



January 16, 2014

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Washington, D.C. 20555-0001

SUBJECT: *Expedited Transfer of Spent Fuel From Reactor Storage Pools*

Dear Commissioners:

On behalf of 33 Environmental Organizations¹, we are writing regarding your pending decision regarding whether to accept the recommendation by the U.S. Nuclear Regulatory Commission's ("NRC's") Executive Director for Operations ("EDO") against the expedited transfer of spent fuel from reactor storage pools to dry storage. *See* COMSECY-13-0030, Memorandum from Mark A. Satorius, EDO, to NRC Commissioners re: Staff Evaluation and Recommendation for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel (Nov. 12, 2013) ("COMSECY-13-0030"). These Environmental Organizations strongly urge you to reject the EDO's recommendation and order all operating reactor licensees to immediately replace high-density spent fuel storage racks with open-frame racks in reactor pools and transfer to hardened dry storage any spent fuel that no longer can be accommodated in low-density pool storage.

In the event that you are inclined to accept the EDO's recommendation, we write to notify you that we consider the technical studies performed by the NRC Staff in support of the recommendation to be grossly inadequate to comply with the Atomic Energy Act ("AEA"), the National Environmental Policy Act ("NEPA"), or NRC's regulations for implementation of those statutes. We urge you to take steps to comply with those statutes and regulations before adopting the EDO's recommendation. This letter complements our letter to you dated August 1, 2013, Dr.

¹ Alliance to Halt Fermi 3, Beyond Nuclear, Blue Ridge Environmental Defense League, Center for a Sustainable Coast, Citizens Allied for Safe Energy, Citizens' Environmental Coalition, Don't Waste Michigan, Ecology Party of Florida, Friends of the Coast, Friends of the Earth, Georgia Women's Action for New Directions, Green State Solutions, Hudson River Sloop Clearwater, Missouri Coalition for the Environment, NC WARN, Nevada Nuclear Waste Task Force, New England Coalition, No Nukes Pennsylvania, Northwest Environmental Advocates, Nuclear Energy Information Service, Nuclear Information and Resource Service, Nuclear Watch South, Physicians for Social Responsibility, Public Citizen, Promoting Health and Sustainable Energy, Radiation and Public Health Project, Riverkeeper, SEED Coalition, San Clemente Green, San Luis Obispo Mothers for Peace, Snake River Alliance, Southern Alliance for Clean Energy, and Vista 360.

Gordon Thompson's August 1, 2013 comments on the NRC Staff's Draft Consequence Study²; and Dr. Thompson's remarks at your briefing on January 6, 2014.³

Our concerns are as follows:

As previously stated in Dr. Thompson's August 1, 2013 comments on the Draft Consequence Study, and his presentation to you on January 6, 2014, the NRC Staff has failed to conduct a thorough or credible inquiry into the question of whether expedited transfer of spent fuel out of high-density reactor pools is warranted for protection of the environment and public health and safety. Dr. Thompson identified the following grave deficiencies in his comments on the Draft Consequence Study:

1. Pretence of considering low-density storage: The Study does not consider the risk implications of reverting to low-density, open-frame racks. Instead, NRC misuses the phrase "low density" in order to create a false impression of the Study's scope. This pretence reflects pre-determined conclusions based on a "feeling".
2. Limited consideration of water-loss scenarios: The Study focuses its analysis exclusively on water-loss scenarios involving total drainage. By so doing, the Study ignores a substantial part of the pool-fire risk. For example, the Study makes no effort to determine how the presence of residual water could affect fuel ignition. Extrapolation of Study findings indicates that consideration of this issue would substantially increase the estimated risk.
3. Limited consideration of initiating events: The Study considers only one type of initiating event – an earthquake. That narrow focus reflects a pre-determined conclusion that earthquake is the dominant contributor to the risk of a pool fire.
4. No consideration of attack: The Study ignores the potential for an attack on a pool and/or adjacent reactor to initiate a pool fire. Yet, the probability of an attack with a substantial likelihood of success is at least equal to the probability of the severe earthquake that the Study does consider. Thus, the Study significantly under-estimates pool-fire risk.
5. No analysis of risk linkages among pools and reactors: The Study identifies the potential for risk linkages, but does not properly analyze them. For example, the Study does not analyze a situation in which onsite radioactive contamination and other impacts of a reactor core melt would preclude mitigating actions that might prevent a pool fire. Yet, the probability of a core melt at an adjacent reactor is at least equal to the probability of the severe earthquake that the Study does consider. Thus, the Study significantly under-estimates pool-fire risk.

