

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD  
AND THE SECRETARY

In the Matter of	)	Rulemaking Docket No. ___
Tennessee Valley Authority	)	Docket No. 50-391
(Watts Bar Unit 2)	)	

**RULEMAKING PETITION TO RESCIND PROHIBITION  
AGAINST CONSIDERATION OF ENVIRONMENTAL IMPACTS  
OF SEVERE REACTOR AND SPENT FUEL POOL ACCIDENTS  
AND REQUEST TO SUSPEND LICENSING DECISION**

**I. INTRODUCTION**

Pursuant to 10 C.F.R. § 2.802, Southern Alliance for Clean Energy (“SACE”) petitions the U.S. Nuclear Regulatory Commission (“NRC”) to rescind regulations in 10 C.F.R. Part 51 that make generic conclusions about the environmental impacts of severe reactor and spent fuel pool accidents and that preclude consideration of those issues in individual licensing proceedings. This petition also requests the NRC to suspend the above-captioned licensing proceeding while the NRC considers this petition and the environmental issues raised in the attached Contention Regarding NEPA Requirement to Address Safety and Environmental Implications of the Fukushima Task Force Report (“Contention”).

This petition is captioned in both the rulemaking docket and the docket for the Watts Bar Unit 2 licensing proceeding because it seeks relief that is both generic and applicable to the individual proceeding. The rulemaking petition is also being filed by other organizations and individuals who have submitted contentions regarding the safety

and environmental implications of the NRC’s report entitled Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident at 20-21 (July 12, 2011) (“Task Force Report”).

## **II. DISCUSSION**

### **A. General Solution**

The general solution sought by SACE is to rescind all regulations in 10 C.F.R. Part 51 to the extent that they reach generic conclusions about the environmental impacts of severe reactor and/or spent fuel pool accidents and therefore prohibit consideration of those impacts in reactor licensing proceedings. These regulations include 10 C.F.R. Part 51, Appendix B; 10 C.F.R. §§ 51.45, 51.53, and 51.95.

### **B. SACE’s Grounds for and Interest in the Action Requested.**

SACE seeks rescission of any NRC regulations that would prevent the NRC from complying with its obligation under the National Environmental Policy Act (“NEPA”) and NRC implementing regulations to consider, in the operating license proceeding for Watts Bar Unit 2, the environmental implications of new and significant information discussed in the Task Force Report regarding the regulatory implications of the Fukushima Dai-ichi nuclear accident. Our legal and technical grounds for seeking consideration of new and significant information in the Task Force Report are discussed at length in the attached Contention, which is attached and incorporated herein by reference.

### **C. Support for Petition**

This petition for rulemaking is supported by the Task Force Report and also by the attached Declaration of Dr. Arjun Makhijani (August 8, 2011). As demonstrated in both of those documents, the Fukushima accident has significant regulatory implications with respect to both severe reactor accidents and spent fuel pool accidents, because the Task Force Report recommends that mitigative measures for both of these types of accidents, which are not currently included in the design basis for nuclear reactors, should be added to the design basis and subject to mandatory safety regulation.

#### **D. Request for Suspension of Licensing Proceeding**

As discussed in the attached Contention, NEPA requires that agencies consider the environmental impacts of their actions *before* they are taken, in order to ensure that “important effects [of the licensing decision] will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast.” *Robertson*, 490 U.S. 332, 349 (1989). *See also* 40 C.F.R. §§ 1500.1(c), 1502.1, 1502.14. The NRC’s obligation to comply with NEPA in this respect is independent of and in addition to the NRC’s responsibilities under the Atomic Energy Act, and must be enforced to the “fullest extent possible.” *Calvert Cliffs Coordinating Committee*, 449 F.2d at 1115. *See also Limerick Ecology Action v. NRC*, 869 F.2d 719, 729 (3rd Cir. 1989) (citing *Public Service Co. of New Hampshire v. NRC*, 582 F.2d 77, 86 (1st Cir. 1978)). The NRC’s obligation to delay licensing decisions until after it has considered the environmental impacts of those decisions is also nondiscretionary. *Silva v. Romney*, 473 F.2d 287, 292 (1st Cir. 1973). Therefore the NRC has a non-discretionary duty to suspend the Watts Bar Unit 2 operating license proceeding while it considers the

environmental impacts of that decision, including the environmental implications of the Task Force Report with respect to severe reactor and spent fuel pool accidents.

### **III. CONCLUSION**

For the foregoing reasons, the Commission should grant this rulemaking petition.

Respectfully submitted,

*Signed (electronically) by:*

Diane Curran

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

1726 M Street N.W. Suite 600

Washington, D.C. 20036

202-328-3500

Fax: 202-328-6918

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

August 11, 2011

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
Tennessee Valley Authority	)	Docket No. 50-391
	)	
(Watts Bar Unit 2)	)	
	)	

**CONTENTION REGARDING NEPA REQUIREMENT TO ADDRESS  
SAFETY AND ENVIRONMENTAL IMPLICATIONS OF  
THE FUKUSHIMA TASK FORCE REPORT**

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**I. INTRODUCTION AND SUMMARY**

Pursuant to 10 C.F.R. § 2.309(f)(1), Southern Alliance for Clean Energy (“SACE”) asserts a new contention seeking consideration of new and significant information relevant to the environmental analysis for the proposed licensing of Watts Bar Unit 2. In the contention set forth in Section II below, SACE requests a hearing on the significant – indeed extraordinary – safety and environmental implications for the Watts Bar Unit 2 licensing decision of the conclusions and recommendations of the U.S. Nuclear Regulatory Commission’s Near-Term Task Force (the “Task Force”). The contention is supported by the expert declaration of Dr. Arjun Makhijani of the Institute for Energy and Environmental Research. The contention is also supported by a Motion to Admit a New Contention.

The Task Force, a group of highly qualified and experienced Nuclear Regulatory Commission (“NRC” or the “Commission”) staff members selected by the Commission to evaluate the regulatory implications of the Fukushima Dai-ichi accident, has issued a

report recommending the NRC strengthen its regulatory scheme for protecting public health and safety by increasing the scope of accidents that fall within the “design basis” and are therefore subject to mandatory safety regulation. Recommendations for Enhancing Reactor Safety in the 21<sup>st</sup> Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident at 20-21 (July 12, 2011) (“Task Force Report”). The Task Force’s recommendation to establish mandatory safety regulations for severe accidents has extremely grave environmental and safety implications because it would not be logical or necessary to recommend an upgrade to the basic level of protection currently afforded by NRC regulations unless those existing regulations were insufficient to ensure adequate protection of public health, safety, and the environment throughout the licensed life of nuclear reactors. The recommendation is all the more grave because it constitutes the second warning that the Commission has received regarding the need to expand the scope of design basis accidents. The first warning, issued by the Rogovin Report over thirty years ago, following the Three Mile Island accident and explained in more detail in Section II below, essentially went unheeded. *Id.* at 16-17. As the Task Force urges, “the time has come” to make fundamental changes to the NRC’s program for establishing minimum safety requirements for nuclear reactors. *Id.* at 18.

Moreover, the Task Force’s recommendation that the scope of mandatory safety regulations be expanded to include severe accidents raises significant environmental concerns in this proceeding, including that (1) the risks of operating Watts Bar Unit 2 are higher than estimated in the FSEIS and (2) TVA’s previous environmental analysis of the relative costs and benefits of severe accident mitigation alternatives (“SAMAs”) is

fundamentally inadequate because those measures are, in fact, necessary to assure adequate protection of the public health and safety and, therefore, should be imposed without regard to their cost.

Pursuant to the National Environmental Policy Act (“NEPA”), the analysis demanded by this contention may not be deferred until after Watts Bar Unit 2 is licensed. Given that the NRC Commissioners have postponed taking action on the Task Force’s recommendations, admission of this contention constitutes the only way of ensuring that the environmental implications of the Task Force recommendations are taken into account in the licensing decision for Watts Bar Unit 2.

