

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE SECRETARY

_____)
In the Matter of)
)
Proposed Amendment to 10 C.F.R. Part 51) Docket No. PRM-____
modifying all regulations regarding)
environmental impacts of pool storage of)
spent reactor fuel during reactor operation)
_____)

**ENVIRONMENTAL ORGANIZATIONS' PETITION TO CONSIDER NEW AND
SIGNIFICANT INFORMATION REGARDING ENVIRONMENTAL IMPACTS OF
HIGH-DENSITY SPENT FUEL STORAGE AND MITIGATION ALTERNATIVES
IN LICENSING PROCEEDINGS FOR NEW REACTORS AND LICENSE
RENEWAL PROCEEDINGS FOR EXISTING REACTORS
AND
DULY MODIFY ALL NRC REGULATIONS REGARDING ENVIRONMENTAL
IMPACTS OF SPENT FUEL STORAGE DURING REACTOR OPERATION**

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I. INTRODUCTION

Pursuant to the Administrative Procedure Act (“APA”) [5 U.S.C. § 553(e)], the National Environmental Policy Act (“NEPA”) [42 U.S.C. § 4332], and the U.S. Nuclear Regulatory Commission’s (“NRC’s” or “Commission’s”) regulations for implementation of the APA and NEPA, including 10 C.F.R. §§ 2.802(a) and 51.92(a), thirty four Environmental Organizations (hereinafter “Petitioners”)¹ hereby request the NRC to consider, in all pending and future reactor licensing and re-licensing decisions, new and significant information bearing on the environmental impacts of high-density pool storage in reactor pools and alternatives for avoiding or mitigating those impacts. The NRC Staff generated this new and significant information during its post-Fukushima proceeding to consider whether it should order operating reactor licensees to expedite the transfer of spent fuel from high-density pool storage to dry storage.² No previous Environmental Impact Statement (“EIS”) for initial reactor licensing, Generic Environmental Impact Statement (“GEIS”) for re-licensing of operating reactors, or Environmental Assessment (“EA”) for certification of standardized reactor designs has considered this information.³

¹ The Petitioners are: 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, National Parks Conservation Association, 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 Petitioners also submitted comments on the proposed Waste Confidence Rule and Waste Confidence GEIS, including a rulemaking petition to revise and consolidate all safety and environmental regulations related to spent fuel storage and disposal. 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 (Dec. 20, 2013) (ADAMS Accession No. ML14024A297). This rulemaking petition is consistent with Petitioners’ comments and rulemaking petition.

² See COMSECY-13-0030, Memorandum from Mark Satorius, Executive Director for Operations, to NRC Commissioners re: Staff Evaluation and Recommendations for Lessons Learned Tier 3 Issue on Expected Transfer of Spent Fuel (Nov. 12, 2013) (“COMSECY-13-0013”) (ADAMS Accession No. ML13273A601) and documents cited therein. Throughout this Petition, the proceeding described in COMSECY-13-0030 will be described as the “Expedited Spent Fuel Transfer Proceeding.”

³ The Commissioners have not responded to a previous request by Petitioners to consider the new and significant information generated by the Expedited Spent Fuel Transfer Proceeding in reactor licensing and re-licensing proceedings. Letter from Diane Curran and Mindy Goldstein to NRC Commissioners re: Expedited Transfer of Spent Fuel from Reactor Storage Pools (January 16, 2014) (not yet posted on ADAMS). Therefore Petitioners are submitting this formal petition pursuant to 10 C.F.R. § 2.802.

The new and significant information that must be considered in reactor licensing and re-licensing proceedings is reported in the Consequence Study and Regulatory Analysis prepared by the NRC Staff in the course of the Expedited Spent Fuel Transfer Proceeding.⁴ The information consists of the following:

- In the Expedited Spent Fuel Transfer Proceeding, the NRC Staff found that if even a small fraction of the inventory of a Peach Bottom reactor pool were released to the environment in a severe spent fuel pool accident, an average area of 9,400 square miles (24,300 square kilometers) would be rendered uninhabitable, and that 4.1 million people would be displaced over the long-term.⁵ This information is “new” because no EIS for reactor licensing, GEIS for reactor re-licensing, or EA for standardized design certification has specified the size of the area that could be contaminated or the number of people who could be displaced for an extended period of time by a high-density spent fuel pool fire. The information is “significant” because it undermines the NRC’s conclusion in environmental studies for reactor licensing and re-licensing that the impacts of spent fuel storage during reactor operation are insignificant. Such widespread contamination and long-term displacement of people could have enormous socioeconomic impacts, as witnessed by the effects of the Fukushima accident, where “land contamination has disrupted the lives of a large number of Japanese citizens.”⁶
- In the Expedited Spent Fuel Transfer Proceeding, the NRC Staff conducted a series of cost-benefit analyses comparing the costs and safety benefits of expediting the transfer of spent fuel from high-density pool storage to dry storage. These cost-benefit analyses included “sensitivity studies” showing that the safety benefits of reducing the inventory of high-density storage pools, combined with dry storage, outweigh the costs.⁷ The Expedited Spent Fuel Transfer Proceeding thus shows for the first time that – even when only health-and-safety-related benefits are considered rather than broader environmental

⁴ Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor (Oct. 2013) (“Consequence Study”) (ADAMS Accession No. ML13256A342) (attached to SECY-13-0112, Memorandum from Mark A. Satorius, Executive Director for Operations, to the Commissioners, re Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor (Oct. 9, 2013) (“SECY-13-0112”)) (ADAMS Accession No. ML13256A339); Regulatory Analysis for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel (“Regulatory Analysis”) (Attachment 1 to COMSECY-13-0013) (ADAMS Accession No. ML13273A628).

⁵ Consequence Study at 232 (Table 62) and 162 (Table 33).

⁶ SECY-12-0010, Memorandum from Annette L. Vietti-Cook, NRC Secretary, to Commissioners, re: Staff Requirements – SECY-12-0110 – Consideration of Economic Consequences Within the U.S. Nuclear Regulatory Commission’s Regulatory Framework (March 20, 2012) (SECY-12-0100) (ADAMS Accession No. ML12173A478).

⁷ Regulatory Analysis at 7, 46-51.

benefits -- a combination of reduced-density pool storage and dry storage constitutes a reasonable alternative for mitigating the risks of high-density pool storage of spent fuel.⁸ In other words, the Staff has acknowledged for the first time that the potential consequences of a pool fire are severe enough to warrant mitigation, regardless of the low probability estimated by the NRC for such an accident. No EIS for reactor licensing, GEIS for reactor re-licensing, or EA for reactor design certification has acknowledged that mitigation of pool fires is warranted or weighed the costs and environmental benefits of such mitigation measures.

- In the Expedited Spent Fuel Transfer Proceeding, the NRC concluded for the first time that the likelihood of spent fuel pool fires could be affected by reactor accidents.⁹ Although the NRC did not evaluate the issue in the Expedited Spent Fuel Transfer Proceeding due to resource limitations,¹⁰ it undertook a study of the phenomenon in a Level 3 probabilistic risk assessment (“PRA”) for Vogtle Electric Generating Plant Units 1 and 2,” which is now an “ongoing project.”¹¹ At the Commission briefing on January 6, 2014, the NRC Staff confirmed that it is “already doing the analysis for spent fuel pool.”¹² While the PRA is not finished, the NRC has planned it in such a way that important results will be available before the final product is completed.¹³ No EIS for reactor licensing, GEIS for reactor re-licensing, or EA for reactor design certification has identified or evaluated the contribution of reactor accidents to the risk of spent fuel pool fires. The NRC should consider any new information that has been generated by the PRA regarding the effect of reactor accidents on pool fire risks.

⁸ Petitioners note that the NRC uses the term “low-density” to refer to storage of a reduced volume of spent fuel in closed-frame high-density storage racks. Petitioners believe it is more appropriate to describe this form of spent fuel storage as “reduced-density.” True “low-density” spent fuel storage involves the use of a completely different spent fuel pool design, employing open-frame low-density storage racks. As discussed below in Section IV.A, open-frame racks are less vulnerable to pool fires.

⁹ Consequence Study at 29.

¹⁰ *Id.*

¹¹ *Id.* See also SECY-11-089, Memorandum from R.W. Borchardt to NRC Commissioners, re: Options For Proceeding with Future Level 3 Probabilistic Risk Assessment Activities (July 7, 2011) (ADAMS Accession No. ML11090A039). In SRM-11-0089, the Commission directed the NRC Staff to complete the study in four years, *i.e.*, by the fall of 2015. Memorandum from Annette L. Vietti-Cook, NRC Secretary, to R.W. Borchardt, EDO, re: Staff Requirements – SECY-11-0089 – Options for Proceeding with Future Level 3 Probabilistic Risk Assessment (PRA) Activities (Sept. 21, 2011) (ADAMS Accession No. ML112640419).

¹² Transcript of Commission Briefing on Spent Fuel Safety and Consideration of Expedited Transfer of Spent Fuel to Dry Casks at 119 (Jan. 6, 2013) (Hossein Esmaili) (“2014/01/06 Briefing Transcript”) (ADAMS Accession No. ML14008A249).

¹³ Technical Analysis Approach Plan for Level 3 PRA Project, Rev. 0a – Working Draft at 6-7 (April 2013) (ADAMS Accession No. ML13112A444) (publicly released on December 2, 2013, under FOIA/PA-2013-0240).

