To: **California Coastal Commission** Date: August 9, 2015
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From: **Donna Gilmore**
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Re: **Application No. 9-15-0162 Application of Southern California Edison (SCE) to install independent cooling system, known as "Spent Fuel Pool Island" (SFPI) [using air chillers] and replace existing once-through ocean water cooling system serving spent nuclear fuel pools at San Onofre Nuclear Generating Station**

Please reject the application for this experimental Spent Fuel Pool Island air chiller cooling system. The proposed system for primary cooling of spent fuel pool water (similar to technology used to cool fish aquariums) is unproven and untested. SCE has provided inadequate evidence that this technology will work or can be maintained for the thousands of extremely hot fuel assemblies that currently require constant cooling. SCE's only example of primary air chiller spent fuel pool cooling, Rancho Seco, is not comparable. It was only used for three years, had less fuel and much cooler fuel. SCE's other two examples did not use chillers for primary cooling. See attachment for details. If the spent fuel pools are not cooled adequately, even a partial boil-off of the water below the level of the assemblies can cause a failure of the system that could result in loss of coastal access, including Interstate 5 and other potential impacts.

The assumption this system is needed for only a few years has not been substantiated by SCE. On the contrary, this system will likely be needed for decades, maybe longer. This affects seismic and other analysis provided in the Coastal Commission staff report and by SCE.

There is nothing in the documentation that addresses the impact if this system fails. There is nothing in the documentation that addresses the impact or plan if there is a need to revert back to ocean cooling. Reimbursement or mitigation for any impacts to the coastal environment caused by malfunction of this system, including loss of I-5 coastal access, is not adequately addressed.

SCE has provided inadequate substantiation to the Coastal Commission that this experimental unproven system will function properly to cool San Onofre's extremely hot spent nuclear fuel and for the duration this system is needed to work. Destroying the existing cooling system prior to ensuring this new system will work is unacceptable.

The SCE Inspection and Maintenance Plan should be part of the documentation that the public can review and comment on prior to any Coastal permit approval. There is no urgency that requires the permit be approved before this is done.

We urge you to not rely on SCE statements without verification, given SCE's past "misstatements". The Nuclear Regulatory Commission (NRC) does not plan to inspect this system until after it is installed. Therefore, there will be no review other than from the Coastal Commission. Our communities appreciate actions you have taken in the past on this issue and rely on the Coastal Commission to continue to protect our Coastal environment. Thank you.

Reasons to deny San Onofre Air Chiller Cooling System Coastal Permit

1. **SCE's only example of air chillers used for primary cooling of spent nuclear fuel is Rancho Seco and this is not comparable to San Onofre's extremely hot fuel**.
    a. SCE provided names of nuclear plants that use Spent Fuel Pool Islands, but none besides Rancho Seco that used air chillers for primary cooling of spent fuel pools.
    b. Rancho Seco used air chillers for only three years and their fuel was not as hot as San Onofre's fuel, so their cooling and maintenance requirements were significantly less demanding. Rancho Seco had only 6 full power years of operation, had fewer fuel assemblies, had no high burnup fuel, and their fuel cooled many more years in the pool before it was converted to an air chiller cooling system. Therefore, Rancho Seco's cooling and maintenance requirements were significantly less demanding than San Onofre's, so provides insufficient justification that this will be an adequate and reliable system.
    c. Unlike Rancho Seco, San Onofre is located in a corrosive marine environment which more quickly degrades chiller equipment and related systems. Chiller manufacturers have different requirements and sometimes shorter warranties for this environment.
    d. SCE has demonstrated their plan to change the cooling system for the spent fuel pools, relying on air chillers instead of ocean water to keep the spent fuel assemblies cool, was based on incomplete analysis. SCE initially said there were numerous nuclear plants using "spent fuel pool islands" and made the decision to use the air chiller system without knowing or providing the names of any nuclear plants that used air chillers in their spent fuel pool island systems. When Coastal Commission staff and I asked Tom Palmisano (SCE) which nuclear plants used air chillers to cool the spent fuel pools, the initial information provided did not contain any plants that used air chillers to cool the pools.
    e. After SCE's permit waiver was denied by the Coastal Commission, SCE could find only one plant that used air chillers for primary cooling of spent fuel pools (Rancho Seco).
    f. SCE named one plant (Brunswick) that used air chillers to supplement their primary cooling tower system during outages. This is not comparable to using air chillers for primary cooling.
    g. SCE named one plant (Robinson) that used water chillers (not air chillers) as a temporary supplement to their primary cooling tower system. This is not comparable to using air chillers for primary cooling.
    h. As stated by SCE, other plants use evaporative cooling systems (e.g., towers), which is the proven standard for cooling nuclear fuel.
    i. SCE's statement that other nuclear plants use Spent Fuel Pool Islands is misleading. That term does not describe the cooling system, which is the critical and relevant information.
    j. Rancho Seco has no high-burnup fuel[1] and only 493 fuel assemblies. The fuel cooled for many more years than San Onofre's fuel, so the demand for cooling at Rancho Seco