² 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 ("Thompson Declaration").

³ See Presentation by Gordon Thompson: Imperatives for Expedited Transfer, NRC Commissioners' Briefing on Spent Fuel Pool Safety and Consideration of Expedited Transfer of Spent Fuel to Dry Casks, Rockville, MD, 6 January 2014; Transcript of briefing (Jan. 6, 2014).



6. Misleading statements regarding mitigating actions: The Study concedes that its analysis of the feasibility of mitigating actions is very limited. Yet, the Study makes unequivocal statements about this feasibility. Some of those statements are misleading, and reflect pre-determined conclusions.⁴

Instead of responding to Dr. Thompson's comments by addressing or correcting these serious deficiencies, the Staff merely fell back on past studies that have been discredited because they suffer from the same deficiencies.

In addition, your own technical staff members have dissented from the conclusions of COMSECY-13-0030 that the consequences of a spent fuel pool fire are not significant enough to warrant expedited transfer of spent fuel. Their nonconcurrency reports make serious criticisms of the methodology used in the NRC's Regulatory Analysis to analyze the relative costs and benefits of expediting transfer of spent fuel out of pools and into dry storage. For example, the nonconcurrency by Brian Wagner states:

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.

Other criticisms by NRC Staff members include the use of inappropriate parameters to evaluate pool fire consequences, the lack of a resolution for pool fire risks in the western U.S., failure to consider factors that would increase the benefit of expedited transfer, and disregard of reasonable alternatives. The multiple criticisms in these nonconcurring opinions are set forth in an Appendix to this letter.

In addition, at the briefing you conducted on January 6, 2014, 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. This lack of relevant information was starkly demonstrated by the NRC Staff's response to Chairman Macfarlane's question regarding whether the NRC knows how much spent fuel is in each reactor pool, the level of burnup, and the arrangement of fuel in the pools. 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.*"⁵ Thus, it is clear that the Draft

⁴ Thompson Comments on Draft Consequence Study at 24

⁵ U.S. Nuclear Regulatory Commission, Briefing On Spent Fuel Pool Safety and Consideration of Expedited Transfer of Spent Fuel to Dry Cask, Official Transcript at 127-128 (emphasis added).



Consequence Study and Regulatory Analysis reflect no attempt to determine actual conditions in reactor spent fuel pools.

Given the serious deficiencies in the Staff's technical studies and the reservations expressed by your technical staff, we respectfully submit that adoption of the EDO's recommendation would violate your duty to protect public health and safety under the AEA.

Equally important, the EDO's recommendation violates the procedural requirements of NEPA because it identifies but rejects implementation of cost-beneficial mitigation measures that are relevant to the environmental impacts of spent fuel storage during license renewal terms. The existence of cost-beneficial measures to reduce the risk of spent fuel pool fires constitutes new and significant information bearing on the NRC's license renewal decisions, and therefore must be considered in proceedings for the renewal of reactor operating licenses. 10 C.F.R. § 51.92(a)(2); *Marsh v. Oregon Natural Resources Counsel*, 490 U.S. 360, 373-374 (1989). In violation of NEPA, the EDO has made no efforts to ensure the consideration of these mitigation measures in individual license renewal proceedings or the generic proceeding for the License Renewal Generic Environmental Impact Statement ("License Renewal GEIS").

In this context, we note that over 30 years have passed since the NRC last evaluated alternatives for the storage of spent fuel during reactor operation, in NUREG-0575, Final Generic Environmental Impact Statement On Handling and Storage of Spent Light Water Power Reactor Fuel (August 1979) ("Handling and Storage GEIS"). As pointed out in a January 3, 2014, letter submitted to you by the States of Vermont, New York, Massachusetts and Connecticut regarding COMSECY-13-0030, the temporal scope of the Handling and Storage GEIS extended only to the year 2000. No subsequent environmental impact statement exists that analyzes alternatives to pool storage of spent fuel during four, six, or eight decades of prospective reactor operation, despite the fact that risks of pool storage dramatically exceed the risks posed by dry storage of spent fuel.