SACE wishes to point out that this contention is substantially similar to contentions and comments that are being filed this week in other pending reactor licensing and re-licensing cases and standardized design certification proceedings. In addition, SACE has joined with other individuals and organizations in a rulemaking petition seeking to suspend any regulations that would preclude full consideration of the environmental implications of the Task Force Report. A copy of the rulemaking petition is attached. Finally, in an Emergency Petition, now pending before the Commission for nearly four months, many of the same organizations and individuals previously asked the Commission to suspend its licensing decisions while it evaluated the environmental implications of the Fukushima accident and to establish procedures for the fair and meaningful consideration of those issues in licensing hearings. Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions Pending Investigation of Lessons learned From Fukushima Daiichi Nuclear Power Station Accident (April 14-18, 2011) (the “Emergency Petition”).

In the aggregate, these contentions, rulemaking comments, and the rulemaking petition follow up on the Emergency Petition's demand that the NRC comply with NEPA by addressing the lessons of the Fukushima accident in its environmental analyses for licensing decisions. Having received no response to their Emergency Petition, the signatories to the Emergency Petition now seek consideration of the Task Force's far-reaching conclusions and recommendations in each individual licensing proceeding, including the instant case.

SACE recognizes that given the sweeping scope of the Task Force conclusions and recommendations, it may be more appropriate for the NRC to consider them in generic rather than site-specific environmental proceedings. That is for the NRC to decide. *Baltimore Gas & Electric Co. v. Natural Resources Defense Council*, 462 U.S. 87, 100 (1983). It is the NRC, and not the public, which is responsible for compliance with NEPA. *Duke Power Co. et al. (Catawba Nuclear Station, Units 1 and 2)*, CLI-83-19, 17 NRC 1041, 1049 (1983).

## **II. SACE'S NEW CONTENTION SATISFIES THE REQUIREMENTS OF 10 C.F.R. § 2.309 (f)(1).**

### **1. Statement of Contention.**

The FSEIS for Watts Bar Unit 2 fails to satisfy the requirements of NEPA because it does not address the new and significant environmental implications of the findings and recommendations raised by the NRC's Fukushima Task Force Report. As required by NEPA and the NRC regulations, these implications must be addressed in the ER.

### **2. Brief Explanation of the Basis for the Contention.**

**The Task Force Report.**



This contention is based on the Task Force Report, in which the Commission instructed the Task Force to provide:

A systematic and methodical review of [NRC] processes and regulations to determine whether the agency should make additional improvements to its regulatory system and to make recommendations to the Commission for its policy direction, in light of the accident at the Fukushima Dai-ichi Nuclear Power Plant.

Task Force Report at vii. In response to that directive, the Task Force prepared a detailed history of the NRC's program for regulation of safety and public health and evaluated that program in light of the experience of the Fukushima accident.

The Task Force then assessed the risk posed by “continued operation and continued licensing activities” for U.S. nuclear plants. Applying the NRC's standard for whether nuclear plants pose an “imminent risk” such that they should be shut down immediately, *see, e.g., Yankee Atomic Electric Co.* (Yankee Nuclear Power Station), CLI-96-6, 43 NRC 123, 128 (1996) (finding no “imminent hazard” that would warrant shutdown of a reactor), the Task Force found that no imminent risk was posed by operation or licensing. *Id.* at 18. In addition, the Task Force concluded that U.S. reactors meet the statutory standard for security, *i.e.*, they are “not inimical to the common defense and security.” *Id.* at 18; *see also* 42 U.S.C. § 2133(d) (forbidding the NRC from licensing reactors if their operation would be “inimical to the common defense and security”). Notably, however, the Task Force did not report a conclusion that licensing of reactors would not be “inimical to public health and safety,” as the AEA requires for licensing of reactors. 42 U.S.C. § 2133.

Instead, the Task Force concluded that the regulatory system on which the NRC relies to make the safety findings that the AEA requires for licensing of reactors must be

strengthened by raising the level of safety that is minimally required for the protection of public health and safety:

In response to the Fukushima accident and the insights it brings to light, the Task Force is recommending actions, some general, some specific, that it believes would be a reasonable, well-formulated set of actions *to increase the level of safety associated with adequate protection of the public health and safety.*

*Id.* at 18 (emphasis added). In particular, the Task Force found that “the NRC’s safety approach is incomplete without a strong program for dealing with the unexpected, including severe accidents.” *Id.* at 20. Therefore, the Task Force recommended that the NRC incorporate severe accidents into the “design basis” and subject it to mandatory safety regulations. In order to upgrade the design basis, the Task Force also recommended that the NRC undertake new safety investigations and impose design changes, equipment upgrades, and improvements to emergency planning and operating procedures. *See, e.g.*, Task Force Report at 73-75.<sup>1</sup>

The Task Force also found that the Fukushima accident was not the first warning the NRC had received that it needed to strengthen its safety program in order to provide an adequate level of protection to public health and safety. After the Three Mile Island accident in 1979, an independent body appointed to investigate the accident’s implications, headed by Mitchell Rogovin of the NRC’s Special Inquiry Group, recommended that the NRC “[e]xpand the spectrum of design basis accidents.” *Id.* at 16. But the NRC did little to follow the recommendations of the Rogovin Report. While it “encouraged licensees to search for vulnerabilities” in their plant designs through Individual Plant Examination (“IPE”) and Individual Plant Examination for External

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<sup>1</sup> The Task Force Report contains twelve “overarching” recommendations, which are summarized on pages 69-70.

Events (“IPEEE”) programs and encouraged the development of severe accident mitigation guidelines (“SAMGs”), “the Commission did not take action to require the IPEs, IPEEEs, or SAMGs.” *Id.* Thus, the Task Force concluded that:

While the Commission has been partially responsive to recommendations calling for requirements to address beyond-design-basis accidents, the NRC has not made fundamental changes to the regulatory approach for beyond-design-basis events and severe accidents for operating reactors.

*Id.* at 17. Looking back on the Commission’s failure to heed the Rogovin Report’s recommendations, the Task Force urged that “the time has come” when NRC safety regulations must be “reviewed, evaluated and changed, as necessary, to insure (sic) that they continue to address the NRC’s requirements to provide reasonable assurance of adequate protection of public health and safety.” *Id.* at 18.

To finally fulfill the Rogovin Report’s recommendation, a need now re-confirmed by the Fukushima Task Force, would require a major re-evaluation and overhaul of the NRC’s regulatory program. As the Task Force recognized, the great majority of the NRC’s current regulations do not impose mandatory safety requirements on severe accidents, and severe accident measures are adopted only on a “voluntary” basis or through a “patchwork” of requirements. *Id.*

The lack of an NRC program for mandatory regulation of severe accidents is clearly evident from the regulations themselves. The Part 50 regulations, which establish fundamental safety requirements for all reactors (including the current generation and the proposed new generation), are based on a “design basis” that does not include severe accidents. Task Force Report at 16. While NRC NEPA regulations require consideration of severe accident mitigation measures, they need not be adopted unless they are found to be cost-beneficial. *See, e.g., Entergy Nuclear Operations, Inc.* (Indian Point Nuclear

Generating Station, Units 2 and 3), LBP-11-17, slip op. at 17 (July 14, 2011). Because the imposition of severe accident mitigation measures is based on cost considerations, they are not part of the design basis for adequate protection of public health and safety.

*Union of Concerned Scientists v. NRC*, 824 F.2d 108, 120 (D.C. Cir. 1987).<sup>2</sup>

Therefore, the NRC's current regulatory scheme requires significant re-evaluation and revision in order to expand or upgrade the design basis for reactor safety as recommended by the Task Force Report. The fact that this effort has been postponed for thirty years makes the scope of the required undertaking all the more massive and urgent.

#### **The National Environmental Policy Act.**

The contention is also based on NEPA, "our basic national charter for protection of the environment." 40 C.F.R. § 1500.1(a). NEPA requires a federal agency to prepare an Environmental Impact Statement for any "major Federal action significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C)(i). This duty to carefully consider information regarding a project's environmental impacts is non-discretionary. *Silva v. Romney*, 473 F.2d 287, 292 (1st Cir. 1973). Federal agencies are

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<sup>2</sup> Even the NRC's Part 52 regulations for new reactors do not contain mandatory requirements for severe accident mitigation features. While the Part 52 regulations require combined license applicants to submit analyses of measures to mitigate severe accidents, Part 52 contains no standards for the adequacy of such analyses. In addition, the Commission has also stated that Part 52 severe accident mitigation measures, which must be described under the NRC's safety regulations in 10 C.F.R. §§ 52.47(a)(23) and 52.79(a)(38), are subject to cost-benefit analysis. *See, e.g.*, Statement of Considerations ("SOC") for AP1000 design certification rule, 10 C.F.R. Part 52 Appendix B, 71 Fed. Reg. 4,464, 4,469 (January 27, 2006): As stated in that notice:

Westinghouse's evaluation of various design alternatives to prevent and mitigate severe accidents does not constitute design requirements. The Commission's assessment of this information is discussed in Section VII (sic) of this SOC on environmental impacts.

held to a “strict standard of compliance” with the Act’s requirements. *Calvert Cliff’s Coordinating Commission v. AEC*, 449 F.2d 1109, 1112 (D.C. Cir. 1971).

