUREG-0586 at 3-21.

Therefore, NRC's own documents demonstrate that there is a reasonably foreseeable potential that spent fuel will be stored in reactor pools for more than 60 years. The DGEIS should account for this potentially extended time frame for pool storage. If it does not, the proposed rule should be changed to limit the prediction of environmental impacts to only 60 years.

**E. The Proposed Rule's Determination That Spent Fuel Can Be Safely Stored in Pools for an Indefinite Period is Not Based on an Adequate Environmental Analysis of Spent Fuel Pool Fire Risks**

Under NEPA, the NRC is required to "examine both the probability of a given harm occurring *and* the consequences of that harm if it does occur." *New York v. NRC*, 681 F.3d at 482 (emphasis in original). "Only if the harm in question is so 'remote and speculative' as to reduce the effective probability of its occurrence to zero may the agency dispense with the consequences portion of the analysis." *Id.* (citing *Limerick Ecology Action, Inc. v. NRC*, 869 F.2d at 739). In its 2010 waste confidence update, the NRC did not look at the consequences of spent fuel pool fires. Instead, it asserted that "it did not need to examine the consequences of fires because the 'risk of fires [is] very low.'" But the Court rejected the NRC's analysis holding that NRC must look at the consequences of spent fuel pool fires. *Id.* (NRC "must put the weights on both sides of the scale before it can make a determination.").

To determine risk, NRC purports to "combine[ ] the probability of an accident with the consequences of that accident." DGEIS at xxx, 4-68, 4-69. Using this method to determine risk, the DGEIS asserts that the environmental impact of pool fires is "SMALL," *i.e.*, insignificant. DGEIS at F-12. NRC admits however, that "the consequences of a severe accident, should one occur, would be significant and destabilizing." DGEIS at F-7.

Dr. Thompson's declaration provides a detailed analysis of the reasons for his opinion that the NRC has seriously understated both the probability and consequences of pool fires, and that in fact their environmental impacts are significant.

A fundamental problem with the DGEIS is its method of assessing risk. The DGEIS defines radiological risk as the numerical product of the probability and the consequences of an event, and further argues that a high-consequence, low-probability event, such as a severe accident,

could be determined to have a small environmental impact if the risk is sufficiently low. In the context of the DGEIS, that definition of radiological risk, and the associated determination of environmental impact, are fundamentally flawed from at least four overlapping perspectives:

- First, numerical estimates of consequences and probability are typically incomplete and highly uncertain.
- Second, significant aspects of consequences and probability are not susceptible to numerical estimation.
- Third, larger consequences can be qualitatively different than smaller consequences.
- Fourth, devotees of this definition of risk typically argue, as does the draft GEIS, that equal levels of “risk”, as they define it, should be equally acceptable to citizens. That argument may be given a scientific gloss, but is actually a statement laden with subjective values and interests. An informed citizen could reject the argument on reasonable grounds.

Thompson Declaration, Section IV. The qualitative difference between large and small consequences is not a well-known factor in the United States, but is recognized in Europe. For example, analysts at the French government’s Institut de Radioprotection et de Surete Nucleaire (“IRSN”) have found a qualitative difference between larger and smaller radiological consequences. The IRSN analysts estimated the costs (i.e., economic damage) that would arise from an accidental, atmospheric release of radioactive material from the Dampierre nuclear generating station in France. They considered two types of release – a “controlled” (smaller) and a “massive” (larger) release. A paper summarizing their findings was presented at the 2012 Eurosafe conference. Thompson Declaration, par. IV-11.

The IRSN analysts concluded that the costs arising from a massive release would differ “profoundly” from the costs arising from a controlled release, in terms of both qualitative and quantitative factors. Indeed, they described the massive release as “an unmanageable European catastrophe.” Their paper concluded with the statement:

“Safety decisions may also be informed by this picture, in particular if it is realized that the most severe cases actually carry huge stakes for the nation and therefore that their lower probability may not balance their catastrophic potential.”

Thompson Declaration, par. IV-13 (quoting Ludivine Pascucci-Cahen and Momal Patrick (IRSN), “Massive radiological releases profoundly differ from controlled releases”, paper for presentation at the Eurosafe conference, Brussels, 5-6 November 2012).