While in COMSECY-13-0030 the NRC Staff found that the above-cited information is not sufficient to justify backfits of operating reactors pursuant to safety regulation 10 C.F.R. § 50.109, it has not made any determination regarding the separate question that must be addressed under NEPA: whether the information is “new” and “significant” for purposes of supplementing existing environmental analyses for the licensing and re-licensing of reactors.¹⁴ Petitioners respectfully submit that the NEPA standard for “new and significant information” is satisfied here. The information is new because it has not been considered in any environmental study for the licensing or re-licensing of nuclear reactors. The information is significant because it could affect the outcome of licensing and license renewal decisions for nuclear reactors, by altering the NRC’s characterization of the impacts of spent fuel storage and/or by resulting in the consideration of measures to mitigate the environmental impacts of pool fires.¹⁵

To ensure compliance with NEPA in the consideration of this new and significant information, Petitioners request the NRC to take the following actions:

- suspend the effectiveness of Table B-1 of 10 C.F.R. Part 51, Subpart A, Appendix B (“Table B-1”), which codifies the NRC’s generic finding that spent fuel storage in high-density reactor pools during the license renewal term of operating reactors poses no significant environmental impacts and therefore need not be considered in individual reactor licensing decisions;
- suspend the effectiveness, in any new reactor licensing proceeding for reactors that employ high-density pool storage of spent fuel, of all regulations approving the standardized designs for those new reactors and all Environmental Assessments (“EAs”) approving Severe Accident Mitigation Design Alternatives (“SAMDA”) ¹⁶;
- re-publish for public comment the following documents with respect to new and significant information regarding the environmental impacts of high-density spent fuel storage in reactor pools and the costs and benefits of measures for avoiding or mitigating those impacts:
 - the License Renewal Generic Environmental Impact Statement (NUREG-1437, Rev.1, June 2013) (“2013 Revised License Renewal GEIS”);
 - the EISs for all new reactors;

¹⁴ 10 C.F.R. § 51.92(a).

¹⁵ 10 C.F.R. § 51.92(a). *See also Marsh v. Or. Natural Res. Council*, 490 U.S. 360, 371 (1989).

¹⁶ This request includes Watts Bar Unit 2 as well as new reactors for which combined license (“COL”) applications have been submitted.

- the EAs for all new certifications of standardized reactor designs;
- duly modify NRC regulations that make or rely on findings regarding the environmental impacts of spent fuel storage during reactor operation, including Table B-1 and all regulations approving standardized reactor designs; and
- suspend all new reactor licensing decisions and license renewal decisions pending completion of this proceeding. The pending new reactor cases include Bell Bend, Calvert Cliffs, Comanche Peak, Fermi, Levy County, North Anna, South Texas, Turkey Point, Watts Bar Unit 2, and William States Lee. The pending reactor license renewal cases include Byron, Callaway, Davis-Besse, Diablo Canyon, Grand Gulf, Indian Point, Limerick, Seabrook, Sequoyah, and South Texas.¹⁷

Petitioners submit this rulemaking petition rather than separate waiver petitions for individual proceedings, because the NRC has consistently treated the issue of spent fuel storage impacts as generic in its environmental decision documents.¹⁸ In addition, the NRC treats the issue of spent fuel pool accident risks as generic in the Expedited Spent Fuel Transfer Proceeding.¹⁹

II. DESCRIPTION OF PETITIONERS

The following is a description of the petitioner 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.

¹⁷ Separately, pursuant to 10 C.F.R. § 2.802(d), those Petitioners who are also participants in pending contested reactor licensing and license renewal proceedings intend to move the Commission to suspend licensing decisions in those proceedings, pending the outcome of this Petition.

¹⁸ See *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-01-17, 54 NRC at, 22 (2001) (“FP&L”) (concluding that spent fuel pool accident risks are “amenable” to generic resolution); ; *Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), CLI-07-03, 65 NRC 13, 20 (2007) (“It makes more sense for the NRC to study whether, as a technical matter, the agency should modify its requirements relating to spent fuel storage for all plants across the board than to litigate in particular adjudications whether generic findings in the GEIS are impeached by . . . claims of new information.”)

¹⁹ See COMSECY-13-0030 at 7, 10 (discussing NRC Staff’s generic approach in Expedited Spent Fuel Transfer Proceeding).

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.

National Parks Conservation Association ("NPCA") is a non-profit, non-partisan, public interest membership organization that is a leading voice of the American people in protecting and enhancing our National Park System. Since 1919, NPCA, its members, and partners have worked together to protect the park system and preserve our nation's natural, historical, and cultural

heritage for present and future generations to come. By providing a voice to influence our government and the National Park Service, NPCA and its more than 300,000 members provide an invaluable resource to the nation. As the nation's only independent membership organization dedicated to protecting the park system, NPCA and its hundreds of thousands of members and supporters are committed to preserving our nation's parks.

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. SOURCES OF NEW AND SIGNIFICANT INFORMATION

The new and significant information presented in this Petition was generated by the NRC technical staff during the NRC's post-Fukushima proceeding to consider whether to order licensees to expedite the transfer of spent fuel from high-density storage pools into dry storage and to revert from high-density racking of storage pools to low-density racking. This proceeding was initiated in 2012.²⁰ Petitioners rely on the following documents generated by the NRC during the Expedited Spent Fuel Transfer Proceeding:

- 2014/01/06 Briefing Transcript;
- COMSECY-13-0030;

²⁰ See SECY-12-0095, Memorandum from R.W. Borchardt to the Commissioners re: Tier 3 Program Plans and 6-Month Status Update in Response to Lessons Learned from Japan's March 11, 2011 Great Tohoku Earthquake and Subsequent Tsunami (Jul. 13, 2012) ("SECY-12-0095") (ADAMS Accession No. ML12208A208)

- The Regulatory Analysis;
- Nonconcurrency Process Record for NCP-2013-013 (“NCP Process Record”), including Nonconcurrency of Brian Wagner (“Wagner Nonconcurrency”);²¹
- Remarks by Donald Helton (staff member in the Office of Nuclear Regulatory Research) at the October 2nd, 2013 ACRS [Advisory Committee on Reactor Safeguards] Full Committee Meeting on Expedited Fuel Movement (“Helton 10/02/13 Remarks to ACRS”).²²
- The Consequence Study; and
- SECY-12-0110.

Petitioners wish to emphasize that the factual basis for this Petition consists almost exclusively of the NRC Staff’s own factual statements in the above-cited documents regarding the environmental impacts of high-density pool storage of spent fuel and the cost-effectiveness of mitigation measures. There are only two exceptions to Petitioners’ exclusive reliance on those NRC documents. First, Petitioners also rely on the NRC’s regulations to the extent that they show non-conservatism by the Staff’s analyses. For instance, the Staff’s assumption in the Regulatory Analysis of evacuation in a 30 or 40 mile radius is inconsistent with NRC’s regulations limiting evacuations to a ten-mile radius.²³ The inconsistency of the Staff’s assumption with NRC regulations provides prima facie evidence that the assumption is non-conservative and improperly skews the cost-benefit analysis for mitigation measures.

Second, Petitioners rely on documents presented by non-NRC experts to the extent they are consistent with or provide further explanation for the evidence presented in the NRC documents cited above. Thus, Petitioners rely on the Declaration of 19 December 2013 by Gordon R. Thompson: Comments on the US Nuclear Regulatory Commission’s Waste Confidence Generic Environmental Impact Statement, Draft Report for Comment (September 2013) (“Thompson Waste Confidence Declaration”)²⁴ and statements by Dr. Edwin S. Lyman during the NRC’s January 6, 2014 briefing on the Staff’s recommendation regarding expedited fuel transfer. Petitioners wish to clarify that while they agree with Dr. Thompson’s and Dr. Lyman’s criticisms, this Petition does not present those criticisms as the basis for this Petition. As noted above, the basis for this Petition consists of the NRC Staff’s own statements. Petitioners respectfully submit that the Staff’s statements alone are sufficient to demonstrate the existence of new and significant information warranting reconsideration of NRC’s previous environmental analyses of spent fuel storage risks and mitigation measures.

²¹ Attachment 2 to COMSECY-13-0030 (ADAMS Accession No. ML132828632).

²² ADAMS Accession No. ML13256A342. Mr. Helton’s remarks are attached to the meeting transcript.

²³ See 10 C.F.R. § 50.47(b)(10); 10 C.F.R. Part 50, Appendix E, note 1. See also 2014/01/06 Briefing Transcript at 29 (Edwin Lyman).

²⁴ ADAMS Accession No. ML14029A351.

IV. FACTUAL AND PROCEDURAL BACKGROUND

A. History and Risks of High-Density Pool Storage of Spent Fuel

When spent fuel is discharged from a reactor of the type now used in the United States, it is initially stored under water in a pool adjacent to the reactor. The fuel assemblies are held upright in racks sitting on the floor of the pool. At each commercial reactor in the U.S., the adjacent pool is now equipped with high-density, closed-frame racks. The nuclear industry began installing these racks in the 1970s, to replace the low-density, open-frame racks previously used. The high-density racks offered a comparatively cheap option for storing a growing nationwide inventory of spent fuel.²⁵

At each commercial reactor in the U.S., fuel takes the form of long, narrow tubes made of zirconium alloy (i.e., zircaloy), containing uranium oxide pellets. A group of these tubes makes up a fuel assembly. The zircaloy tubes are often referred to as fuel “cladding.” Zircaloy has the property that at a comparatively high temperature (*e.g.*, about 900 °C) it can begin reacting exothermically (i.e., with production of heat) with either air or steam.²⁶

Spent fuel generates internal heat from decay of radioactive isotopes. When the fuel is under water in a normally functioning pool, the decay heat enters the surrounding water, which is in turn cooled by pumping it through heat exchangers. However, if the water level were to fall below the top of the fuel, the fuel temperature would begin to rise. This temperature rise would be exacerbated by storage of spent fuel in high-density, closed-frame racks, as is now universally practiced in the USA. The fuel temperature could continue rising to the point at which an exothermic reaction of zircaloy with air or steam would begin. That reaction could then accelerate, in a runaway process. In this manner, loss of water from a pool could lead to a self-propagating exothermic reaction of zircaloy cladding with air or steam. That phenomenon is often referred to as a “pool fire.” Conditions determining the onset and progression of a pool fire would include the timing of water loss and the level of decay heat production in the fuel. The level of decay heat production declines with increasing age of the fuel after discharge from a reactor.²⁷

²⁵ Thompson Waste Confidence Declaration., ¶ I-7.