NEPA and the Council on Environmental Quality (“CEQ”) regulations implementing NEPA are intended to ensure that environmental considerations are “infused into the ongoing programs and actions of the Federal Government.” *Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 371 n.14 (1989). Thus, NEPA imposes on agencies a continuing obligation to gather and evaluate new information relevant to the environmental impact of its actions. *Warm Springs Dam Task Force v. Gribble*, 621 F.2d 1017, 1023-24 (9th Cir. 1980) (citing 42 U.S.C. 4332(2)(A), (B); *Essex County Preservation Ass’n v. Campbell*, 536 F.2d 956, 960-61 (1st Cir. 1976); *Society for Animal Rights, Inc. v. Schlesinger*, 512 F.2d 915, 917-18 (D.C. Cir. 1975)). “An agency that has prepared an EIS cannot simply rest on the original document. The agency must be alert to new information that may alter the results of its original environmental analysis, and continue to take a “hard look” at the environmental effects of [its] planned action, even after a proposal has received initial approval.” *Friends of the Clearwater v. Dombek*, 222 F.3d 552, 557-58 (9th Cir. 2000) (quoting *Marsh*, 490 U.S. at 373-74).

In order to aid the Commission in complying with NEPA, each applicant shall submit to the Commission an environmental report (“ER”). See 10 C.F.R. §§ 51.14; 51.45. In this case, the TVA’s FSEIS serves the same purpose of an ER, *i.e.*, to provide the applicant’s initial analysis of the environmental impacts of the proposed nuclear power plant operation. The ER must contain a description of the proposed action, a statement of its purposes, and a description of the environment affected. *Id.* § 51.45 (b). Further, the ER must discuss the impact of the proposed action on the environment, any

adverse environmental effects which cannot be avoided should the proposal be implemented, alternatives to the proposed action, the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any reversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. *Id.* § 51.45(b)(5). The ER must also contain an analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects. *Id.* § 51.45(c). An environmental report for the licensing action contemplated in this instance must also include consideration of the economic, technical, and other benefits and costs of the proposed action and its alternatives. *Id.* The environmental report must to the fullest extent practicable, quantify the various factors considered and contain sufficient data to aid the Commission in its development of an independent analysis. *Id.*

Within this regulatory framework, “[t]he Commission recognizes *a continuing obligation* to conduct its domestic licensing and related regulatory functions in a manner which is both receptive to environmental concerns and consistent with the Commission’s responsibility as an independent regulatory agency for protecting the radiological health and safety of the public.” *Id.* § 51.10(b) (emphasis added).

**The Environmental Report Does Not Consider the Significant New Information Contained in the Task Force Report and the FSEIS Must Be Supplemented to Comply with NEPA.**

NEPA requires federal agencies to supplement their NEPA documentation when “there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.” 40 C.F.R. § 1509(c)(1)(ii).

A federal agency's *continuing duty* to take a "hard look" at the environmental effects of their actions requires they consider, evaluate, and make a reasoned determination about the significance of this new information and prepare supplemental NEPA documentation accordingly. *Warm Springs Task Force v. Gribble*, 621 F.2d at 1023-24; *Stop H-3 Association v. Dole*, 740 F.2d 1442, 1463-64 (9th Cir. 1984). The need to supplement under NEPA when there is new and significant information is also found throughout the NRC regulations. *See* 10 C.F.R. §§ 51.92 (a)(2), 51.50(c)(iii), 51.53(b), 51.53(c)(3)(iv).

The conclusions and recommendations presented in the Task Force Report constitute "new and significant information" whose environmental implications must be considered before the NRC may make a decision that approves the licensing of Watts Bar Unit 2. First, the information is "new" because it stems directly from the Fukushima accident, which occurred only five months ago and for which the special study commissioned by the Commission has only just been issued.

Second, the information is "significant" because it raises an extraordinary level of concern regarding the manner in which the proposed operation of Watts Bar Unit 2 "impacts public health and safety." *See* 40 C.F.R. § 1508.27(b)(2). For the first time since the Three Mile Island accident occurred in 1979, a highly respected group of scientists and engineers within the NRC Staff has fundamentally questioned the adequacy of the current level of safety provided by the NRC's program for nuclear reactor regulation. NEPA demands that federal agencies "insure the professional integrity, including the scientific integrity, of the discussions and analyses" included in an EIS<sup>3</sup> and disclose "all major points of view on the environmental impacts" including any

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<sup>3</sup> 40 C.F.R. § 1502.24.

“responsible opposing view.”<sup>4</sup> Courts have found that an EIS that fails to disclose and respond to expert opinions concerning the hazards of a proposed action, particularly those opinions of the agency’s own experts, are “fatally deficient” and run contrary to NEPA’s “hard look” requirement.<sup>5</sup> As a result, the NRC must revisit any conclusions in the FSEIS for Watts Bar Unit 2 which is based on the assumption that compliance with NRC safety regulations is sufficient to ensure that environmental impacts of accidents are acceptable.

*The Task Force Report Reveals that the Full Spectrum of All Design-Basis Accidents Has Not Been Assessed and the FSEIS Must Be Supplemented to Consider Additional Design-Basis Accidents that Have the Potential for Releases to the Environment.*

In Section 3.12.1 of the FSEIS, TVA asserts that:

The term “accident” refers to any unintentional event (i.e., outside the normal or expected plant operation envelope) that results in a release or a potential for a release of radioactive material to the environment. The NRC categorizes accidents as either design basis or severe. Design basis accidents are those for which the risk is great enough that NRC requires the plant design and construction to prevent unacceptable accident consequences. Severe accidents are those that NRC considers too unlikely to warrant normal design controls.

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<sup>4</sup> 40 C.F.R. §§ 1502.9(a), (b)

<sup>5</sup> *Center for Biological Diversity v. United States Forest Service*, 349 F.3d 1157 (9th Cir. 2003) (finding an EIS’s failure to disclose and discuss responsible opposing scientific viewpoints violated NEPA and the implementing regulations); *Seattle Audubon Society v. Moseley*, 798 F.Supp. 1473, 1479 (W.D. Wa. 1992) aff’d sub nom *Seattle Audubon Society v. Espy*, 998 F.2d 699 (9th Cir. 1993) (quoting *Friends of the Earth v. Hall*, 693 F.Supp. 904, 934 (W.D. Wa. 1988) (“[a]n EIS that fails to disclose and respond to ‘the opinions held by well respected scientists concerning the hazards of the proposed action...is fatally deficient.’”)); *Western Watersheds Project v. Kraayenbrink*, 632 F.3d 472, 487 (9th Cir. 2010) (finding that agency failed to take a “hard look” under NEPA when it ignored concerns raised by its own experts). See also *Blue Mtns. Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1213 (9th Cir. 1998) (noting that an agency’s failure to discuss and consider an independent scientific report’s recommendations “lends weight to [plaintiff’s] claim that the [agency] did not take the requisite ‘hard look’ at the environmental consequences” of the project).



FSEIS at 73. Thus, TVA bases its environmental analysis on the assumption that compliance with the NRC's regulatory program for protection against design basis accidents is sufficient to maintain environmental impacts from design basis accidents at an acceptable or insignificant level, and that severe accidents are too unlikely to merit inclusion in the design basis. The findings of the Task Force Report call these assumptions into serious question. *See* Makhijani Declaration, pars. 7-10. If, as suggested by the Task Force Report, the design basis for the reactor does not incorporate accidents that should be considered in order to satisfy the adequate protection standard, then it is not possible to reach a conclusion that the design of the reactor adequately protects against accident risks.