Dr. Thompson also reports that there is strong evidence that the 1986 Chernobyl accident was a principal cause of the dissolution of the Soviet Union. Political unrest related to the accident was noted in a 1987 paper by the US Central Intelligence Agency.

As public dissatisfaction grows, the Chernobyl' accident may provide a focal point around which disgruntled citizens can organize, and Moscow may discover that Chernobyl' is a continuing irritant with a potential for social and ethnic tensions for years to come.

Thompson Declaration, par. IV-14 (quoting *The Chernobyl' Accident: Social and Political Implications* (Washington, DC: CIA, December 1987). Public dissatisfaction did indeed grow, and the Warsaw Pact and the Soviet Union dissolved in 1991. Mikhail Gorbachev, the last head of state of the Soviet Union, confirmed in a 2006 essay that the Chernobyl accident was a principal cause of the Union's dissolution. Thompson Declaration, par. IV-IV-15.

As Dr. Thompson observes, the full array of consequences of a large, atmospheric release of radioactive material from a nuclear facility in the United States is difficult to predict. The nature and scale of those consequences would vary according to the characteristics of the release and other factors. It is clear, however, that there are unresolved socio-political tensions in this country. Thus, the consequences of a large release could include substantial political stress. It is unlikely that aggrieved citizens would be comforted if they learned that NRC had determined, at a prior time, that the release was a low-risk event. Thompson Declaration, par. IV-16.

The DGEIS relies on probabilistic risk assessment ("PRA") type studies for its estimation of radiological risk. Studies of this type can provide useful information about radiological risk, for certain purposes. However, these studies cannot provide a credible estimate of the probability of a radiological event such as a pool fire. Thompson Declaration, pars. X-31–X-39.

The DGEIS sets forth a highly optimistic view of the future conditions that will affect stored spent fuel. It assumes that institutional controls will remain operative into the indefinite future, arguing that this assumption "avoids unreasonable speculation regarding what might happen in the future". This assumption, like other optimistic assumptions in the DGEIS, is neither reasonable nor prudent. Moreover, assuming static conditions is speculative in the extreme, and shows a profound ignorance of human history. Given the long timeframes envisioned in the DGEIS, the only reasonable approach is to consider a broad range of scenarios. Those scenarios would encompass substantial changes in the risk environment over time. The changes could be non-uniform across the United States. Thompson Declaration, par. VII-2.

The DGEIS significantly under-estimates the probability of an attack-induced pool fire. That probability cannot be determined quantitatively. In light of human history, observation of the contemporary world, and consideration of possible societal trends, a prudent decision maker would conclude that a successful attack on a reactor or spent-fuel-storage facility in the United States over the coming decades is as likely to occur as are major national challenges that are planned for, such as severe natural disasters or engagement in wars. Thompson Declaration, pars. VI-10, X-35.

Another significant deficiency in the DGEIS' risk analysis is its failure to consider the relationship between pool fires and operating reactors. Pool storage of spent fuel, as considered in the DGEIS, could occur, and probably will occur, at locations near operational reactors. Risk linkages among spent-fuel pools and operational reactors at a site could be manifested in a cascading sequence of incidents that preclude mitigating actions needed to maintain pools in a safe state. Mitigating actions could be precluded by, for example, a radiation field arising from the release of radioactive material. NRC has never, to Dr. Thompson's knowledge, published a credible technical analysis of a cascading sequence of incidents of this type, or publicly stated

that it has performed such analysis in secret. The present state of knowledge suggests that risk linkage among pools and operational reactors leads to an under-estimate of risk by at least one order of magnitude (i.e., factor of 10). Accordingly, the DGEIS should have carefully considered the potential linkage of radiological risk among pools and operational reactors at each site. The DGEIS has not considered this matter. Thompson Declaration, Section X.

Importantly, the DGEIS substantially underestimates the consequences of a pool fire. Those consequences could include the long-term displacement of millions of people, economic damage measured in trillions of dollars, and adverse social and political outcomes. A pool fire yielding these consequences would be a national disaster of historic dimensions. Thompson Declaration, Section X. And as discussed above, very large consequences are qualitatively different than smaller ones.