In this Expedited Transfer proceeding, therefore, NEPA precludes you from approving the continued high-density pool storage of spent reactor fuel at reactors where license renewal applications are now pending or may be submitted. Instead, NEPA requires you to issue a revised Draft License Renewal GEIS that examines all of the technical information generated by the Expedited Transfer proceeding, including the Draft Consequence Study, the Regulatory Analysis, and the technical issues raised in public comments regarding both documents. These comments show the existence of a high level of controversy regarding the adequacy of the NRC's risk analysis, even within the NRC Staff. As Dr. Thompson commented, for instance, there are significant gaps in the analysis presented in the Draft Consequence Study. Preparing a Draft GEIS would go far to "ensure that the agency does not act upon incomplete information, only to regret its decision after it is too late to correct." *Duke Energy Corporation* (McGuire, Units 1 and 2; Catawba, Units 1 and 2) CLI-02-17, 56 NRC 1, 10 (2002).

A new Draft License Renewal GEIS is also necessary to resolve the gross discrepancies between NRC's own analyses 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 official model used by the NRC to inform emergency responders of the degree and extent of a nuclear accident, NUREG-1887, RASCAL 3.0.5 Descriptions of Models and Methods (August 2007) ("RASCAL Workbook").⁶ 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.⁷

In contrast, the RASCAL Workbook projects that a spent fuel pool fire following a major earthquake at the San Onofre Nuclear Generating Station 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 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."⁸

⁶ <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1887/sr1887.pdf> 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.

⁷ Transcript at 100.

⁸ RASCAL Workbook at 116.



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.⁹ Of that release, approximately 30 percent is cesium (roughly 40 million curies).¹⁰ 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.¹¹ Thyroid doses from inhalation of radioiodine are calculated at 39,000, 1,200 and 450 rems respectively.¹² 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 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.

In conclusion, we urge you to reject the EDO's recommendation. Should you disagree, NEPA requires you to reopen the License Renewal GEIS to consider impacts and alternative methods of storing spent fuel during reactor operation. In furtherance of this, you must initiate a new rulemaking proceeding and take any additional action necessary to ensure that NEPA's requirements are fulfilled.

Sincerely,

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⁹ *Id.* at 118.

¹⁰ *Id.* at 110.

¹¹ *Id.* at 118.

¹² *Id.*

**APPENDIX: SUMMARY OF NRC STAFF NON-CONCURRENCES
REGARDING EXPEDITED TRANSFER RECOMMENDATION IN COMSECY-13-0030**

I. NRC staff nonoccurrence issues presented by Donald Helton of the Office of Nuclear Regulatory Research to the ACRS on October 2, 2013

1. “The Regulatory Analysis shows that expedited movement of fuel older than 5 years from spent fuel pools to dry cask storage does not provide a substantial safety enhancement. *It is important for the reader to understand that the significance of the safety enhancement has been judged based solely on the risk to individuals living in close proximity to a nuclear power plant. This means that risk to an individual is assumed to be a reasonable surrogate for cumulative human health risk, even though the events in question are known to have widespread effects in the unlikely event they occur.*”¹
2. “*The Regulatory Analysis shows that the studied action is not cost-beneficial when radiological release frequency estimates are biased in favor of a cost/beneficial finding, while total offsite impacts (human health and otherwise) are not comprehensively considered.* Specifically, a dated dose conversion factor and a 50-mile distance truncation are employed. The Commission paper acknowledges this, and emphasizes the importance of the sensitivity studies, without informing the reader that: a. in many instances this is the difference between a cost/beneficial and noncost/beneficial determination, and b. it makes an order-of-magnitude difference in some results.”²
3. “*The staff’s work to date does not provide a clear perspective on the cost/beneficial result when both the conservatisms and non-conservatisms are removed.* Based on my own investigation (which involved constructing a cumulative distribution function from the low, base, and high cases, using the beyond-50-mile/\$4000 per person-rem sensitivities), I expect that the action would not be cost/beneficial for a majority of the fleet but could be cost/beneficial for many plants. Additional work to refine specific simplifying assumptions in the Regulatory Analysis (such as the effect of mitigation in reducing the release frequency), or to perform a simplified plant-by-plant screening based on available information, might alter this conclusion in a more non-cost/beneficial direction.”³