*The FEIS Must Be Supplemented in Light of the Task Force Findings that Certain Accidents Formerly Classified as Severe Should Be Incorporated into the Design Basis.*

By recommending the incorporation of accidents formerly classified as “severe” or “beyond design basis” into the design basis, the Task Force effectively recommends a complete overhaul of the NRC's system for mitigating severe accidents through consideration of SAMAs. *See* 10 C.F.R. § 51.45(c). As the Task Force recognizes, currently the NRC does not impose measures for the mitigation of severe accidents unless they are shown to be cost-beneficial or unless they are adopted voluntarily. Task Force Report at 15. *See also* 10 C.F.R. §§ 51.71(d); 51.75(c)(2) (allowing EISs for combined license applications (“COLAs”) that rely on certified standardized designs to reference the severe accident mitigation analyses for those designs).<sup>6</sup> But the Task Force

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<sup>6</sup> *See also* Memorandum from NRC Staff to AP1000 and ESBWR design-Centered Working Groups re: Summary of the March 22 and 23, 2007, Meeting to Discuss pre-Combined License Application Issues (April 23, 2007) (suggesting that some SAMAs for

recommends that severe accident mitigation measures should be adopted into the design basis, *i.e.*, the set of regulations adopted *without regard to their cost* as fundamentally required for all NRC standards that set requirements for adequate protection of health and safety. *Union of Concerned Scientists v. NRC*, 824 F.2d 108, 120 (D.C. Cir. 1987).

Thus, the values assigned to the cost-benefit analysis for Watts Bar Unit 2, as described in TVA's SAMA analysis (*see* Memorandum to File from Robert Lutz, Westinghouse, re: Watts Bar Unit 2 Severe Accident Mitigation Analysis (January 29, 2009)), must be re-evaluated in light of the Task Force's conclusion that the value of SAMAs is so high that they should be elected as a matter of course.

Were SAMAs imposed as mandatory measures, the outcome of the FSEIS and subsequently the NRC's EIS for Watts Bar Unit 2 could be affected significantly in two major respects. First, severe accident mitigative measures now rejected as too costly may be required, thus substantially improving the safety of the Watts Bar Unit 2 operation if it is licensed. Second, consideration of the costs of mandatory mitigative measures could affect the overall cost-benefit analysis for the reactor.<sup>7</sup> As discussed in Dr. Makhijani's declaration, these costs may be significant, showing that other alternatives such as the no-action alternative and other alternative electricity production sources may be more attractive.<sup>8</sup> As the fundamental purposes of NEPA are: (1) to guarantee that the

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proposed reactors with standardized designs should be included in the design application and some should be included in COLAs).

<sup>7</sup> *See* 10 C.F.R. § 51.45 (c) (explaining that environmental reports should also include consideration of the economic, technical, and other benefits and costs of the proposed action and its alternatives).

<sup>8</sup> NEPA requires the NRC to include in its EIS a "detailed statement . . . on . . . alternatives to the proposed action." 42 U.S.C. § 4332(C)(iii). The alternatives analysis should address "the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for the

government takes a “hard look” at all of the environmental consequences of proposed federal actions before the actions occur, *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989); and (2) to “guarantee[] that the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision,” *id.* at 349, the NRC cannot meet the fundamental purposes of NEPA if it does not include all of the costs associated with required mitigative measures. *See Sierra Club v. Sigler*, 695 F.2d 957, 979 (5<sup>th</sup> Cir. 1983) (“There can be no ‘hard look’ at the costs and benefits unless all costs are disclosed.”).

*The FSEIS Must Be Supplemented to Include a Discussion of the Task Force Report’s Recommended Measures to Ensure the Plant’s Protection From Seismic and Flooding Events.*

Following the devastating events in Japan, the Task Force Report explained the importance of protecting structures, systems and components (SSCs) of nuclear reactors from natural phenomena, including seismic and flooding hazards:

Protection from natural phenomena such seismic and flooding is critical for safe operation of nuclear power plants due to potential common-cause failures and significant contribution to core damage frequency from external events. Failure to adequately protect SSC’s important to safety from appropriate design-basis natural phenomena with appropriate safety margins has the potential for common-

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choice among options by the decisionmaker and the public.” 40 C.F.R. § 1502.14. This analysis must “rigorously explore and objectively evaluate all reasonable alternatives.” 40 C.F.R. § 1502.14(a). Agencies must consider three types of alternatives, which include a no action alternative, other reasonable courses of actions, and mitigation measures not in the proposed action. 40 C.F.R. § 1508.25. The purpose of this section is “to insist that no major federal project should be undertaken without intense consideration of other more ecologically sound courses of action, including shelving the entire project, or of accomplishing the same result by entirely different means.” *Environmental Defense Fund v. Corps of Engineers*, 492 F.2d 1123, 1135 (5th Cir. 1974). “The existence of a viable but unexamined alternative renders an [EIS] inadequate.” *Natural Resources Defense Council v. U.S. Forest Service*, 421 F.3d 797, 813 (9th Cir. 2005) (quoting *Citizens for a Better Henderson v. Hodel*, 768 F.2d 1051, 1057 (9th Cir. 1985)).

cause failures and significant consequences as demonstrated at Fukushima. Task Force Report at 30.

Yet, the Task Force found that significant differences may exist between plants in the way they protect against design-basis natural phenomena (including seismic and flooding hazards) and the safety margin provided. Task Force Report at 29. For instance, while tsunami hazards have been considered in the design basis for operating plants sited on the Pacific Ocean, the same cannot be said for those sited on the Atlantic Ocean and Gulf of Mexico. *Id.* Accordingly, the Task Force recommended that licensees reevaluate the seismic and flooding hazards at their sites and if necessary update the design basis and SSCs important to safety to protect against the updated hazards. Task Force Report at 30.

The FSEIS must be supplemented in light of this new and significant information. The Task Force's findings and recommendations are directly relevant to environmental concerns and have a bearing on the proposed action and its impacts as they point to the need for a reevaluation of the seismic and flooding hazards at the Watts Bar Unit 2 site, a "hard look" at the environmental consequences such hazards could pose, and an examination of what, if any, design measures could be implemented (i.e. through NEPA's requisite "alternatives" analysis) to ensure that the public is adequately protected from these risks.

*The FSEIS Must Be Supplemented to Include a Discussion of the Additional Mitigation Measures Recommended by the Task Force Report.*

"The discussion of steps that can be taken to mitigate adverse environmental consequences plays an important role in the environmental analysis under NEPA."

*Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351 (1989); *see also*

1502.16(h) (stating that an EIS must contain “means to mitigate adverse environmental impacts”). There must be a “reasonably complete discussion of possible mitigation measures.” *Robertson*, 490 U.S. at 352. Mitigation measures may be found insufficient when the agency fails to study the efficacy of the proposed mitigation, fails to take certain steps to ensure the efficacy of the proposed mitigation (such as including mandatory conditions in permits), or fails to consider alternatives in the event that the mitigation measures fail. *Id.*

The Task Force Report makes several significant findings when it comes to increasing and improving mitigation measures at new reactors and recommends a number of specific steps licensees could take in this regard. These recommendations include strengthening SBO mitigation capability at all operating and new reactors for design-basis and beyond-design-basis external events, (Section 4.2.1), requiring reliable hardened vent designs in BWR facilities with Mark I and Mark II containments (Section 4.2.2), enhancing spent fuel pool makeup capability and instrumentation for the spent fuel pool (Section 4.2.4), strengthening and integrating onsite emergency response capabilities such as EOPs, SAMGs, and EDMGs (Section 4.2.5) and addressing multi-unit accidents. *See also* Makhijani Declaration, pars. 18-24. Accordingly, the FSEIS must be supplemented to consider the use of these additional mitigation measures to reduce the project’s environmental impacts. *See* 40 C.F.R. §§ 1502.14(f), 1502.16), 1508.25 (b)(3)).

#### **Requirement for Prior Consideration of Environmental Impacts.**

The Task Force urges that some of its recommendations be considered before certain licensing decisions are made. For instance, the Task Force recommends that the

operating license review for Watts Bar Unit 2 should include “all of the near-term actions and any of the recommended rule changes that have been completed at the time of licensing.” Task Force Report at 72. Similarly, the Task Force recommends that Recommendation 4 (proposing new requirements for prolonged station blackout (“SBO”) mitigation) and Recommendation 7 (proposing measures for spent fuel pool makeup capability and instrumentation) should apply to all design certifications or to COL applicants if the recommended requirements are not addressed in the referenced certified design. Task Force Report at 71. The Task Force recommends that design certifications and COLs under active staff review address this recommendation “before licensing.” *Id.* at 72.