As Dr. Thompson's declaration shows, the nature of pool fire risks is such that a meaningful environmental impact estimate cannot be yielded by simply multiplying probability times consequences. First, some of the key factors are not easily quantifiable; for instance, it is difficult to quantify the probability of an attack, which is easily the greatest threat to a spent fuel pool. As Dr. Thompson suggests, the element of prudence should pay a significant role where a facility is as attractive a target as a fully laden fuel pool.

Second, the NRC does not have a full picture of all the factors that could cause a pool fire. For instance, in footnote 5 on page F-9 of the DGEIS, the NRC admits that the seismic risk analysis on which it based its consequence analysis did not include reactors in the western United States, presumably because of the fact that they have been studied less than eastern earthquakes. Third, the NRC has not aggressively pursued research or open public debate about the behavior of spent fuel in pools. As a result, there is not a significant body of rigorous scientific research that can be relied upon, as is more the case with reactor studies. And finally, the consequences of an accident or successful attack on a fuel pool could be catastrophic on a massive scale. Measuring potential damages in billions of dollars is not sufficient to account for the social, economic and political upheaval that such an event may cause. Thus, the NRC's estimate that spent fuel pool fires have insignificant impact is not defensible. In fact, a reasonable assessment of pool fire impacts would conclude they are significant.

## **VII. THE PROPOSED RULE HAS SIGNIFICANT ENVIRONMENTAL IMPACTS THAT MUST BE PLUGGED INTO INDIVIDUAL REACTOR LICENSING DECISIONS**

As the Supreme Court observed in *Baltimore Gas and Electric Co.*:

Congress did not enact NEPA . . . so that an agency would contemplate the environmental impact of an action as an abstract exercise. Rather, Congress intended that the 'hard look' be incorporated as part of the agency's process of deciding whether to pursue a particular federal action. It was on this ground that the Court of Appeals faulted the Commission's action, for failing to allow the uncertainties potentially to 'tip the balance' in a particular licensing decision. As a general proposition, we can agree with the Court of Appeals' determination that an agency must allow all significant

environmental risks to be factored into the decision whether to undertake a proposed action.

462 U.S. at 101. Here, the environmental impacts of the spent fuel to be generated by new or re-licensed reactors, and the costs of avoiding or mitigating those impacts, are potentially enormous. Yet, in violation of NEPA, the DGEIS provides no mechanism for integrating those costs and impacts back into individual licensing decisions.

#### **A. The Impacts and Costs Related to Spent Fuel Storage and Disposal Are Significant**

As demonstrated in the attached expert declarations by Dr. Arjun Makhijani, David Lochbaum, and Dr. Gordon Thompson, the environmental impacts of storing spent fuel are significant.

Environmental impacts of indefinite storage of spent fuel may be catastrophic, as discussed in the declaration of Dr. Arjun Makhijani, Section 7. In the Yucca Mountain EIS, for instance, the DOE found that loss of institutional controls would result in the “unchecked deterioration and dissolution of the materials” in storage, with “catastrophic” effects. And the DOE conservatively underestimated those impacts. Makhijani Declaration, pars. 7.3 and 7.4. Dr. Thompson also testified that the cumulative frequency of successful attacks on ISFSIs could be substantial and that the consequences of a successful attack could be severe. Thompson Declaration, Section XI.

David Lochbaum’s declaration shows that NRC relies on nonexistent or inapplicable regulatory requirements to prevent or detect future leaks at decommissioned reactors. Given the large volume and radioactivity of some undiscovered pool leaks in the past, and given NRC’s failure to show that they will be detected and prevented in the future, environmental impacts of pool leaks are significant.

Dr. Gordon Thompson’s declaration shows that NRC has significantly underestimated the environmental impacts of pool fires. *See* discussion above in Section VI.F.