²⁶ *Id.*, ¶ I-8.

²⁷ *Id.*, ¶ I-9.

B. History of NRC’s Consideration of Spent Fuel Pool Fire Risks in Reactor Licensing and License Renewal Proceedings

To Petitioners’ knowledge, there are only two GEISs that discuss the risks of catastrophic accidents in high-density fuel storage pools at operating reactors: the License Renewal GEIS and the Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel (NUREG-0575, August 1979) (“Spent Fuel Handling and Storage GEIS”). While new reactor licensing EISs assert that spent fuel storage does not pose significant adverse environmental impacts, they contain no discussion of spent fuel pool fire risks. Nor do EAs prepared by the NRC for certified new reactor designs address environmental impacts of any kind. Instead, these EAs are limited to a discussion of mitigation measures for severe accidents, or SAMDAs. These SAMDAs are for reactor accidents only, and do not include SAMDAs for pool fires.

1. Spent Fuel Handling and Storage GEIS

In the Spent Fuel Handling and Storage GEIS, the NRC “examine[d] alternative methods of spent fuel storage as well as the possible restriction or termination of the generation of spent fuel through nuclear power plant shutdown.”²⁸ In a number of license amendment proceedings, the NRC used this GEIS to support EAs for allowing the re-racking of spent fuel pools to provide for high-density storage racks.²⁹ The 1979 GEIS included a brief discussion of fire risks in high-density storage pools, concluding they were insignificant.³⁰ The time frame covered by the Spent Fuel Handling and Storage GEIS extended only to the year 2000 and assumed that inventories of spent fuel that were building up at reactor sites would be transferred to a repository by then.³¹

2. EISs for initial reactor licensing and EAs for design certification

Severe accident risks posed by high-density storage of spent fuel in reactor pools are not addressed in EISs for initial licensing of reactors, including reactor license applications submitted under 10 C.F.R. Part 50 and combined license applications submitted under 10 C.F.R. Part 52. In the Final EIS for the proposed Watts Bar Unit 2 reactor, for example, risks of spent fuel pool fires are not discussed at all, other than to make the following very general statement in response to a comment about accident risks posed by high-density pool storage of spent fuel:

²⁸ *Id.* at ES-1.

²⁹ *See e.g.*, Environmental Assessment and Finding of No Significant Impact by the Office of Nuclear Reactor Regulation Relating to the Spent Fuel Pool Facility Operating License No. DPP-28, Vermont Yankee Nuclear Power.

³⁰ Spent Fuel Handling and Storage GEIS at 4-20 – 4-21.

³¹ *Id.* at ES-1 – ES-3.

The NRC is committed to ensuring that both spent nuclear fuel and high-level radioactive wastes are managed to prevent health impacts to the public. Spent nuclear fuel is currently stored safely at reactor sites in the spent fuel pools and/or independent spent fuel storage installations (ISFSIs). This practice is expected to continue until the U.S. Department of Energy is ready to take possession of the spent nuclear fuel. At this time, it is uncertain when this will happen. Interim storage needs for spent nuclear fuel vary among plants, with older units having less available pool storage capacity than newer ones. However, given the uncertainty as to when a geologic repository will open and lack of other options, it is likely that some sort of expanded spent fuel storage capacity beyond the original design capacity will be needed at all nuclear power plants.

As discussed in Section 4.10.1, the impacts of storing spent nuclear fuel when the reactor is operating are addressed on an ongoing basis as part of reactor operations or under a separate license for an ISFSI. Current and potential environmental impacts from spent fuel storage onsite during the licensed operating period at the current reactor sites have been studied extensively by the NRC and are well understood.³²

For combined license applications, the NRC treats the safety and environmental impacts of spent fuel storage as a generic design issue that may not be raised in individual licensing proceedings.³³ The only environmental documents prepared for these generic designs are EAs, not EISs. The scope of the EAs is limited to consideration of SAMDAs for severe reactor accidents and does not include consideration of spent fuel pool accidents. For instance, the EA for the AP1000 design, which is the principal design now under consideration in new reactor licensing proceedings, does not discuss severe accident mitigation alternatives for spent fuel pools.³⁴

3. License Renewal GEIS

The NRC issued the first version of the License Renewal GEIS in 1996.³⁵ The 1996 License Renewal GEIS concluded that the environmental risks of storing spent fuel for an additional 20

³² Final Environmental Statement Related to the Operation of Watts Bar Unit 2 at E-90 (NUREG-0498, Supp. 2, Vol. 2, May 2013).

³³ See, e.g., *Progress Energy Carolinas, Inc.* (Sharon Harris Nuclear Power Plant, Units 2 and 3), LBP-08-21, 68 NRC 554, 572 (2008) (aff'd, CLI-10-09, 71 NRC 245, 260 (2010)).

³⁴ See Environmental Assessment by the U.S. Nuclear Regulatory Commission Relating to the Certification of the AP1000 Standard Plant Design, Docket No. 52-006 (May 2, 2007) (ADAMS Accession No. ML053250292); Environmental Assessment by the U.S. Nuclear Regulatory Commission Relating to Certification of the Amendment of the AP1000 Standard Plant Design, Docket No. 52-006 (Dec. 22, 2011) (ADAMS Accession No. ML113480019).

³⁵ Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437, May 1996) ("1996 License Renewal GEIS").

years at operating reactors were not significant.³⁶ The NRC also designated spent fuel storage impacts as a “Category 1” issue, meaning that the impacts could be resolved generically and did not require consideration of mitigation measures.³⁷

In 2006, the Commonwealth of Massachusetts and the State of California petitioned the NRC to consider the environmental impacts of spent fuel pool fires in a supplement to the 1996 License Renewal GEIS, in light of new and significant information showing that the impacts of spent fuel storage at operating reactors are significant due to the potential for and consequences of a catastrophic pool fire. The NRC denied the petition based on its own determination that spent fuel pool fires pose a “very low risk.”³⁸ The NRC also concluded that it was not necessary to analyze SAMDAs for severe accidents in spent fuel pools because the likelihood of a pool fire is very low and that mitigation strategies already had been implemented after the attacks of September 11, 2001.³⁹

The NRC published a draft revised License Renewal GEIS for comment in 2009.⁴⁰ In an appendix, the NRC addressed the environmental impacts of a pool fire, concluding they are insignificant based on their low probability.⁴¹ In its license renewal regulations, the NRC designated spent fuel pool accident risks as a “Category 1” issue, meaning it could be resolved generically and that consideration of mitigation measures was not warranted.

The Draft Revised License Renewal GEIS presented impact estimates for spent fuel pool fires in Appendix E. In the text of Appendix E, the NRC stated that the economic impacts of spent fuel pool accidents:

are related to the likelihood of the accidents and the cost of cleanup and food interdiction. Even with higher fuel inventories, the lower likelihood of accidents in the SFP reduces the economic impacts. For example, the UCB [upper confidence bound] economic impact identified in Table 5.31 in the 1996 GEIS from full power reactor accidents at Surry is

³⁶ *Id.* at 6-72 – 6-75. Petitioners note that in *Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), CLI-07-03, 65 NRC 13, 17 (2007) (“*Entergy*”), the NRC Commissioners erroneously stated that the 1996 License Renewal GEIS found the probability of a pool fire to be “remote.” In fact, the NRC has never used the word “remote” to describe the probability of a pool fire. See *FP&L*, 54 NRC at 22 (characterizing risk of spent fuel pool fires as “acceptably small”) (“FP&L”); 73 Fed. Reg. 46,204, 46,207 (Aug. 8, 2008) (aff’d, *New York v. NRC*, 589 F.3d 551 (2nd Cir. 2009)) (characterizing pool fire risks as “very low”); *New York*, 681 F.3d at 482 (noting that NRC had found the risk of pool fires to be “very low,” not “remote.”)

³⁷ *Entergy*, 65 NRC at 17, 21.

³⁸ 73 Fed. Reg. at 46,207.

³⁹ *Id.* at 46,211-12.

⁴⁰ Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Rev. 1, Draft Report for Comment (NUREG-1437, July 2009) (“2009 Draft License Renewal GEIS”).

⁴¹ *Id.* at E-32 – E-37.

approximately 1.1×10^6 dollars/yr. The worst-case economic impacts estimated in past studies for SFP accidents ranged from approximately 1.8×10^4 dollars/yr to 1.2×10^5 dollars/yr.^(a)

(a) The former estimate uses information from Tables C.95 and C.101 of NUREG/BR-0184 (NRC 1997a), while the latter uses information from Tables 5.1.1 and 5.1.2 of NUREG-1353(NRC 1989).⁴²

Neither of the two studies cited in footnote (a) quoted above contains information about how much land would be contaminated or how many people would be displaced.⁴³ Thus, it is not possible to identify or evaluate the actual physical impacts to which the economic cost estimates relate.

In Table E-18, the Draft Revised License Renewal GEIS also presented quantitative impact estimates, based on the NRC's 2001 Technical Study Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (NUREG-1738, February 2001) ("NUREG-1738").⁴⁴ But these impacts were limited to probability-weighted estimates of early fatalities and late fatalities. The table did not separately provide consequence estimates independent of probability. Nor did the table contain any information regarding the area of land that would be contaminated, the number of people who would be displaced, or how long these effects would last.

While the 2009 Draft Revised License Renewal GEIS required site-specific consideration of mitigation measures for reactor accidents, it did not analyze mitigation measures for pool fires. The NRC rejected such measures out of hand, stating that in light of the mitigation measures implemented after the 2001 attacks and the relative low likelihood of pool fires:

With respect to accidents in SFPs, the additional mitigative measures implemented following the attacks of September 11, 2001, make the potential for cost-effective SAMAs related to SFP accidents substantially less than for reactor accidents. Therefore, it is reasonable to conclude that accidents at SFPs do not need to be considered in the SAMA analysis, and no change is warranted from its current Category 1 designation in

⁴² *Id.* at E-37 (emphasis added).