SACE respectfully submits that NEPA does not give the NRC the discretion to postpone consideration of any of the Task Force recommendations until after the licensing of Watts Bar or any other reactor for which a licensing decision is before the agency. NEPA requires the NRC to address the environmental implications of the Task Force’s analysis *before* making a re-licensing decision for Watts Bar Unit 2, in order to ensure that “important effects [of the licensing decision] will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast.” *Robertson*, 490 U.S. at 349. *See also* 40 C.F.R. §§ 1500.1(c), 1502.1, 1502.14. The NRC’s obligation to comply with NEPA in this respect is independent of and in addition to the NRC’s responsibilities under the AEA, and must be enforced to the “fullest extent possible.” *Calvert Cliffs Coordinating Committee*, 449 F.2d at 1115. *See also Limerick Ecology Action v. NRC*, 869 F.2d 719, 729 (3rd Cir. 1989) (citing *Public Service Co. of New Hampshire v. NRC*, 582 F.2d 77, 86 (1st Cir. 1978)). Under NEPA,

therefore, the Commission is required to address the Task Force's findings and recommendations as they pertain to Watts Bar Unit 2 before making a licensing decision, regardless of whether it does or does not choose to do so in the context of its AEA-based regulations.

Of course the Commission could moot the contention by adopting all of the Task Force's recommendations. *See Citizens for Safe Power v. NRC*, 524 F.2d 1291, 1299 (D.C. Cir. 1975). However, a majority of the Commissioners has voted not to do so immediately. *See* Notation Vote Response Sheets re: SECY-11-0093, Near-Term Report and Recommendations for Agency Actions Following the Events in Japan, posted on the NRC's website at <http://www.nrc.gov/reading-rm/doc-collections/commission/cvr/2011/>. Thus, while the NRC may eventually address the Task Force's recommendations in the context of its AEA-based regulatory scheme, the Commission has given no indication that it intends to address any of the Task Force's conclusions in its prospective licensing decisions. In the absence of any AEA-based review of the Task Force's conclusions, the FSEIS for Watts Bar Unit 2 must be supplemented in order to meet NEPA's goal that the NRC's licensing decision for Watts Bar Unit 2 will be "based on an accurate understanding of the environmental consequences of [its] actions." *Indian Point*, LBP-11-17, slip op. at 17.

**3. Demonstration that the Contention is Within the Scope of the Proceeding.**

The contention is within the scope of the proceeding because it seeks compliance with NEPA and NRC-implementing regulations, which must be complied with before Watts Bar Unit 2 may be licensed.

**4. Demonstration that the Contention is Material to the Findings NRC Must Make to License Watts Bar Unit 2.**

As demonstrated above in Section B, this contention challenges TVA's failure to fully comply with NEPA and federal regulations for the implementation of NEPA in its FSEIS for the proposed licensing of Watts Bar Unit 2. TVA's FSEIS is akin to an environmental report and therefore it must comply with NEPA supplementation requirements in the same way that ERs prepared by applicants or environmental impact statements prepared by the NRC must comply. Unless TVA and the NRC comply with the procedural requirements of NEPA that are discussed in the contention, the NRC cannot make a valid finding that Watts Bar Unit 2 should be licensed. Therefore the contention is material to the findings the NRC must make in order to license this facility.

SACE recognizes that some issues raised by the Task Force Report may be appropriate for generic rather than case-specific resolution. The determination of whether it is appropriate to address the issues raised in this contention generically or on a case-specific basis is a discretionary matter for the NRC to decide. *Baltimore Gas & Electric Co. v. Natural Resources Defense Council*, 462 U.S. at 100. Nevertheless, any generic resolution of the issues must be reached *before* the licensing decision in this case is made, and must be applied to this licensing decision. *Robertson*, 490 U.S. at 350.

**5. Concise Statement of the Facts or Expert Opinion Supporting the Contention, Along With Appropriate Citations to Supporting Scientific or Factual Materials.**

SACE relies on the facts and opinions of the Task Force members as set forth in their Task Force Report and as summarized above in Section B. The high level of technical qualifications of the Task Force members has been recognized by the



Commission. *See* Transcript of May 12, 2011, briefing at 5, in which Commissioner Magwood refers to the Task force as the NRC's "A-team."

Additional technical support is provided by the attached Declaration of Dr. Arjun Makhijani, which confirms the environmental significance of the Task Force's findings and recommendations with respect to the environmental analyses for all pending nuclear reactor licensing cases and design certification applications including the instant case.

**6. Sufficient Information to Show the Existence of a Genuine Dispute With the Applicant and the NRC.**

Based on the complete failure of the NRC to address the environmental implications of the Task Force Report for the proposed licensing of Watts Bar Unit 2, it appears that the parties have a dispute as to whether the FSEIS for the facility must be revised to address those implications. As demonstrated above in Section B, the Task Force Report and Dr. Makhijani's Declaration provide sufficient information to show the genuineness and materiality of the dispute.

**III. CONCLUSION**

For the foregoing reasons, the contention is admissible and should be admitted for a hearing.

Respectfully submitted,

*Signed (electronically) by:*

Diane Curran  
Harmon, Curran, Spielberg & Eisenberg, L.L.P.  
1726 M Street N.W. Suite 600  
Washington, D.C. 20036  
202-328-3500  
Fax: 202-328-6918  
E-mail: [dcurran@harmoncurran.com](mailto:dcurran@harmoncurran.com)

August 11, 2011



**INSTITUTE FOR ENERGY AND ENVIRONMENTAL RESEARCH**

6935 Laurel Avenue, Suite 201  
Takoma Park, MD 20912

Phone: (301) 270-5500  
FAX: (301) 270-3029  
e-mail: [ieer@ieer.org](mailto:ieer@ieer.org)  
<http://www.ieer.org>

**DECLARATION OF DR. ARJUN MAKHIJANI  
REGARDING SAFETY AND ENVIRONMENTAL SIGNIFICANCE OF  
NRC TASK FORCE REPORT REGARDING LESSONS LEARNED FROM  
FUKUSHIMA DAIICHI NUCLEAR POWER STATION ACCIDENT<sup>1</sup>**

I, Arjun Makhijani, declare as follows:

**Introduction and Statement of Qualifications**

1. I am President of the Institute for Energy and Environmental Research (“IEER”) in Takoma Park, Maryland. Under my direction, IEER produces technical studies on a wide range of energy and environmental issues to provide advocacy groups and policy makers with sound scientific information and analyses as applied to environmental and health protection and for the purpose of promoting the understanding and democratization of science. A copy of my curriculum vita is attached.
2. I am qualified by training and experience as an expert in the fields of plasma physics, electrical engineering, nuclear engineering, the health effects of radiation, radioactive waste management and disposal (including spent fuel), estimation of source terms from nuclear facilities, risk assessment, energy-related technology and policy issues, and the relative costs and benefits of nuclear energy and other energy sources. I am the principal author of a report on the 1959 accident at the Sodium Reactor Experiment facility near Simi Valley in California, prepared as an expert report for litigation involving radioactivity emissions from that site. I am also the principal author of a book, *The Nuclear Power Deception: U.S. Nuclear Mythology from Electricity “Too Cheap to Meter” to “Inherently Safe’ Reactors”* (Apex Press, New York, 1999, co-author, Scott Saleska), which examines, among other things, the safety of various designs of nuclear reactors.
3. I have written or co-written a number of other books, reports, and publications analyzing the safety, economics, and efficiency of various energy sources, including nuclear power. I am also the author of *Securing the Energy Future of the United States: Oil, Nuclear and Electricity*

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<sup>1</sup> Task Force Review (*Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, Nuclear Regulatory Commission, July 12, 2011, at <http://pbdupws.nrc.gov/docs/ML11118/ML111861807.pdf>)

*Vulnerabilities and a Post-September 11, 2001 Roadmap for Action* (Institute for Energy and Environmental Research, Takoma Park, Maryland, December 2001). In 2004, I wrote “Atomic Myths, Radioactive Realities: Why nuclear power is a poor way to meet energy needs,” *Journal of Land, Resources, & Environmental Law*, v. 24, no. 1 at 61-72 (2004). The article was adapted from an oral presentation given on April 18, 2003, at the Eighth Annual Wallace Stegner Center Symposium entitled, “Nuclear West: Legacy and Future,” held at the University of Utah S.J. Quinney College of Law. In 2008, I prepared a report for the Sustainable Energy & Economic Development (SEED) Coalition entitled *Assessing Nuclear Plant Capital Costs for the Two Proposed NRG Reactors at the South Texas Project Site*.