In addition, the costs of avoiding or mitigating those impacts are significant. For instance, the NRC’s finding that it is feasible to have a geologic repository raises questions of cost. What will it cost to isolate spent fuel for many thousands of years? Is the cost affordable when compared with the profit that a nuclear reactor will yield? As discussed in the declaration of Mark Cooper, these costs are so large they must be considered. Conservatively estimating the costs of spent fuel storage and disposal, Mr. Cooper estimates total costs in the range of \$210 to \$350 billion, in real, undiscounted dollars. Cooper Declaration, p. 10. That is a figure that is certainly large enough to demand consideration by the Nuclear Regulatory Commission. Moreover, converting those costs to costs per unit of output, he concludes that the costs would be in the range of \$10 to \$20 per megawatt hour (\$0.01 to \$0.02/ kWh) of electricity generated by the reactors that produce the waste. Cooper Declaration, p. 4. This is equal to 10 to 20 percent of the cost of nuclear power from newly constructed reactors as calculated by the Energy Information Administration. Compared to the cost of the other resources included in the Energy Information Administration analysis, the cost of waste management would make nuclear power much less attractive as a resource.

The Cooper Declaration also shows that the cost of nuclear waste management is often larger compared to the operating costs and margins of existing reactors. Several operating reactors have recently been abandoned because their operating margins can be as low as \$9/MWh, which is insufficient to cover their costs and meet the revenue requirements that their owners demand and others may face a similar fate. Cooper Declaration, pp. 20-21. Waste management costs of \$10 to \$20 per MWh must be considered very significant in evaluating the economics of aging reactors. The majority of the license renewals that are pending at the NRC, or expected to come before the NRC in the next few years, involve reactors whose operating costs and margins are no better than the margins for reactors that were recently retired before their licenses expired.

### **B. Costs of Spent Fuel Storage and Disposal Could Tip the Balance Of Reactor Licensing Decisions**

As demonstrated by the Cooper Declaration, the costs of spent fuel storage and disposal could tip the balance of reactor licensing decisions away from licensing and in the direction of renewables and energy efficiency. As discussed above, spent fuel costs are equal to 10 to 20 percent of the cost of nuclear power from newly constructed reactors. These costs are also significant for existing reactors, which face increasing operating costs as a result of aging. Cooper cites estimates of the cost of electricity resources prepared by the mid-Atlantic grid operator PJM and Lazard, a Wall Street analysis firm, which show that a significant amount of energy efficiency can be achieved at a cost that is lower than the cost of waste management alone. Cooper Declaration, p. 17.

## **VIII. THE PROPOSED RULE AND DRAFT WASTE CONFIDENCE EIS VIOLATE NEPA BECAUSE THEY SEGMENT THE ANALYSIS OF ENVIRONMENTAL IMPACTS OF SPENT FUEL STORAGE AND DISPOSAL**

The NRC has splintered the analysis of safety and environmental issues associated with management of spent fuel into myriad of separate subparts. This hodgepodge of regulatory provisions and environmental findings is characterized by inconsistencies, internal deficiencies, and huge analytical gaps. Although all of them are related, the NRC refuses to consider their relationship or to reform any of them. The result is that any decisions NRC makes about licensing of reactors are utterly uninformed about the environmental impacts of spent fuel storage or disposal. For instance:

- In the proposed waste confidence rule, the NRC makes a finding that spent fuel disposal is feasible, but it fails to make any reasonable assurance finding regarding the availability of sufficient repository capacity to accommodate the spent fuel that will be generated as a result of future NRC licensing decisions. While the Court directed the NRC to analyze the uncertainty associated with failure to site a repository, the NRC simply dropped the safety finding from its regulations. *See* Section IV above.
- In order to comply with the Court's order to analyze the uncertainty associated with its prediction of sufficient spent fuel disposal capacity, the NRC would need to analyze the

environmental impacts of spent fuel disposal in an array of geologic media, with an analysis of the uncertainty regarding whether the repositories could meet federal limits for containing radioactivity and how much spent fuel they could accommodate. Makhijani Declaration, pars. 8.2-8.24. The DGEIS does not provide any information about spent fuel disposal impacts, however. Instead, the DGEIS declares spent fuel disposal impacts irrelevant to its analysis and refers the reader to Table S-3. DGEIS at 1-18.