⁴³ See Regulatory analysis Technical Evaluation Handbook (NUREG/BR-0184, 1997) (ADAMS Accession No. ML050190193) ("NUREG/BR-0184"); Regulatory Analysis for the Resolution of Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools" (NUREG-1353, 1989) ("NUREG-1353") (NRC Accession No. ML082330232).

⁴⁴ *Id.* at E-33.

Table B-1. Accordingly, the current SAMA process is considered adequate for use in future SAMA analyses.⁴⁵

In addition, the Draft Revised License Renewal GEIS contained no information or analysis about the effect of reactor accidents on spent fuel pool accident risks.

In June of 2013, the NRC issued the Revised License Renewal GEIS in final form. The 2013 Revised License Renewal GEIS repeated practically verbatim the analysis and quantitative estimates of pool fire impacts that had appeared in the draft version.⁴⁶ It also repeated the statement in the 2009 draft revised License Renewal GEIS that consideration of mitigation measures for spent fuel pool fires is not necessary.⁴⁷

4. Waste Confidence GEIS

In September 2013, in response to the U.S. Court of Appeals' decision in *New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012), the NRC issued the Draft Waste Confidence GEIS. The NRC plans to rely on the Waste Confidence GEIS to evaluate the post-operational impacts of spent fuel in reactor licensing decisions.⁴⁸

The Draft Waste Confidence GEIS included an analysis of the probability and consequences of a pool fire during the decommissioning period. Table F-1 estimated total onsite and offsite economic costs of a pool fire at \$55.7 – 55.8 billion.⁴⁹ But the Draft Waste Confidence GEIS did not provide estimates regarding land area rendered unfit for habitation, numbers of people who would be displaced, or how long displacement would last. Nor did it discuss the potential contribution of nearby reactor accidents to the probability of a pool fire; or mitigation measures to reduce the likelihood of a pool fire.

The comment period on the Draft Waste Confidence GEIS has closed, and the NRC expects to issue a final version in October 2014.⁵⁰

⁴⁵ *Id.* at E-42.

⁴⁶ *Id.* at E-34 – E-39.

⁴⁷ *Id.* at E-44 – E-45.

⁴⁸ *Id.* at xxiv.

⁴⁹ *Id.* (citing NUREG/BR-0184, NUREG-1353).

⁵⁰ See NRC Press Release 14-003 (Jan. 23, 2014) (ADAMS Accession No. ML14023A710).

C. Consideration of Spent Fuel Pool Fire Risks in Expedited Spent Fuel Transfer Proceeding

The NRC initiated the Expedited Spent Fuel Transfer Proceeding in 2012, as part of its response to the Fukushima Daichii nuclear reactor disaster. In light of the concerns that arose during the Fukushima accident regarding the integrity of the fuel pools and their vulnerability to a catastrophic fire, the NRC Commissioners ordered the Staff to investigate whether it should order the immediate transfer of spent fuel from high-density pool storage to dry storage.⁵¹ In the course of the Expedited Spent Fuel Transfer Proceeding, the NRC Staff conducted the Consequence Study and the Regulatory Analysis.

1. Consequence Study

In the Consequence Study, the Staff evaluated the probability and consequence of a spent fuel pool fire caused by a severe earthquake at the Peach Bottom nuclear reactor.⁵² While the scope of the study was narrowly focused on a single reactor and a single accident initiator, the NRC Staff claimed that it could be used to make generalizations about spent fuel fire risks at all U.S. reactors.⁵³

The Consequence Study acknowledged that the likelihood of spent fuel pool fires could be affected by reactor accidents.⁵⁴ But the Staff omitted this issue from the Consequence Study “because of the existing limitations with the available computational tools.”⁵⁵ For this reason, the Consequence Study also omitted any analysis of the effects of a hydrogen combustion event from a concurrent reactor accident.⁵⁶ The Staff asserted, however, that it planned to evaluate the effect of reactor accidents “in the framework of a multiunit Level 3 PRA for Vogtle Electric Generating Plant Units 1 and 2.”⁵⁷

Petitioners assert that the Consequence Study grossly underestimated the probability of a spent fuel accident.⁵⁸ Nevertheless, despite its significant defects, the Consequence Study presented

⁵¹ COMSECY-13-0030 at 2-4.

⁵² *Id.* at 4.

⁵³ *Id.* at iii-iv.

⁵⁴ Consequence Study at 29.

⁵⁵ *Id.*

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ Declaration of 1 August 2013 by Gordon R. Thompson: Comments on the US Nuclear Regulatory Commission’s Draft Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a US Mark I Boiling Water Reactor (ADAMS Accession No. ML13225A3971); letter from Diane Curran to Cindy Bladey, NRC, re: Comments on Draft Consequence Study, NRC-2013-013 (August 1, 2013) (ADAMS Accession No. ML13225A3971).

estimates of pool fire consequences that are far more complete and more grave than any consequence estimates previously issued by the NRC. In Table 62, for instance, the Consequence Study estimates that between 170 and 9,400 square miles of land could be temporarily interdicted (*i.e.*, rendered uninhabitable for as long as 30 years) and one to 83 square miles of land could be permanently condemned.⁵⁹ In Table 33, the Consequence Study also estimated that 4.1 million people could be displaced “long-term,” *i.e.*, for decades, by an unmitigated spent fuel pool fire in a high-density pool.⁶⁰ No previous EIS or GEIS for spent fuel storage impacts has provided such information regarding the potentially drastic impacts of a pool fire.

The Consequence Study evaluated two different patterns of pool storage of spent fuel: high-density storage in a 1 x 4 configuration and “low-density” storage in high-density closed-frame racks.⁶¹ The Consequence Study did not examine re-racking of spent fuels to substitute open-frame low-density racks, because “[r]e-racking the pool would represent a significant expense, along with additional worker dose, and was not felt to be the likely regulatory approach taken based on consultation with the Office of Nuclear Reactor Regulation.”⁶² The study did not provide any information about the expense of re-racking or why it was considered “significant.” The Consequence Study concluded that the likelihood of a radiological release due to a spent fuel pool fire was “equally low” for a high-density pool and a “low-density” pool (*i.e.*, high-density pool with some fuel removed.)⁶³

In the Consequence Study, the NRC acknowledged for the first time that the likelihood of spent fuel pool fires could be affected by reactor accidents.⁶⁴ The NRC explained:

Along with the possibility of a concurrent SFP and reactor accident, there is the possibility for a concurrent accident at the SFP of one unit with an accident at the SFP or reactor of the other unit. Again, a large seismic event or a severe weather SBO are the events that are most likely to lead to a multiunit event. In general, if accidents at both SFPs proceed in similar manners and similar timeframes, and both pools have similar inventories of spent fuel, then the resulting source term from a dual-unit event would be roughly twice the single-unit source term. In reality, this type of perfect symmetry is unlikely because the two (or more) SFPs are very unlikely to have the same total pool heat load or peak assembly heat load. (Recall that for multiunit sites, the reactors did not usually start operation at the same time and outages are intentionally staggered.) Even if

⁵⁹ *Id.* at 232. Table 62 also shows that previous NRC studies focused on radiation doses and did not include this information.

⁶⁰ *Id.* at 162 (Table 33).

⁶¹ *Id.* at 23.

⁶² *Id.* See also *id.* at 31.

⁶³ *Id.* at vii.

⁶⁴ *Id.* at 29.

this symmetry did exist, the offsite consequences would not follow a linear scaling because of a number of nonlinearities associated with that portion of the analysis.⁶⁵

However, the NRC asserted that “capturing these effects was not a focus of this study,” because of “the existing limitations with the available computational tools.”⁶⁶ Instead, the NRC asserted that “future work” in a Level 3 PRA for Vogtle Units 1 and 2 “will attempt to more rigorously treat these effects.”⁶⁷

2. Regulatory Analysis

In Appendix D of the Consequence Study, the NRC Staff presented a “Regulatory Analysis,” whose purpose was “to inform NRC decision makers whether there is a substantial increase in the overall protection of the public health and safety, and whether the direct and indirect costs of implementation are justified in view of a potential substantial increase in protection.”⁶⁸ The NRC concluded that the safety benefits of transferring spent fuel out of high-density pools were not great enough to justify the action under the backfit rule.⁶⁹ Although the Staff reasoned that no further analysis was required, nevertheless it conducted an analysis of whether the safety benefits would outweigh the costs:

As discussed above, the NRC has determined that the reference plant would not achieve a substantial increase in the protection of public health and safety from a change to low-density spent-fuel-pool storage. The NRC has therefore determined that imposing a requirement to use only low-density spent fuel pool storage at the reference plant would not meet the requirements of the backfit rule. However, to ensure that there is a complete discussion of these issues, the NRC has drafted an analysis of the costs associated with imposing these requirements as a backfit for illustrative purposes. This analysis of the direct and indirect costs of implementing the new requirements provides an assessment of the costs associated with imposing these requirements and the relative safety benefits in terms of the NRC’s backfit rule.⁷⁰

Based on the cost-benefit analysis, the NRC concluded that the safety benefits of expedited transfer did not outweigh the costs. As the Staff explained:

[A] requirement for low-density spent fuel storage alternative does not achieve a cost-beneficial increase in public health and safety for the reference plant using the current regulatory framework when all event initiators, which may challenge spent fuel cooling

⁶⁵ *Id.*

⁶⁶ *Id.*

⁶⁷ *Id.*

⁶⁸ *Id.* at 3.

⁶⁹ *Id.* at D-44.