4. I am generally familiar with the basic design and operation of U.S. nuclear reactors and with the safety and environmental risks they pose. I am also generally familiar with materials from the press, the Japanese government, the Tokyo Electric Power Company, the French government safety authorities, and the U.S. Nuclear Regulatory Commission (“NRC”) regarding the Fukushima Daiichi (hereafter Fukushima) accident and its potential implications for the safety and environmental protection of U.S. reactors. I have also read *Recommendations for Enhancing Reactor Safety in the 21<sup>st</sup> Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, July 12, 2011 (hereafter the “Task Force Review”), published by the NRC.

5. On April 19, 2011, I prepared a declaration stating my opinion that although the causes, evolution, and consequences of the Fukushima accident were not yet fully clear a month after the accident began, it was already presenting new and significant information regarding the risks to public health and safety and the environment posed by the operation of nuclear reactors. My declaration was submitted to the NRC by numerous individuals and environmental organizations in support of a legal petition to suspend licensing decisions while the NRC investigated the regulatory implications of the Fukushima accident. *Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions Pending Investigation of Lessons learned From Fukushima Daiichi Nuclear Power Station Accident* (April 14-18, 2011). In my declaration I also stated my belief that the integration of new information from the Fukushima accident into the NRC’s licensing process could affect the outcome of safety and environmental analyses for reactor licensing and relicensing decisions by resulting in the denial of licenses or license extensions or the imposition of new conditions and/or new regulatory requirements. I also expressed the opinion that the new information could also affect the NRC’s evaluation of the fitness of new reactor designs for certification. *Id.*, par. 5.

### **Purpose**

6. The purpose of my declaration is to explain why the Task Force Review provides further support for my opinions that the Fukushima accident presents new and significant information regarding the risks to public health and safety and the environment posed by the operation of nuclear reactors and that the integration of this new information into the NRC’s licensing process could affect the outcome of safety and environmental analyses for reactor licensing and relicensing decisions and the NRC’s evaluation of the fitness of new reactor designs for certification.

## Agreement With Task Force Review’s Conclusions Regarding Need to Expand Design Basis

7. In my opinion, the Task Force reasonably concludes that substantial revisions to the very framework of NRC regulations are needed to adequately protect public health and the environment. I also agree that a major overarching step that needs to be taken is to integrate into the design basis for NRC safety requirements an expanded list of severe accidents and events, based on current scientific understanding and evaluations. This would ensure that potential mitigation measures are evaluated on the basis of whether they are needed for safety and not whether they are merely desirable. Should the NRC fail to incorporate an expanded list of severe accident requirements in the design basis of reactors, then a conclusion that the design provides for adequate protection to the public against severe accident risks could not be justified. The necessity for an expanded list of design basis requirements should be viewed in light of the Fukushima experience and the nuclear accident experience which preceded Fukushima, including Three Mile Island and Chernobyl accidents. Specifically, adequate protection of the public is incompatible with the NRC’s continued reliance on voluntary evaluation of severe external and internal events, voluntary adoption of mitigation measures, or the use of cost-benefit analysis to evaluate their desirability.

8. I believe my opinion is consistent with the Task Force’s statement that:

Adequate protection has been, and should continue to be, an evolving safety standard supported by new scientific information, technologies, methods, and operating experience. This was the case when new information about the security environment was revealed through the events of September 11, 2001. Licensing or operating a nuclear power plant with no emergency core cooling system or without robust security protections, while done in the past, would not occur under the current regulations. As new information and new analytical techniques are developed, safety standards need to be *reviewed, evaluated, and changed, as necessary, to insure that they continue to address the NRC’s requirements to provide reasonable assurance of adequate protection of public health and safety. The Task Force believes, based on its review of the information currently available from Japan and the current regulations, that the time has come for such change.* [p. 18, italics added]

9. I am concerned that over the past three decades or more, the NRC has not conducted the type of review of the adequacy of its safety regulations that is necessary to update its requirements so as to ensure that NRC safety requirements will provide the minimum level of protection required by the Atomic Energy Act. For instance, the Task Force Review points out that, over 30 years ago, the Rogovin Commission recommended that the scope of the design basis should be expanded to include a greater range of severe accidents. The Rogovin Commission explicitly stated that “[m]odification is definitely needed in the current philosophy that there are some accidents (“Class Nine accidents”)<sup>[2]</sup> so unlikely that reactor designs need not

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<sup>2</sup> Class Nine accidents are now called “severe accidents.” (Task Force Review p. 16)

provide for mitigating their consequences.”<sup>3</sup>. This recommendation was effectively disregarded by the NRC. Instead of imposing and enforcing mandatory requirements for prevention and mitigation of severe accidents, the NRC accepted voluntary measures and the use of cost-benefit assessments by licensees to exclude requirements for a range of preventive or mitigative measures. As a result the Task Force Review concluded that despite including some requirements for beyond-design-basis accidents, “the NRC *has not made fundamental changes to the regulatory approach for beyond-design-basis events and severe accidents* for operating reactors.” (p. 17, italics added). Even the installation of hardened vents on Mark I and Mark II BWRs was left to the voluntary discretion of the licensees. Given the NRC’s failure to make the needed changes in its basic regulatory requirements for safety since the Rogovin Commission report was issued over thirty years ago, and in light of the disastrous consequences of the Fukushima accident, which continues nearly five months after it started, I consider the current inadequacies in the NRC’s program for regulation of basic reactor safety to be extraordinarily grave problems.

### **Potential Effects of Task Force Review on Environmental Analyses for New Reactors, Existing Reactor License Renewal, and Standardized Design Certification**

10. If the Task Force’s recommendation to incorporate severe accidents into the design basis for NRC safety requirements is considered in environmental analyses for reactor licensing decisions or standardized design certifications, I think it would have very significant effects on the outcome of those analyses, in three key respects. First, the environmental analysis would have to consider the implication of the Task Force Review that compliance with current NRC safety requirements does not adequately protect public health and safety from severe accidents and their environmental effects. Second, for reactors that are unable to comply with new mandatory requirements, it could result in the denial of licenses. Third, the cost of adopting mandatory measures necessary to significantly improve the safety of currently operating reactors and proposed new reactors is likely to be significant.

### **Change to Estimate of Environmental Risk**

11. An analysis of the environmental implications of the Task Force Review would have to consider the ramifications of the Task Force’s implicit conclusion that compliance with current NRC safety standards does not adequately protect public health and safety from severe accidents and their environmental effects. For instance, the Task Force Review indicates that seismic and flooding risks as well as risks of seismically-induced fires and floods may be greater than previously understood by the NRC in some cases. Therefore in its environmental analyses, the NRC would have to revise its analysis to reflect the new understanding that the risks and radiological impacts of accidents are greater than previously thought.

### **Potential Denial of License Applications Based on Environmental Risk Analyses**

12. The Task Force Review implicitly raises the potential that some reactors will be unable to

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<sup>3</sup> Rogovin Commission report (*Three Mile Island: A Report to the Commissioners and to the Public*, by Mitchell Rogovin and George T. Frampton, et al. NUREG/CR-1250 1980. (Rogovin, Stern & Huges, Washington, DC, January 1980), v. 1, p. 151

comply with new mandatory requirements, thus resulting in the denial of licenses. For instance, this would be the case if a reactor cannot be adequately backfitted to comply with present-day assessment of ground shaking induced by earthquakes. Similarly, multi-unit siting may not be allowed in certain cases due to the impracticality of meeting upgraded emergency management requirements.