- Table S-3 is clearly related to the NRC’s findings regarding feasibility of spent fuel disposal, because the NRC has stated that it will not revisit the conclusions in Table S-3 unless it has reason to doubt its waste confidence conclusion regarding the feasibility of spent fuel disposal. 55 Fed. Reg. at 38,491.
- As discussed in the Makhijani Declaration, Table S-3 assumes that spent fuel will be disposed of in a bedded salt repository. Based on that assumption, Table S-3 states that the environmental impacts of a spent fuel repository are zero. But Table S-3 is no longer technically valid, because the NRC has ruled out the assumption underlying Table S-3 that spent fuel can be safely disposed of in a bedded-salt repository. Makhijani Declaration, par. 8.20. However, NRC has refused to re-evaluate Table S-3, because – as discussed above – only a change in the waste confidence determination would cause NRC to revisit Table S-3.
- In its license renewal rule (Table B-1 of Appendix A to 10 C.F.R. Part 51), the NRC treats the environmental impacts of spent fuel disposal as insignificant for purposes of making license renewal decisions, based on the existence of EPA repository standards, but does not relate this decision to Table S-3, which concludes that spent fuel impacts are insignificant on completely different grounds. The NRC does not explain the inconsistency between Table B-1 and Table S-3.
- The DGEIS claims that environmental impacts of spent fuel disposal are irrelevant to the DGEIS. But when the NRC promulgated its final license renewal rule in 2013, it did not include any conclusions regarding the environmental impacts of spent fuel disposal, stating that “[t]he generic conclusion on offsite radiological impacts of spent nuclear fuel and high-level waste is not being finalized pending the completion of a generic environmental impact statement on waste confidence.” 78 Fed. Reg. 37,282 37,322 (June 20, 2013). In a footnote, the NRC further explained:

As a result of the decision of United States Court of Appeals in *New York v. NRC*, 681 F.3d 471 (DC Cir. 2012), the NRC cannot rely upon its Waste Confidence Decision and Rule until it has taken those actions that will address the deficiencies identified by the D.C. Circuit. Although the Waste Confidence Decision and Rule did not assess the impacts associated with disposal of spent nuclear fuel and high-level waste in a repository, it did reflect the Commission’s confidence, at the time, in the technical feasibility of a repository and when that repository could have been expected to become available. Without the analysis in the Waste Confidence Decision and Rule regarding the technical feasibility and

availability of a repository, the NRC cannot assess how long the spent fuel will need to be stored onsite.

78 Fed. Reg. at 37,323. Clearly, despite denying the existence of a relationship between waste confidence findings and spent fuel disposal impacts in the DGEIS, the NRC considered the relationship significant enough to hold off finalizing environmental findings regarding spent fuel disposal impacts in the license renewal rule.

- There is no environmental impact statement where the NRC discusses the significant costs of a repository and spent fuel storage in a cost-benefit analysis for licensing of nuclear reactors. The only environmental document where costs related to spent fuel disposal are considered is Table S-3, but Table S-3 reports only that if there are no radiation releases from a repository there will be no costs. Table S-3 says nothing about the costs of a repository. And the DGEIS says nothing about the costs of spent fuel storage. As discussed in the declaration of Mark Cooper, costs of spent fuel storage and disposal could be high enough to tip the cost-benefit analysis in a reactor licensing or re-licensing decision away from a recommendation to license a reactor. But NRC provides no mechanism for integrating the high costs of spent fuel storage and disposal into the cost-benefit analysis and comparison of energy alternatives for reactor licensing cases.
- In license renewal cases, the NRC refuses to consider the no-action alternative, which includes energy conservation. 61 Fed. Reg. 28,467, 28,471-73 (June 5, 1996). Yet, as described in the Cooper Declaration, energy conservation may be more cost-effective than paying for spent fuel storage and disposal. But the NRC's regulatory system provides no method for evaluating the effects of spent fuel storage and disposal costs on the choice of the no-action alternative.
- The NRC evaluates the environmental impacts of pool storage of spent fuel in two different contexts: during reactor operation (in the license renewal rule) and afterwards. The NRC makes no attempt to integrate these analyses or assess the cumulative impacts of storing massive amounts of spent fuel in high-density storage pools at every reactor site around the country. This division of environmental analysis makes no sense from a technical basis, and results in an understatement of environmental impacts. See e.g., Thompson Declaration, pars. X-60–X-61.