¹ U.S. Nuclear Regulatory Commission, Advisory Committee on Reactor Safeguards, 608th Meeting, October 2, 2013, Official Transcript of Proceedings, Remarks by Donald Helton (staff member in the Office of Nuclear Regulatory Research) at the October 2nd, 2013 ACRS Full Committee Meeting on Expedited Fuel Movement p. 284-285 (emphasis added).

<http://pbadupws.nrc.gov/docs/ML1329/ML13290A497.pdf>

² *Id.* (emphasis added)

³ *Id.* (emphasis added).

4. ***“The Regulatory Analysis does not consider related alternatives (e.g., expedited movement of fuel older than ten years, refinement of spent fuel pool heat load management requirements) that might be more cost-beneficial.”***⁴
5. “Since, on the whole, there is no compelling evidence upon which to take generic regulatory action, I agree with the Commission paper’s recommendation to close the Japan Lessons Learned Tier 3 item. ***However, in light of the points raised above, I believe that the staff should advocate for continued staff activity under another appropriate regulatory program to assess whether action would be cost-beneficial for specific plants when simplifying assumptions are refined, or when other contributing factors (such as inadvertent criticality) are considered. This would be in addition to resolving the issue for Western plants (as the Commission paper already envisions). This information would then be provided to the Commission.***”⁵
6. ***“I believe the staff should also 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.”***⁶
7. “I believe that the characterization of the Regulatory Analysis in the Commission paper needs to be strengthened to capture the importance of these items, such that the Commission paper provides the Commission with a balanced perspective on which to provide direction.”⁷

⁴ *Id.* (emphasis added)

⁵ *Id.* (emphasis added)

⁶ *Id.* (emphasis added)

⁷ *Id.* (emphasis added)

**II. Written Nonoccurrence Submitted by Brian Wagner, Office of Nuclear
Regulatory Research, Division of Risk Analysis, Performance Reliability Branch
to the Commission
January 6, 2013**

1. ***“Contrary to NUREG/BR-0058, ‘Regulatory Analysis Guidelines of the USNRC’ 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 (MLI3133A 132) and the ACRS letter (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.”⁸
2. “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.”⁹
3. ***“The regulatory analysis uses a 50-mile truncation as a baseline.*** 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. This truncation is arbitrary and technically indefensible.***”¹⁰
4. “The SECY paper and regulatory analysis argues that no further action is necessary since the alternative does not represent a substantial safety enhancement. It is not clear how this position reconciles with the SRM to SECY-93-086, which states that the substantial standard ‘is not intended to be interpreted in a manner that would result in disapprovals of worthwhile safety or security improvements having costs that are justified in view of the increased protection that would be provided.’ ***The substantial safety enhancement screen should not be used to dismiss cost-beneficial results or as a reason to not compute cost-benefit information for other reasonable alternatives.***”¹¹

⁸ U.S. Nuclear Regulatory Commission, Non-Concurrence Process, NCP-20 13-013, NRC Form 757, Section A, Brian Wagner, Staff Evaluation and Recommendation for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Nuclear Fuel, September 24, 2013, ADAMS ACCESSION NO. MLI3256A348

⁹ *Id.* (emphasis added)

¹⁰ *Id.* (emphasis added)

¹¹ *Id.* (emphasis added)

5. “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 1Q/'-3 per year to approach the safety goals (1 00x 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 Commission with relevant information to inform their decision.”*¹²

6. “*The regulatory analysis concludes the alternative is not cost-beneficial. This is in spite of the fact that the fleet is only bounded by the high estimates (which are shown to be cost-beneficial) and not the base case estimates.”*¹³

7. “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:
 - 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*

¹² *Id.* (emphasis added)

¹³ *Id.* (emphasis added)

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.”¹⁴*

¹⁴ *Id.* (emphasis added)