### **Significant Changes to Cost-Benefit Analyses**

13. The cost of adopting mandatory measures necessary to significantly improve the safety of currently operating reactors and proposed new reactors is likely to be significant. Adoption of a coherent regulatory framework as recommended by the Task Force, including periodic reassessments of whether the design basis is up to date with scientific assessments of flooding and seismic threats, is likely to result in significantly increased costs for nuclear reactors.

14. The Task Force Review contains numerous recommendations for consideration of new mandatory requirements for increasing the capability of the reactors, equipment, and personnel to handle and to respond to a range of severe accidents. Adoption of such measures could have high costs. This, in turn, will affect the overall cost-benefit analysis for reactors, especially the comparisons of nuclear power with alternative sources of electricity. Examples of potentially significant costs if severe accident mitigation measures are adopted follow in paragraphs 15 through 24 below:

15. If the Task Force recommendations are adopted, all existing reactors will be required to make changes to extend their capacity to handle station blackouts. This design upgrade is likely to have significant costs.

16. Similar considerations apply to new reactor combined construction and operating license applications. For instance, the Task Force recommends adding station blackout requirements to the Advanced Boiling Water Reactor, which would also likely result in increased costs. (p. 72).

17. Even where the Task Force deems some narrow issues to be already resolved by COL (combined license) applications and/or design certification applications, the interplay of other Task Force recommendations may raise environmental issues and cost concerns. For instance, while the Task Force found that the AP1000 and ESBWR designs already have a 72-hour provision for passive emergency core cooling, thereby satisfying the design requirement recommendations for station blackouts (pp. 71-72), other statements in the Task Force Review indicate the existence of environmental concerns that should be addressed in an EIS. For instance, the Task Force recommendations relating to the provision of backup power during the time beyond 72 hours relate mainly to repositioning equipment offsite (Recommendation 4.1, p. 38) and therefore were regarded as not relevant to AP1000 and ESBWR design certifications but only to the COL process (p. 72). However, in the context of emergency preparedness, the Task Force Review notes that “[i]n the case of large natural disasters such as earthquakes, hurricanes, and floods, the phenomena challenging the plant will also have affected the local community. In these cases, *prearranged resources may not be available because of their inability to reach the plant site....*” (p. 60, italics added). Therefore the designs of the AP1000 and the ESBWR need to be reviewed in the context of their ability to mitigate the environmental impacts of station

blackout lasting more than 72 hours. The potential for destruction of infrastructure that would prevent prestaged offsite equipment from reaching the site would also needs to be taken into account in environmental analyses for COLs and license extension applications.

18. Similarly, while the Task Force concludes that COL and Early Site Permit (ESP) applications already satisfy Recommendation 2.1 with respect to analysis of seismic and flooding risks (p. 71), it does not appear that all of the seismic and flooding-related implications of the Review have been addressed. Specifically, the flooding and fires that may be induced by earthquakes was closed by the NRC without imposing new requirements; the Task Force Review recommends reopening this issue (p. 32). These are issues that combine site characteristics and reactor design. For instance, the passive cooling features of AP1000s and ESBWRs involve pools of water located above the reactors. In addition, the ESBWR design has a buffer spent fuel pool in roughly the same position relative to the reactor as the Mark I design reactors (i.e., above the reactor vessel). Hence it is important to revisit this issue for these two reactor designs since they may be built at seismically active sites, including in the central and eastern United States (see paragraph 22 below), where there are active COL applications pending.

19. In the context of existing reactors, the Task Force Review recommends incorporating the latest understanding of seismic impacts and flooding (Recommendation 2, p. 30), and reopening the issue seismically induced flooding and fires (Recommendation 3, p. 32). This reassessment may also involve increased costs due to required backfits.

20. Taken as a whole, the Task Force Review's recommendations implicitly call for a review of all new reactor design certifications regarding station blackout (SBO) arrangements, including mitigation measures for SBO events that extend beyond 72 hours and spent fuel pool instrumentation and make up water supply capability. The effects of seismically induced flooding and fires on spent fuel pool arrangements should also be reviewed. All of these reviews could result in the imposition of costly prevention or mitigation measures, affecting comparisons with the alternatives.

21.. In view of the events leading to the hydrogen explosions in Units 1, 3, and 4 at Fukushima, the reliability of the existing hardened vent system in Mark I and Mark II reactors has been thrown into question. The Task Force Review recommends installation of *reliable* hardened vents in all Mark I and Mark II BWRs (Recommendation 5, p. 41). Because such vents have not yet been designed and tested, their costs are unknown. However, they are likely to be substantial. These costs must be determined and evaluated for NEPA purposes for all 23 Mark I reactors and all eight Mark II reactors.

22. The recommended mandatory review of the flooding and seismic design basis of existing reactors to evaluate whether they meet the design basis safety requirements could result in greatly increased costs in some or many cases. The establishment of the Shoreline Fault just offshore the Diablo Canyon Power Plant and the Oceanside thrust in the area of the San Onofre Nuclear Generating Station provides examples of recent developments that could lead to large expenditures for restoring the design basis safety margins for these reactors. As a reflection of the uncertainty, Pacific Gas & Electric (PG&E), which owns Diablo Canyon has itself requested and obtained a delay of 52 months in its license extension application so that the necessary

seismic studies can be completed. Another example relates to seismic hazard assessments in the central and eastern United States. In that case, the NRC has concluded that “[u]pdates to seismic data and models indicate that estimates of the seismic hazard, at some operating nuclear power plant sites in the Central and Eastern United States, have increased.”<sup>4</sup> The NRC does not have enough data at present to determine what, if any, backfits may be called for, but intends to use a cost-benefit approach in deciding whether they should be implemented. It specifically states that “[i]n order to progress with the Regulatory Analysis Stage, a comprehensive list of candidate plant backfits must be identified for subsequent value-impact analysis.”<sup>5</sup> “Value-impact analysis” is the NRC’s terminology for a cost-benefit analysis.<sup>6</sup> However, if backfitting for more severe earthquakes than were incorporated into the original design were *required* for safety rather than left to a cost-benefit analysis, the implications for comparison with the alternatives could be considerable for existing reactors in the Central and Eastern United States.

23. The Task Force noted that the same concern applies to flooding hazards, where “the assumptions and factors that were considered in flood protection at operating plants vary. In some cases, the design basis does not consider the probable maximum flood (PMF).” (p. 29) Again, protection of reactors against updated flood hazards could involve significant costs, depending on the outcome of the updated evaluations.

24. Finally, the Task Force Review points out the importance of considering mitigation measures associated with multi-unit events. Such events had not been considered before and therefore were assigned zero probability for all intents and purposes. The Task Force review recommends a revision of regulations to cover multi-unit events, for instance, to ensure adequate emergency core and spent fuel cooling for more than one unit at a time:

As part of the revision to 10 CFR 50.63, the NRC should require that the *equipment* and personnel necessary to implement the minimum and extended coping strategies shall include *sufficient capacity to provide core and spent fuel pool cooling, and reactor cooling system and primary containment integrity for all units at a multiunit facility*. The staff should also make the appropriate revisions to the definitions of “station blackout” and “alternate ac source” in 10 CFR 50.2. [p. 39, italics added]

Because most new applicants for COLs, such as Vogtle 3 and 4, propose to locate the new units at sites that already have reactors, the entire basis of emergency response adequacy, station-blackout related requirements, and emergency core and spent fuel pool cooling needs to be

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<sup>4</sup> *Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants Safety/Risk Assessments*, Generic Issue 199 (GI-199), Nuclear Regulatory Commission, August 2010, at <http://pbadupws.nrc.gov/docs/ML1002/ML100270639.pdf>, p. 30

<sup>5</sup> GI-199 p. 30

<sup>6</sup> NRC guidelines require “that the value-impact of an alternative be quantified as the “net value” (or “net benefit”). To the extent possible, all attributes, whether values or impacts, are quantified in monetary terms and added together (with the appropriate algebraic signs) to obtain the net value in dollars. The net value calculation is generally favored over other measures, such as a value-impact ratio or internal rate of return (RWG 1996, Section III.A.2).” (*Regulatory Analysis Technical Evaluation Handbook: Final Report*, NUREG/BR-0184, Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, January 1997, p. 5.2. Link at [http://www.osti.gov/energycitations/product.biblio.jsp?osti\\_id=446391](http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=446391).



reconsidered for the total number of units proposed at the site. The design and cost implications could be significant and must be reconsidered and reevaluated.