⁷⁰ *Id.*

or pool integrity, are considered. Furthermore, the three sensitivity studies provided in section D.4.1.4 also showed that the low-density spent fuel storage alternative was not cost-justified for any of the discounted sensitivity cases.⁷¹

3. Dissenting views submitted by NRC Staff members

After the NRC Staff issued the Consequence Study, two members of the Staff who had participated in the Consequence Study – Donald Helton and Brian Wagner -- published dissenting views criticizing the use of inappropriate criteria and non-conservative assumptions in the Regulatory Analysis. For instance:

- Mr. Helton and Mr. Wagner both asserted that the Regulatory Analysis is nonconservative because its geographic scope is truncated to 50 miles.⁷² Mr. Wagner criticized the 50-mile limit of the analysis as “arbitrary and technically indefensible.” As Mr. Wagner explained:

Guidance in NUREG/BR-0058 indicates that a 50 mile truncation should be used for nuclear power plants but that the appropriate distance for other facilities should be decided on a case-by-case basis. For SFP accidents in high density pools, which are expected to release much more material than reactor accidents, this truncation can decrease the calculated consequences by nearly a factor of 10.⁷³

- Mr. Helton also criticized the Regulatory Analysis’ use of a “dated” dose conversion factor” of \$2,000 per person-rem, which should be increased to \$4,000 per person-rem.⁷⁴ Mr. Wagner agreed, stating:

The regulatory analysis uses \$2000/person-rem as the baseline. It is known that a change in guidance is imminent that would change this value to the \$4000-\$5000/person-rem range to be more consistent with the practices of other agencies.⁷⁵

⁷¹ *Id.* at D-50.

⁷² Helton 10/02/13 Remarks to ACRS, ¶ 2; Wagner Nonconcurrency, ¶ 3.

⁷³ *Id.*

⁷⁴ Helton 10/02/13 Remarks to ACRS, ¶ 2.

⁷⁵ Wagner Nonconcurrency, ¶ 2. At the January 6, 2014, Commission briefing, Fred Schofer of the NRC Staff stated that the Staff is considering an even higher value for avoided person-rem of \$5,000. *Id.* at 124.

- Mr. Wagner and Mr. Helton both questioned the Staff's use of quantitative health objectives ("QHOs") as criteria for the evaluation of the benefits of expedited spent fuel transfer.⁷⁶ As Mr. Wagner explained:

The regulatory analysis answers the substantial safety enhancement question by comparing to the Quantitative Health Objectives (QHOs) found in the Safety Goal Policy Statement. Though this is standard practice, the QHOs were developed for reactor accidents and are not well suited for making this determination for SFP accidents. SFP accidents in high density pools can lightly contaminate very large areas, displacing millions of people and requiring extensive protective actions. Conversely, the individual LCF risk from 0-10 miles is relatively low, even for the largest releases. SFP releases would have to occur with a frequency greater than 10^{-3} per year to approach the safety goals (100x higher than the Large Early Release Frequency subsidiary objective used for reactors.) While an alternative measure of a substantial safety enhancement is not readily available, one informative metric is that, for some 'high estimate' cases, the proposed alternative results in nearly a billion dollars in frequency-weighted safety benefits. The SECY paper should acknowledge the significant limitations of applying the QHOs to non-reactors to provide The (sic) Commission with relevant information to inform their decision.⁷⁷

Mr. Helton urged the NRC Staff to:

seek Commission direction on the use of quantitative health objectives for an individual as a suitable measure of substantial safety enhancement for classes of accidents known to be low-likelihood, high consequence events, particularly when this determination causes the staff to dismiss cost-beneficial or potentially cost-beneficial alternatives.⁷⁸

- In general, Mr. Wagner also criticized the manner in which conservatisms were used and described in the Regulatory Analysis:

Though the Regulatory Analysis contains an appropriate range of estimates and sensitivity results, both the 'Decision Rationale' section of the regulatory analysis and the discussion of the results in the COMSECY transmitting the regulatory analysis fail to provide a balanced view of the range of results. There are several examples of this:

⁷⁶ Helton Remarks to ACRS, ¶ 6; Wagner Nonconcurrency, ¶ 5.

⁷⁷ Wagner nonconcurrency, ¶ 5.

⁷⁸ Helton Statement to ACRS, ¶6.

- The COMSECY states that conservative assumptions are used in the regulatory analysis without making it clear that conservatives are primarily to account for variations within the group considered in the high estimates. The base case estimates represent a point estimate and contain a few minor conservatisms. The base case estimates do not bound the group of SFPs.
- The COMSECY states ‘it is unlikely that individual plants would meet or exceed the most conservative assumptions made in these sensitivity cases within the regulatory analysis.’ This is highly misleading. The cases referenced are extremely cost-beneficial so a pool even approaching these assumptions would be very cost beneficial.
- The ‘Decision Rationale’ section of the regulatory analysis states there are other considerations discussed in Section 4.5.10 that would further decrease the benefits and make the proposed alternative less cost-justified. Though some of the items discussed would clearly decrease the benefits (e.g. credit for mitigation) others could increase or decrease the benefits. The list omits considerations which would increase the benefits such as relaxing the potentially optimistic assumptions that extensive protective actions are effective following a severe seismic event.
- The analysis concludes that the alternative is not cost-beneficial by apparently focusing on the base case estimate truncated at 50 miles and using \$2000/person-rem. Results that are cost-beneficial are downplayed as resulting from combinations of high estimates ‘sensitivity studies and some combinations of high estimates ... such that, in a few cases, the benefits ... appear to be cost beneficial.’ This is inconsistent with the results of the regulatory analysis which are: all high estimates are cost beneficial regardless of what other assumptions are used; and, when considering all consequences and an updated value of \$4000/person-rem, all base cases are essentially cost neutral.”⁷⁹
- Mr. Helton and Mr. Wagner also criticized the Regulatory Analysis for evaluating only one alternative rather than an adequate array. As stated by Mr. Wagner:

Contrary to NUREG/BR-0058, ‘Regulatory Analysis Guidelines of the US NRC’ guidance which recommends that ‘the range of all potentially reasonable and practical approaches to the problem are considered,’ only a single alternative is considered. Other alternatives may be more cost beneficial. For example, transferring less fuel or discharging into an Ix8 pattern may yield the same benefits while costing significantly less than the analyzed alternative. Both the draft Spent Fuel Pool Study (ML13133A 132) and the ACRS letter

⁷⁹ *Id.*, ¶ 7.

(MLI3224A060) recommended further analysis of the Ix8 fuel pattern. The draft COMSECY transmitting the regulatory analysis claims this would not provide a substantial safety enhancement despite it not being analyzed (or even mentioned) in the attached regulatory analysis.⁸⁰

In addition, Mr. Helton criticized the Regulatory Analysis for failing to consider a range of “related alternatives,” including “expedited movement of fuel older than ten years, refinement of spent fuel pool heat load management requirements) that might be more cost-beneficial.”⁸¹

4. COMSECY-13-0030 and revised Regulatory Analysis

On November 12, 2013, in COMSECY-13-0030, the Staff formally issued a recommendation to the NRC Commissioners to end further inquiry into the question of whether to order the expedited transfer of spent fuel from high-density pool storage into dry storage. Attached to COMSECY-13-0030 was the Staff’s revised Regulatory Analysis, in which it responded to Mr. Helton’s and Mr. Wagner’s criticisms. In response to Mr. Helton’s and Mr. Wagner’s criticisms of the 50-mile area and \$2,000 per person-rem assumptions, for instance, the NRC conducted sensitivity studies analyzing effects of pool fires an unspecified distance beyond 50 miles and using a \$4,000 per person-rem assumption. The Staff also added a sensitivity study of the alternative of using a 1 x 8 array in a high-density storage pool.

In every one of 11 cases examined by the NRC in these sensitivity studies, expedited transfer of spent fuel was found to be beneficial in comparison to its costs.⁸² As the NRC explained:

Sensitivity studies were also conducted on key factors such as the dollars per person-rem conversion factor, population density, habitability criteria and consideration of consequences beyond 50 miles to measure each attribute’s effect upon the overall result. The sensitivity of the dollars per person-rem conversion factor is important to consider because related guidance is currently being updated. The sensitivity of consequences beyond 50 miles is important to consider for accidents involving SFP fires, as the spread of radioactive materials could extend over long distances. The supporting analysis used key insights from operating experience, the October 2013 SFP study, and previous studies on SFP safety, such as the plant damage state for seismic events, probability of a release for specific pool damage states, and the expected amount and type of radioactive material released. The various cases and sensitivity studies show that while the impacts on public health and safety for an average individual are, for the most part, very low, collective dose and economic consequences for these low probability events can be very

⁸⁰ Wagner Nonconcurrency, ¶ 1.

⁸¹ Helton 10/02/13 Statement to ACRS, ¶ 4.

⁸² Regulatory Analysis at 44-51, Tables 20 through 30.

large. The combination of high estimates for important parameters assumed in some of the sensitivity cases presented in Enclosure 1 result in large economic consequences, such that, the calculated benefits from expedited transfer of spent fuel to dry cask storage for those cases outweigh the associated costs (see Section 4.4.1.4 in enclosed regulatory analysis).⁸³

In spite of the results of the sensitivity studies, the NRC Staff concluded in the Regulatory Analysis that the “safety benefits” of expedited spent fuel transfer did not justify the costs. As explained in COMSECY-13-030, “there is only a limited safety benefit when using the QHOs and the expected implementation costs would not be warranted.”⁸⁴ The Staff also cited NRC guidance that “economic consequences should not be treated as equivalent in regulatory character to matters of adequate protection of public health and safety.”⁸⁵

5. Commission briefing and follow-up

On January 6, 2014, the NRC Staff briefed the NRC Commissioners regarding COMSECY-13-0030 and its recommendation against further study of whether the NRC should order expedited transfer of spent fuel from high-density fuel pools. In addition, the Commission heard presentations by Dr. Thompson, Dr. Lyman, and officials from Dominion Nuclear and EPRI.