The NRC's piecemeal and disjointed approach to the consideration of spent fuel storage and disposal impacts violates the NEPA principle that an agency may not segment its analysis in a manner that conceals the environmental significance of its action. *Taxpayers Watchdog, Inc. v. Stanley*, 819 F.2d 294, 298 (D.C. Cir. 1987) (“‘Piecemealing’ or ‘Segmentation’ allows an agency to avoid the NEPA requirement that an EIS be prepared for all major federal actions with significant impacts by dividing an overall plan into component parts, each involving action with less significant environmental effects.”). See also *Coalition on Sensible Transportation v. Dole*, 826 F.2d 60, 68 (D.C. Cir. 1987). See also *National Wildlife Federation v. Appalachian Regional Commission*, 677 F.2d 883, 890 (D.C. Cir. 1981) (“The existence of a comprehensive program with cumulative environmental effects cannot be escaped by disingenuously describing it as only an amalgamation of unrelated smaller projects.”); *Natural Resources Defense Council*

*v. Hodel*, 865 F.2d 288, 297-98 (1988). In order to provide a true picture of the environmental impacts of pool storage of spent fuel, for example, the NRC may not divide it into smaller segments based on arbitrary time periods. And it is “simply illogical” to view the admittedly interrelated waste confidence proposed rule and DGEIS separately from NRC’s environmental impact analyses for spent fuel disposal. See *One Thousand Friends of Iowa v. Mineta*, 364 F.3d 890, 894 (8th Cir. 2004) (“A segmentation is improper when the segmented project . . . is simply illogical when viewed in isolation.”).

The NRC claims that its piecemeal approach constitutes permissible “tiering.” DGEIS at 1-17–1-22.<sup>32</sup> But tiering is only permissible when the cross-referenced environmental analyses are valid. Here, the NRC relies to a significant extent on Table S-3, whose basis the NRC itself has repudiated. An agency “errs when it relies on old data without showing that the data remains accurate.” *Western Watersheds Project v. Abbey*, 719 F.3d 1035, 1052 (9th Cir. 2013) (citing *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1086–87 (9th Cir.2011) (concluding that the Surface Transportation Board did not take a “hard look” at environmental impacts when it relied on ten-year-old aerial surveys)). See also 10 C.F.R. § 51.92 (requiring NRC to prepare supplemental EISs if, “[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts”); *City of Olmsted Falls, OH v. FAA*, 292 F.3d 261 (D.C. Cir 2002) (quoting *Wisconsin v. Weinberger*, 745 F.2d 412 (7th Cir. 1984)) (agency must consider new information that “provides a seriously different picture of the environmental landscape.”)

Here, the disjointed nature of NRC’s program for evaluation of environmental impacts related to spent fuel storage and disposal is not only piecemeal but internally inconsistent, full of gaps, and riddled with outdated information. As a result, the NRC utterly fails to support its safety

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<sup>32</sup> The CEQ regulations explain tiering as follows:

A. Tiering refers to the coverage of general matters in broader environmental impact statements . . . with subsequent narrower statements or environmental analyses . . . incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared. Tiering is appropriate when the sequence of statements or analyses is:

(a) From a program, plan, or policy environmental impact statement to a program, plan, or policy statement or analysis of lesser scope or to a site specific statement or analysis.

(b) From an environmental impact statement on a specific action at an early stage (such as need and site selection) to a supplement (which is preferred) or a subsequent statement or analysis at a later stage (such as environmental mitigation). Tiering in such cases is appropriate when it helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe.

10 C.F.R. § 1508.28; see also 10 C.F.R. Part 51, App’x A(1)(b).

findings with an adequate environmental analysis, thus violating both the Atomic Energy Act and NEPA. In addition, the NRC fails to provide decisionmakers and the public with a reasonably comprehensive analysis of environmental impacts and how they could be avoided or mitigated through the avoidance of licensing or the imposition of reasonable alternatives. *Baltimore Gas & Elec. Co. v. NRDC*, 462 U.S. 87, 96 (1983) (“The key requirement of NEPA . . . is that the agency consider and disclose the actual environmental effects in a manner that will ensure that the overall process . . . brings those effects to bear on decisions to take particular actions that significantly affect the environment.”).