## **Conclusions**

25. I agree with the conclusions of the Task Force that significant changes to the NRC's regulatory system are needed in order to ensure that the operation of new reactors and re-licensed existing reactors does not pose unacceptable safety and environmental risks to the public. In light of the disastrous and ongoing events at Fukushima since March 11, 2011, it is clear that the issues of public safety raised by the Task Force are exceptionally grave. I also believe that it is highly likely that consideration of the Task Force's conclusions and recommendations in environmental analyses for new reactor licensing, existing reactor re-licensing, and design certification rulemakings, would materially affect the outcome of many and possibly all those studies.

The facts presented above are true and correct to the best of my knowledge, and the opinions expressed therein are based on my best professional judgment.



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Dr. Arjun Makhijani

Date: 8 August 2011

## Curriculum Vita of Arjun Makhijani

### *Address and Phone:*

Institute for Energy and Environmental Research  
6935 Laurel Ave., Suite 201  
Takoma Park, MD 20912  
Phone: 301-270-5500  
e-mail: [arjun@ieer.org](mailto:arjun@ieer.org)  
Website: [www.ieer.org](http://www.ieer.org)

A recognized authority on energy issues, Dr. Makhijani is the author and co-author of numerous reports and books on energy and environment related issues, including two published by MIT Press. He was the principal author of the first study of the energy efficiency potential of the US economy published in 1971. He is the author of *Carbon-Free and Nuclear-Free: A Roadmap for U.S. Energy Policy* (2007).

In 2007, he was elected Fellow of the American Physical Society. He was named a Ploughshares Hero, by the Ploughshares Fund (2006); was awarded the Jane Bagley Lehman Award of the Tides Foundation in 2008 and the Josephine Butler Nuclear Free Future Award in 2001; and in 1989 he received The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, with Robert Alvarez. He has many published articles in journals and magazines as varied as *The Bulletin of the Atomic Scientists*, *Environment*, *The Physics of Fluids*, *The Journal of the American Medical Association*, and *The Progressive*, as well as in newspapers, including the *Washington Post*.

Dr. Makhijani has testified before Congress, and has appeared on ABC World News Tonight, the CBS Evening News, CBS 60 Minutes, NPR, CNN, and BBC, among others. He has served as a consultant on energy issues to utilities, including the Tennessee Valley Authority, the Edison Electric Institute, the Lawrence Berkeley Laboratory, and several agencies of the United Nations.

### *Education:*

- Ph.D. University of California, Berkeley, 1972, from the Department of Electrical Engineering. Area of specialization: plasma physics as applied to controlled nuclear fusion. Dissertation topic: multiple mirror confinement of plasmas. Minor fields of doctoral study: statistics and physics.
- M.S. (Electrical Engineering) Washington State University, Pullman, Washington, 1967. Thesis topic: electromagnetic wave propagation in the ionosphere.
- Bachelor of Engineering (Electrical), University of Bombay, Bombay, India, 1965.

### ***Current Employment:***

- 1987-present: President and Senior Engineer, Institute for Energy and Environmental Research, Takoma Park, Maryland. (part-time in 1987).
- February 3, 2004-present, Associate, SC&A, Inc., one of the principal investigators in the audit of the reconstruction of worker radiation doses under the Energy Employees Occupational Illness Compensation Program Act under contract to the Centers for Disease Control and Prevention, U.S. Department of Health and Human Services.

### ***Other Long-term Employment***

- 1984-88: Associate Professor, Capitol College, Laurel, Maryland (part-time in 1988).
- 1983-84: Assistant Professor, Capitol College, Laurel, Maryland.
- 1977-79: Visiting Professor, National Institute of Bank Management, Bombay, India. Principal responsibility: evaluation of the Institute's extensive pilot rural development program.
- 1975-87: Independent consultant (see page 2 for details)
- 1972-74: Project Specialist, Ford Foundation Energy Policy Project. Responsibilities included research and writing on the technical and economic aspects of energy conservation and supply in the U.S.; analysis of Third World rural energy problems; preparation of requests for proposals; evaluation of proposals; and the management of grants made by the Project to other institutions.
- 1969-70: Assistant Electrical Engineer, Kaiser Engineers, Oakland California. Responsibilities included the design and checking of the electrical aspects of mineral industries such as cement plants, and plants for processing mineral ores such as lead and uranium ores. Pioneered the use of the desk-top computer at Kaiser Engineers for performing electrical design calculations.

### ***Professional Societies:***

- Institute of Electrical and Electronics Engineers and its Power Engineering Society
- American Physical Society (Fellow)
- Health Physics Society
- American Association for the Advancement of Science

### ***Awards and Honors:***

- The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, 1989, with Robert Alvarez
- The Josephine Butler Nuclear Free Future Award, 2001
- Ploughshares Hero, Ploughshares Fund, 2006
- Elected a Fellow of the American Physical Society, 2007, "*For his tireless efforts to provide the public with accurate and understandable information on energy and environmental issues*"
- Jane Bagley Lehman Award of the Tides Foundation, 2007/2008

***Invited Faculty Member, Center for Health and the Global Environment, Harvard Medical School:*** Annual Congressional Course, *Environmental Change: The Science and Human Health Impacts*, April 18-19, 2006, Lecture Topic: An Update on Nuclear Power - Is it Safe?

***Consulting Experience, 1975-1987***

Consultant on a wide variety of issues relating to technical and economic analyses of alternative energy sources; electric utility rates and investment planning; energy conservation; analysis of energy use in agriculture; US energy policy; energy policy for the Third World; evaluations of portions of the nuclear fuel cycle.

Partial list of institutions to which I was a consultant in the 1975-87 period:

- Tennessee Valley Authority
- Lower Colorado River Authority
- Federation of Rocky Mountain States
- Environmental Policy Institute
- Lawrence Berkeley Laboratory
- Food and Agriculture Organization of the United Nations
- International Labour Office of the United Nations
- United Nations Environment Programme
- United Nations Center on Transnational Corporations
- The Ford Foundation
- Economic and Social Commission for Asia and the Pacific
- United Nations Development Programme

***Languages:*** English, French, Hindi, Sindhi, and Marathi.

***Reports, Books, and Articles (Partial list)***

(Newsletter, newspaper articles, excerpts from publications reprinted in books and magazines or adapted therein, and other similar publications are not listed below)

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*A Time to Choose: America's Energy Future*, final report of the Ford Foundation Energy Policy Project, Ballinger, Cambridge, 1974. One of many co-authors.

Makhijani, A., and A. Poole, *Energy and Agriculture in the Third World*, Ballinger, Cambridge, 1975.

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Kahn, E., M. Davidson, A. Makhijani, P. Caeser, and S. Berman, *Investment Planning in the Energy Sector*, Lawrence Berkeley Laboratory, Berkeley, 1976.

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Makhijani, A., *Energy Use in the Post-Harvest Component of the Food Systems in Ivory Coast and Nicaragua*, Food and Agriculture Organization of the United Nations, Rome, 1982.

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Makhijani, A., and J. Kelly, *Target: Japan - The Decision to Bomb Hiroshima and Nagasaki*, July 1985, a report published as a book in Japanese under the title, *Why Japan?*, Kyoikusha, Tokyo, 1985.

Makhijani, A., *Experimental Irradiation of Air Force Personnel During Operation Redwing - 1956*, Environmental Policy Institute, Washington, D.C., 1985.

Makhijani, A., and R.S. Browne, "Restructuring the International Monetary System," *World Policy Journal*, New York, Winter, 1985-86.

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*U.S. Department of Energy's Hanford Nuclear Weapons Production Facility*, Institute for Energy and Environmental Research, Takoma Park, 1990.

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Makhijani, A., project director, *Examen critique du programme de recherche de l'ANDRA pour déterminer l'aptitude du site de Bure au confinement géologique des déchets à haute activité et à vie longue: Rapport final*, prepared for le Comité ocal d'Information et de Suivi; coordinator: Annie Makhijani; authors: Detlef Appel, Jaak Daemen, George Danko, Yuri Dublyansky, Rod Ewing, Gerhard Jentsch, Horst Letz, Arjun Makhijani, Institute for Energy and Environmental Research, Takoma Park, Maryland, December 2004

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CV updated October 11, 2010