At the Commission briefing, the NRC Staff updated the Commissioners on the status of its Level 3 PRA regarding the degree to which reactor accidents may affect spent fuel pool accidents. The Staff confirmed that the Vogtle Level 3 PRA is underway and that the Staff is “already doing the analysis for spent fuel pool.”⁸⁶ A planning document for the PRA shows that the NRC has planned it in such a way that important results will be available before the final product is completed.⁸⁷

After the briefing, the Commissioners issued a Staff Requirements Memorandum (“SRM”) requesting additional information from the Staff regarding international research on spent fuel hazards and how the international community handles the storage of spent fuel at reactor sites.⁸⁸

⁸³ COMSECY-13-0030 at 7 (footnote omitted).

⁸⁴ *Id.*

⁸⁵ *Id.* (citing SRM-12-0110). In SRM-12-0110, the Commission reiterated its longstanding policy that “economic consequences should not be treated as equivalent in regulatory character to matters of adequate protection of public health and safety.” *Id.* at 1.

⁸⁶ Transcript of Commission Briefing on Spent Fuel Safety and Consideration of Expedited Transfer of Spent Fuel to Dry Casks at 119 (Jan. 6, 2013) (Hossein Esmaili) (“2014/01/06 Briefing Transcript”) (ADAMS Accession No. ML14008A249).

⁸⁷ See Technical Analysis Approach Plan cited in note 13, *supra*.

⁸⁸ Memorandum from Annette Vietti-Cook, NRC Secretary, to Mark A. Satorius re: Staff Requirements – Briefing on Spent Fuel Pool Safety and Consideration of Expedited Transfer to Dry Cask Storage, Etc.

V. NRC MUST CONSIDER THE NEW AND SIGNIFICANT INFORMATION GENERATED DURING THE EXPEDITED TRANSFER PROCEEDING IN ITS REACTOR LICENSING AND LICENSE RENEWAL PROCEEDINGS AND IN RULEMAKINGS FOR CERTIFICATION OF STANDARDIZED REACTOR DESIGNS.

A. The Information is New and Significant Information and Therefore Must Be Considered in Pending Reactor Licensing and License Renewal Proceedings and in Standardized Design Certification Proceedings.

Before making any reactor licensing decision, the NRC must take a “hard look” at that decision’s environmental consequences.⁸⁹ NEPA also requires agencies to balance the costs and benefits of the proposed action and to compare the costs and benefits of a reasonable array of alternatives.⁹⁰ An agency that has prepared an EIS “cannot simply rest on the original document,” but must be “alert to new information that may alter the results of its original environmental analysis, and [must] continue to take a ‘hard look’ at the environmental effects of [its] planned action, even after a proposal has received initial approval.”⁹¹ Even where the impacts of a proposed licensing action have been studied and reported in an EIS, NEPA requires the agency to issue a supplement addressing the implications of any new information that could significantly affect its outcome.⁹²

Here, “new and significant information” is presented by the NRC’s findings in the Expedited Spent Fuel Transfer Proceeding regarding the enormous size of the land area that could be rendered inhabitable, the number of people who could be displaced long-term by a relatively small release from the Peach Bottom reactor, the cost-beneficial nature of some mitigation measures, and NRC’s recognition that the likelihood of pool fires may be affected by reactor accidents.⁹³

(Jan. 23, 2014) (ADAMS Accession No. ML14023A271).

⁸⁹ *Baltimore Gas & Electric v. NRDC*, 462 U.S. 87, 97 (1983); *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

⁹⁰ *Calvert Cliffs' Coordinating Comm. v. United States Atomic Energy Comm'n*, 449 F.2d 1109, 1113 (D.C. Cir. 1971); *Pa'ina Hawaii, LLC* (Docket No. 30-36974-ML), CLI-10-18, 72 NRC 56, 75 (2010) (“When preparing an EIS, [the NRC] must ‘[r]igorously explore and objectively evaluate all reasonable alternatives.’”).

⁹¹ *Friends of the Clearwater v. Dombeck*, 222 F.3d 552, 557-58 (9th Cir. 2000) (quoting *Marsh*, 490 U.S. at 373-74).

⁹² *Marsh*, 490 U.S. at 371.

⁹³ 10 C.F.R. § 51.92. See also *Marsh*, 490 U.S. at 371.

1. The information is new.

The information is new because the NRC has not previously addressed the information in environmental studies for reactor licensing and re-licensing or for certification of standardized designs. See discussion above in Section IV.B. The Licensing Renewal GEIS focuses on early fatalities and latent cancers. While the 2013 Revised License Renewal GEIS makes estimates of economic damage, it is not clear what assumptions underlie those estimates. For instance, it is impossible to determine what NRC assumes regarding how much land is contaminated, how many people are dislocated, or for what length of time these effects will persist. And there is no indication that the NRC considered the cost of the socioeconomic catastrophe that would occur if 4.1 million people were displaced for 30 years.

Finally, the text of the Revised License Renewal GEIS implies that NRC's consideration of these costs in the License Renewal GEIS was probability-weighted: in the course of discussing economic impacts, the GEIS states that "[t]hese impacts are related to the likelihood of the accidents. . . ."⁹⁴ Given the ambiguity of this language, it is impossible to determine how considerations of probability affected the consequence analysis in the 2013 Revised License Renewal GEIS. Accordingly, it is not possible to say that the 2013 Revised License Renewal GEIS considered spent fuel pool accident consequences that had any similarity to the consequences revealed by the Expedited Spent Fuel Transfer Proceeding. Thus, to the limited extent that the NRC has presented information about the consequences of a pool fire in the License Renewal GEIS, it has distorted those consequences by discounting them *ab initio*, based on their estimated probability. This approach is inconsistent with the Court of Appeals' ruling in *New York*, that NRC must "put the weight on both sides of the scales."⁹⁵

2. The information is significant.

The information is significant because in two important respects, it could affect the outcome of reactor licensing decisions, license renewal decisions, and standardized design certification rulemakings. First, the information calls into question the finding in the 2013 Revised License Renewal GEIS and Table B-1 that environmental impacts of spent fuel pool are insignificant, because it undermines previous NRC determinations regarding both the probability and the consequences of pool fires. As the U.S. Court of Appeals recognized in *New York*, both of these elements of risk must be addressed in an EIS.⁹⁶ The NRC's recognition of reactor accidents as potential initiators of pool fires demonstrates that the probability of a pool fire may be greater than previously estimated. If this concern is borne out, by itself it could change the designation of spent fuel pool fires from insignificant to significant. It could also change the designation of spent fuel pool fires from Category 1 to Category 2, requiring the consideration of mitigation

⁹⁴ See discussion above at 16 and 2013 Revised License Renewal GEIS at E-37.

⁹⁵ *New York*, 681 F.3d at 482.

⁹⁶ 681 F.3d at 482.

measures.⁹⁷

Second, setting aside the question of the increased probability of a pool fire, the sensitivity studies performed in the Regulatory Analysis already show that the consequences of a radiological release of even a fraction of the cesium in a spent fuel pool fire are so severe that mitigation is warranted, even if the probability of a spent fuel pool fire is low. As a result, the catastrophic consequences of a pool fire may tip the cost-benefit analysis in favor of mitigation. As Mr. Wagner pointed out in the Wagner Nonconcurrency, the “proposed alternative” of removing spent fuel from high-density storage pools “results in nearly a billion dollars in frequency-weighted safety benefits.”⁹⁸ The benefit will be even greater when the NRC conducts a cost-benefit analysis that fully considers environmental values and is not restricted to Atomic Energy Act-based health and safety values.⁹⁹ Thus, the Regulatory Analysis’ revelation of cost-beneficial measures for mitigation of pool fires calls for a new NEPA analysis of SAMDAs for spent fuel pool fires in reactor licensing decisions and in rulemakings for standardized design certifications.¹⁰⁰

B. The NRC Staff’s Finding That the New Information Does Not Meet the Backfit Standard is Not Equivalent to a NEPA Finding Regarding New and Significant Information.

Petitioners respectfully submit that the NRC Staff’s determination that the new information cited above does not satisfy the backfit standard is in no way equivalent or comparable to a NEPA determination of whether the information is new and significant for purposes of revisiting reactor licensing decisions. In COMSECY-13-0030, the NRC Staff applied the agency’s backfit regulation and the NRC’s Safety Goal policy to conclude that the safety benefit of expediting the transfer of spent fuel from high-density pools to dry storage was not sufficient to satisfy the NRC’s backfit regulations and that the safety benefits of expedited spent fuel transfer did not outweigh its costs.¹⁰¹

The Staff made its recommendations under the Atomic Energy Act and NRC implementing regulations and policies, which focus exclusively on public health and safety.¹⁰² The Staff did

⁹⁷ See *Entergy, supra*, 65 NRC at 21.

⁹⁸ Wagner Nonconcurrency, ¶ 5.

⁹⁹ See discussion below in Section V.C.

¹⁰⁰ *Pa’ina Hawaii, LLC* (Docket No. 30-36974-ML), CLI-10-18, 72 NRC 56, 75 (2010) (“When preparing an EIS, [the NRC] must ‘[r]igorously explore and objectively evaluate all reasonable alternatives.’”).

¹⁰¹ COMSECY-13-0030 at 1-2.