## **IX. PETITION FOR RULEMAKING**

In order to bring the NRC’s disjointed regulatory program for safety and environmental analysis of spent fuel management and disposal risks into compliance with NEPA, the Organizations respectfully request the NRC to revise and integrate its disparate and inconsistent regulations regarding spent fuel storage and disposal in a cohesive and consistent whole. The NRC should prepare a programmatic EIS to ensure that the cumulative nature of the impacts covered by these balkanized regulations are considered.

The regulations that must be revised and integrated are:

**Table S-3.** As discussed above and in the Makhijani Declaration, the basis for Table S-3 has been repudiated. It is also inconsistent with Table B-1.

**Table B-1.** Table B-1 is inconsistent with Table S-3. For one thing, Table B-1 does not include a finding as to whether the impacts of spent fuel disposal are significant or not. Instead, it states that the impacts are not large enough to change a license renewal decision. This suggests that the impacts *would* be large enough to change an initial licensing decision (which is covered by Table S-3). The inconsistencies and questions raised by comparing Table S-3 and Table B-1 are unacceptable under NEPA’s standard for clarity and rigor of scientific analysis.

**10 C.F.R. §§ 51.53(c) and 51.71(d).** These regulations excuse license renewal applicants and the NRC from addressing spent fuel storage impacts in license renewal cases. They also excuse any discussion of need for power. As demonstrated above, it is essential to incorporate the economic costs of spent fuel storage and disposal in reactor cost-benefit analyses. In addition, as Dr. Thompson points out, by excluding need for power from consideration in re-licensing decisions, the DGEIS cripples its ability to assess the environmental impacts of storing spent fuel. Thompson Declaration, par. IX-2. This results in an “unbounded” analysis of radiological risk from spent fuel fires. Thompson Declaration, par. IX-3.

**10 C.F.R. §51.23** (the proposed rule). This proposed rule appears in Part 51 of NRC regulations, indicating that it is an environmental regulation. Yet, it has safety language. To make matters more confusing, the NRC has dropped the “reasonable assurance” findings formerly made in the waste confidence decision. The Atomic Energy Act and NEPA both require the NRC to make findings. Safety findings should be included in Parts 50 and 52 and environmental findings should be included in Part 51. The NRC should also explain that safety findings must be supported by an adequate NEPA analysis.

After three decades of distorted and partial environmental analysis leading to uninformed licensing and re-licensing decisions, it is time now for the NRC to come into compliance with NEPA. The NRC must update its outdated and repudiated assumptions, conduct an environmental study that provides an integrated examination of all environmental impacts and costs related to spent fuel management, and promulgate a new set of regulations that provides for meaningful consideration of these impacts in individual licensing decisions.

## **X. CONCLUSION**

The proposed rule marks a turning point for the NRC. After thirty years of making baselessly optimistic “reasonable assurance” findings about the future availability of a disposal solution for spent reactor fuel, and having allowed many thousands of tons to accumulate at reactor sites around the country based on those findings, the NRC has finally stopped issuing them. Instead of confidently assuring the public that human health and the environment will be protected from highly radioactive spent fuel as long as it remains dangerous, the NRC now claims only to have hope in a theoretical possibility. But hope cannot satisfy the Atomic Energy Act. The NRC has effectively conceded that it lacks a statutory basis for licensing the further generation of spent fuel. It must therefore continue to suspend all reactor licensing unless and until some basis for reasonable assurance findings are restored. The DGEIS cannot cure this fundamental failure to satisfy the Atomic Energy Act. And even if it could, the DGEIS is utterly inadequate to satisfy NEPA.

Respectfully submitted,

*Signed (electronically) by:*

Diane Curran

Harmon, Curran, Spielberg & Eisenberg, L.L.P.

1726 M Street N.W. Suite 600

Washington, D.C. 20036

202-328-3500

Fax: 202-328-6918

E-mail: [dcurran@harmoncurran.com](mailto:dcurran@harmoncurran.com)

*Signed (electronically) by:*

Mindy Goldstein

Jillian Kysor

Turner Environmental Law Clinic

1301 Clifton Road

Atlanta, GA 30322

404-727-3432

Fax: 404-727-7853

Email: [magolds@emory.edu](mailto:magolds@emory.edu)

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