¹⁰² See COMSECY-13-0030 at 1, Regulatory Analysis at 1-4. See also 10 C.F.R. § 50.109; NRC Safety Goals for the Operation of Nuclear Power Plants, 51 Fed. Reg. 28,044 (Aug. 4, 1986) as corrected and republished at 51 Fed. Reg. 30,028 (Aug. 21, 1986); SRM-12-0110.

not consider the broader environmental benefits protected by NEPA, such as health of the non-human environment and non-health-related social benefits. In fact, the NRC Staff decided that it would be inconsistent with NRC policy to allow non-safety-related benefits to play a decisive role in the cost-benefit analysis. As the Staff explained in the Regulatory Analysis:

The significant difference between the calculated consequences of a SFP accident and a reactor accident has led some stakeholders to propose alternate performance measures to help in the decisionmaking process. Such measures could include a revised consideration of economic consequences, collective dose to populations, or other estimates that reflect the large consequences and reduce the influence of the low event frequencies and implementation of protective actions in assessing the overall societal risks associated with SFP accidents. However, the Commission has previously directed that these performance measures should be consistent with the overall safety goals the Commission policy established and should not be so conservative that it creates a *de facto* new policy.[footnote omitted] In addition, the Commission stated in the staff requirements memorandum for SECY-12-0110, “Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission’s Regulatory Framework,” that developing guidance for other regulatory applications should be limited and should be resourced as a lower priority than applying State-of-the-Art Reactor Consequence Analyses (SOARCA) insights and improving guidance and analysis tools.¹⁰³

In other words, the Commission would have to decide upon a major policy shift before it would allow backfit decisions to be heavily influenced by considerations of nonradiological harm to members of the public such as the sociological effects of displacing millions of people for decades.

NEPA’s concerns, however, are much broader than public health and safety. NEPA requires the NRC to consider a full range of environmental impacts before licensing or re-licensing a nuclear reactor. These impacts include effects on environmental quality, society, culture, and

¹⁰³ *Id.* at 10 (citing Memorandum from Samuel J. Chilk, Secretary to Victor Stello, Jr. EDO and William C. Parler, General Counsel, re: Commission Guidance on Implementation of the NRC’s Safety Goal Policy (Nov. 6, 1987)). The memorandum states in relevant part:

The Commission supports the ACRS recommendation for the formulation of a hierarchical structure among the interrelated criteria in the overall goal. Additionally, the subordinate levels in this hierarchical structure should not be so conservative that it creates a de facto new policy.”

Because the memorandum is not posted on ADAMS or any of the other NRC document collections, Petitioners have included it as an attachment to this Petition.

economics.¹⁰⁴ Whether or not the information presented in this Petition is sufficient to warrant safety upgrades to all operating reactors under the backfit rule, it demonstrably constitutes “new and significant information” that must be applied to reactor licensing and license renewal decisions under 10 C.F.R. § 51.92.

C. The NRC Must Apply the Rule of Reason and Consider All Relevant Information in a New Environmental Study.

As discussed above, NEPA requires that agencies must take a “hard look” at environmental problems.¹⁰⁵ In order to satisfy the “hard look” standard, the agency must take into consideration the “best available information” it has at the time of its decision.¹⁰⁶ In addition, in balancing a project’s economic benefits against its costs, an agency must avoid making misleading economic assumptions, which “impair[] the agency's consideration of the adverse environmental effects of a proposed project.”¹⁰⁷

Consistent with these requirements, the NRC should conduct a new environmental analysis of spent fuel pool environmental risks and mitigation alternatives, ensuring that it takes into account all of the new information generated by the Expedited Spent Fuel Transfer proceeding and that all of the assumptions underlying its analysis are based on up-to-date and reasonably accurate information. In addition, the NRC must also take into account the opinions of experts inside and outside the agency, such as Mr. Helton, Mr. Wagner, Dr. Lyman, and Dr. Thompson.¹⁰⁸

In particular, the environmental analysis should take into consideration the following information:

- The NRC should take into account all new information generated to date by the NRC’s Level 3 PRA for Vogtle Units 1 and 2. At the Commission briefing on January 6, 2014, the NRC Staff confirmed that it is “already doing the analysis for spent fuel pool.”¹⁰⁹

¹⁰⁴ See Environmental Standard Review Plan at 5-8.2-5 (NUREG-1555, Oct. 1999) (an EIS should “[d]escribe any unique changes predicted to occur in the social and political structure and character of impacted communities, labor force mobility, and residential choices and describe the mechanisms available to these communities to plan for and accommodate change induced by plant operation. Include the socioeconomic effects in any analysis of potential plant accident scenarios”); *Massachusetts v. U.S. Nuclear Regulatory Com’n*, 708 F.3d 63, 68 n.5 (1st Cir. 2013) (considerations in cost-benefit analyses include “averted costs such as public exposure, offsite property damage, occupational exposure costs, cleanup and decontamination costs, and replacement power costs”).

¹⁰⁵ *Baltimore Gas & Electric*, 462 U.S. at 97; *Robertson*, 490 U.S. at 350.

¹⁰⁶ *Town of Winthrop v. FAA*, 535 F.3d 1, 9-13 (1st Cir. 2008).

¹⁰⁷ *Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446 (4th Cir. 1996) (citing *South La. Envtl. Council, Inc. v. Sand*, 629 F.2d 1005, 1011-12 (5th Cir. 1980)).

¹⁰⁸ *Hughes River Watershed Conservancy*, 81 F.3d at 445.

¹⁰⁹ 2014/01/06 Briefing Transcript at 119 (Hossein Esmaili).

While the Commission’s deadline for completion of the study is not until the fall of 2015, the NRC Staff predicts that a significant amount of useful information will be available before the study is finished.¹¹⁰

- The NRC should take into consideration all comments submitted during the Expedited Spent Fuel Transfer proceeding, including comments on the Draft Consequence Study and comments made during the Commission briefing on January 6, 2014.
- In conducting a cost-benefit analysis of alternatives to storing spent fuel in high-density closed-frame storage racks, the Commission should consider a reasonable array of alternatives, including reversion to low-density spent fuel storage in open-frame racks, as were used in the past at nuclear reactors.
- In conducting a cost-benefit analysis, the NRC should use reasonable and up-to-date assumptions, including a value for avoided person-rems of \$4-5,000, as currently contemplated by the NRC.¹¹¹
- The analysis should examine all reasonably foreseeable impacts of a spent fuel pool fire, including impacts to human society and natural ecosystems and economic impacts.
- The analysis should include up-to-date methodologies for risk assessment, including consideration of findings by the French government’s Institut de Radioprotection et de Surete Nucleaire (“IRSN”) that a qualitative difference exists between larger and smaller radiological consequences.¹¹² 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. They described the massive release as “an unmanageable European catastrophe,” such that “their lower probability may not balance their catastrophic potential.”¹¹³
- As discussed above in Section V.A.1, to the limited extent that the NRC has presented information about the consequences of a pool fire in the License Renewal GEIS, it appears to have distorted those consequences by discounting them *ab initio*, based on their estimated probability. This approach is inconsistent with the Court of Appeals’ ruling in *New York* that NRC must “put the weight on both sides of the scales” in

¹¹⁰ See discussion above at 26 and note 88.

¹¹¹ See discussion above at 22.

¹¹² See Thompson Declaration, ¶¶ IV-11 – IV-16.

¹¹³ *Id.*, ¶ 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).

evaluating environmental impacts.¹¹⁴ The supplemental environmental analysis should separately address the probability and consequences of spent fuel pool fires.

- In contrast to previous environmental studies that have evaluated spent fuel pool fire risks at individual sites for only a period of a year, the new analysis should evaluate cumulative risks across all reactor sites and for all years of reactor operation.
- The impact analysis should cover the entire geographic area that may be affected by a pool fire and should not be truncated at an arbitrary distance from the reactor.
- The cost-benefit analysis should use parameters that are suitable for an assessment of spent fuel pool fire consequences. The QHOs, for example, because they focus on short-term health effects, do not provide an adequate measure of spent fuel pool accident consequences.
- The methodology and assumptions of the environmental analysis should be consistent with the law. If the NRC decides to make an assumption that is inconsistent with the law, it should explain and justify the inconsistency. For instance, the NRC should not assume that evacuation will take place out to 30 or 40 miles, because that assumption is inconsistent with the NRC's emergency planning regulations, which require evacuation out to only ten miles.¹¹⁵ If the NRC thinks that in fact the evacuation will encompass a broader area, it should explain why it has not provided for such an evacuation in its emergency planning regulations.
- The NRC should use complete and up-to-date information about the inventory of spent fuel pools in all pending license renewal cases. For instance, at the January 6, 2014 briefing, the NRC Staff revealed that it lacks the most fundamental information necessary to assess spent fuel pool accident risks: knowledge of the quantity and burnup level of spent fuel in operating reactor pools.¹¹⁶ Such an *ad hoc* approach to gathering basic information about spent fuel pool risks does not satisfy NEPA's requirements for a rigorous analysis.¹¹⁷

¹¹⁴ *New York*, 681 F.3d at 482.

¹¹⁵ See 10 C.F.R. § 50.47(b)(10) and Appendix E to 10 C.F.R. Part 50. See also remarks of Dr. Edwin Lyman, 2014/01/06 Briefing Transcript at 29.

¹¹⁶ According to NRC Staff member Steve Jones, the Staff relies on resident inspectors "to establish that information *if we needed it for a particular pool at a particular time.*" 2014/01/06 Briefing Transcript at 127-128 (emphasis added).

¹¹⁷ *Van Ee v. EPA*, 202 F.3d 296, 309 (D.C. Cir. 2000) (the "heart" of an EIS is "the requirement that an agency rigorously explore and objectively evaluate the projected environmental impacts of all reasonable alternatives for completing the proposed action.")

- The new environmental analysis should also resolve the gross discrepancies between NRC’s own descriptions of the behavior and severity of spent fuel pool fires. For instance, the Staff’s description of the behavior of a spent fuel pool fire in this proceeding cannot be reconciled with the Staff’s description of pool fire behavior in the NRC’s workbook for training emergency responders to evaluate radiological releases from various radiological accidents including pool fires.¹¹⁸ During the January 6 briefing, NRC Staff member Fred Shofer described the progress of a pool fire as follows:

The slow accident progression of a spent fuel pool fire if one should occur suggests a high confidence of evacuating the public. Coupled with the low probability of an accident, this reduces the estimated public health risk to substantially less than the quantitative health objectives even if reducing that risk further can be shown to be potentially cost effective.¹¹⁹

In contrast, in a training exercise involving a hypothetical pool fire at the San Onofre Generating Station, the RASCAL Workbook projects that a spent fuel pool fire following a major earthquake at San Onofre will cause life-threatening doses to the public within a ten-mile radius after eight to ten hours. In the scenario presented in the RASCAL Workbook:

The plant staff is calling you from San Onofre, Unit 2 because there has been an earthquake in the vicinity. The spent fuel pool has lost much of its water due to a large crack possibly flowing into a sink hole. Due to a malfunctioning pump, it has not been possible to provide enough water to make up for the loss. The water dropped to the top of the fuel at 8:49 A.M., and appears likely to continue dropping. Estimates are that the fuel will be fully uncovered by 11:00 A.M. The pool has high density racking and contains one batch of fuel that was unloaded from the reactor only 2 weeks earlier. (A batch is defined as one-third of a core) Another batch was unloaded about a year before that, and 8 batches have been in

¹¹⁸ RASCAL 3.0.5 Descriptions of Models and Methods (NUREG-1887, August 2007) (“RASCAL Workbook”) (ADAMS Accession No. ML072480633). As an important part of its preparedness and response capabilities, the NRC emergency operations center relies on a computer code to provide a rapid evaluation of the radiological impacts from accidents at nuclear power plants, spent fuel storage pools and casks. This code is a key element in deployment of emergency responders and evacuation of people within and beyond the NRC’s 10-mile radius Emergency Planning Zone (EPZ). Known as the Radiological Assessment System for Consequence Analysis (RASCAL 3.0.5), this system provides projections for atmospheric releases and off-site radiation doses. The instructional workbook for the RASCAL system provides an assessment of the consequences of a spent fuel pool fire at the San Onofre Unit 2 reactor, following a destructive earthquake.

¹¹⁹ Transcript at 100.

the pool for longer than 2 years. The spent fuel building has been severely damaged and is in many places directly open to the atmosphere.”¹²⁰

Based on this scenario, within eight to ten hours of the pool drainage the spent fuel cladding would catch fire, releasing approximately 86 million curies into the atmosphere.¹²¹ Of that release, approximately 30 percent is cesium (roughly 40 million curies).¹²² The resulting doses to people within one, five, and ten miles of the release are calculated at 5,200, 1,200 and 450 rems, respectively. These are considered to be life-threatening doses.¹²³ Thyroid doses from inhalation of radioiodine are calculated at 39,000, 1,200 and 450 rems respectively.¹²⁴ Doses from exposure to radioactive iodine would be enough to cause this organ to be destroyed.

Thus, according to the RASCAL Workbook, a spent fuel pool fire at the San Onofre reactor could result in lethal contamination of the ten-mile radius of 314 square miles surrounding the reactor. This characterization of a pool fire behavior and consequences is far more severe than the characterization of pool fires that have been presented in this expedited transfer proceeding or in the 2013 Revised License Renewal GEIS. A full NEPA analysis is required in order to resolve this serious discrepancy and lay to rest legitimate public concern about the reasons for it.

The NRC’s supplemental generic environmental analysis for new reactor licensing, license renewal, and standardized design certification must be published and circulated for comment, as required by 10 C.F.R. § 51.92(f).

VI. THE COMMISSION MUST SUSPEND ALL LICENSING DECISIONS AND THE APPLICABILITY OF NRC NEPA REGULATIONS REGARDING SPENT FUEL STORAGE IMPACTS DURING REACTOR OPERATION WHILE IT CONSIDERS THE NEW AND SIGNIFICANT INFORMATION PRESENTED IN THIS PETITION.

NEPA requires that the new and significant information cited above must be considered *before* the NRC makes decisions in pending reactor licensing and license renewal cases.¹²⁵ As the Supreme Court observed in *Marsh*:

It would be incongruous with [NEPA’s] approach to environmental protection, and with

¹²⁰ RASCAL Workbook at 116.

¹²¹ *Id.* at 118.

¹²² *Id.* at 110.

¹²³ *Id.* at 118.

¹²⁴ *Id.*

¹²⁵ 10 C.F.R. § 51.92; *Marsh*, 490 U.S. at 371.

the Act's manifest concern with preventing uninformed action, for the blinders to adverse environmental effects, once unequivocally removed, to be restored prior to the completion of agency action simply because the relevant proposal has received initial approval.¹²⁶

Thus, the NRC must consider the new and significant information before making any decisions in pending proceedings for new reactor licensing or re-licensing of existing reactors.

VII. CONCLUSION

For the foregoing reasons, the NRC should grant Petitioners the following relief:

- re-publish for public comment the following documents with respect to new and significant information regarding the environmental impacts of high-density spent fuel storage in reactor pools and the costs and benefits of measures for avoiding or mitigating those impacts:
 - The 2013 Revised License Renewal GEIS;
 - the EISs for all new reactors; and
 - the EAs for all new reactor designs.

In the meantime, the NRC should suspend the effectiveness of any licensing decisions or regulations that would allow licensing decisions until it has completed the environmental analysis required by NEPA.¹²⁷ Thus, the NRC should:

- suspend the effectiveness of Table B-1, which codifies the NRC's generic finding that spent fuel storage in high-density reactor pools during the license renewal term of operating reactors poses no significant environmental impacts and therefore need not be considered in individual reactor licensing decisions;
- suspend the effectiveness, in any new reactor licensing proceeding for reactors that employ high-density pool storage of spent fuel, of all regulations approving the standardized designs for those new reactors and all EAs approving SAMDAs; and

¹²⁶ 490 U.S. at 371.

¹²⁷ *Calvert Cliffs 3 Nuclear Project, LLC and Unistar Nuclear Operating Services, LLC* (Calvert Cliffs Nuclear Power Plant, Unit 3), et al., CLI-12-16, 76 NRC 63 (2012) (suspending reactor licensing decisions pending resolution of waste confidence issues remanded by the U.S. Court of Appeals in *New York*).

- suspend all new reactor licensing decisions and license renewal decisions pending completion of this proceeding.

Respectfully submitted,

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February 18, 2014

Counsel to Petitioners



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

November 6, 1987

RELEASED TO THE PDR

3/8/95
date

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initials

COMLZ-87-30/87-34

OFFICE OF THE
SECRETARY

MEMORANDUM FOR: Victor Stello, Jr.
Executive Director for Operations

William C. Parler
General Counsel

FROM: Samuel J. Chilk
Secretary

SUBJECT: COMMISSION GUIDANCE ON IMPLEMENTATION OF THE NRC'S
SAFETY GOAL POLICY

The Commission, with Chairman Zech and Commissioners Roberts, Bernthal and Carr agreeing (Commissioner Rogers did not participate), offer the following comments for staff action on implementing the Commission's safety goal policy.

The Commission does not support continued development of the proposed implementation matrix for use in conjunction with the Commission's safety goals policy. The matrix is seen as too complex.

The Commission concurs with the recommendations made by the ACRS to apply the safety goal criteria in judging the adequacy of regulations rather than making plant specific regulatory judgements. However, if information is developed that is applicable to a particular licensing decision, the Commission endorses consideration of that information as a factor in the licensing decision.

The Commission supports the ACRS recommendation for the formulation of a hierarchical structure among the interrelated criteria in the overall goal. Additionally, the subordinate levels in this hierarchical structure should not be so conservative that it creates a de facto new policy. The staff should work with the ACRS, and include consideration of individual Commissioners' comments on COMLZ-87-30/34 (copy attached) to develop a revised implementation plan which includes the elements in the ACRS letter of May 13, 1987 (copy attached).

(EDO) (SECY SUSPENSE: 1/15/88)

The staff should work with the Office of General Counsel to provide the Commission an information paper on: (1) how the staff would propose to implement OGC's guidance on the use of averted on site cost in backfit analysis, including examples of how recent backfit analyses would be changed, if any, by implementation of the OGC position; (2) whether the issue of averted off-site property damage costs should be included in a

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more explicit manner in backfit analysis; and (3) whether \$1000/person-rem remains an appropriate cost/benefit criterion.

(EDO/OGC) (SECY SUSPENSE: 12/15/87)

The staff should submit for Commission's approval an options paper addressing a range of definitions for a large release of radioactive materials, including defining a large release in terms of quantity of fission products. Industry goals being applied to advanced reactor design programs should also be discussed. The definition of a "large release" should encompass the Chernobyl accidental release.

(EDO) (SECY SUSPENSE: 12/15/87)

The staff should submit for Commission consideration an options paper for specifying appropriate Level Four (see ACRS 5/13/87 letter, attached) performance objectives, which can be used in making decisions as to whether specific regulations or regulatory practices are consistent with criteria or levels 1, 2, and 3. As noted by ACRS, these objectives should be an expression of the effectiveness of plant accident prevention and mitigation systems (e.g., containment performance), as well as plant operations.

(EDO) (SECY SUSPENSE: 1/30/87)

Commissioner Bernthal has provided extensive views on these and other issues in his 8/13/87 memorandum, attached. He notes that several questions raised there and in earlier memoranda referenced therein remain unaddressed. He would like to be informed on staff's current thinking on the following topics:

- ° How population density should be considered in evaluating the overall societal risk criteria.
- ° Whether core melt probability alone could be considered to meet the Commission's 10^{-6} per year criterion for a large off-site release, i.e., would it be acceptable to have no containment in such a case. He notes this is the central policy issue likely to come before the Commission in connection with staff's review of the DOE advanced reactor designs.

(EDO) (SECY SUSPENSE: 1/15/88)

Attachment: As stated

cc: Chairman Zech
Commissioner Roberts
Commissioner Bernthal
Commissioner Carr
Commissioner Rogers
OGC
GPA