[1] High burnup fuel is defined as over 45 gigawatt days per metric tons of uranium (GWd/MTU). It burns longer in the reactor, resulting in fuel that is over twice as hot as lower burnup fuel.

is much less than San Onofre requirements. From its start in 1975 to the permanent shutdown in 1989 Rancho Seco only had a total equivalent of 6 full power years.[2]

k. In contrast, San Onofre has a large percentage of high burnup fuel (up to 52 GWd/MTU) and 2776 spent fuel assemblies in the pools.[3, 4] This fuel is over twice as hot as lower burnup fuel cooled for the same time period.

l. Maine Yankee was on one of SCE's list of Spent Fuel Islands. However, they rejected the use of chillers."[5] Maine Yankee is a pressurized water reactor (825 MWe) last operated in December 1996. After final defueling, the fuel pool housed 1432 assemblies. None of it was high burnup fuel.

m. On August 21, 2002, Rancho Seco completed placing all 493 spent fuel assemblies in dry storage at the onsite Independent Spent Fuel Storage Installation (ISFSI).[6] Rancho Seco fuel assembly burnup maximum is 38.2 GWd/MTU.[7]

2. **Other cooling options should be considered.**

a. The Commission staff report (page 6) appears to state there are only two options for cooling the pools − chillers or evaporative cooling units towers.[8] However, other options should be considered.

b. For example, continue with the current cooling system until the fuel is removed from the pools. Once the fuel is removed, the system usage would be reduced or eliminated unless and until there is a need to reload fuel back into the pools, or until the fuel is relocating to another operating plant or other location that has pools.

3. **The Coastal Commission should not accept SCE's short estimate of the length of time the system will be needed.**

a. SCE's assumption of only a 5 year use is predicated on being able to unload all the fuel by December 2020 and then destroy the pools. There are numerous problems with this assumption.

b. The Holtec spent fuel dry storage system SCE proposes is not approved by the Nuclear Regulatory Commission. In addition, SCE's modification of the design, showing this

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[2] Rancho Seco NRC Inspection Report, August 31, 1999, page 11
https://sanonofresafety.files.wordpress.com/2013/06/ml003772459ranchosecoinspectionreport1999-08-31foiapage44-64.pdf
[3] Attachment 32 - Unit 2 San Onofre Reactor Data (DOE Form GC-859 Schedule C)
https://sanonofresafety.files.wordpress.com/2013/06/songs-4702-masterfromformgc859.pdf
[4] Unit 3 San Onofre Reactor Data (DOE Form GC-859 Schedule C)
https://sanonofresafety.files.wordpress.com/2013/06/songs-4703-masterfromformgc859.pdf
[5] Conceptual Project Assessment, Spent Fuel Pool Island Project, CPA NO. 97-42, October 1997, P. 9 [5] Conceptual Project Assessment, Spent Fuel Pool Island Project, CPA NO. 97-42, October 1997, P. 9
https://sanonofresafety.files.wordpress.com/2015/05/19971000-my-jmb-spent-fuel-pool-island-conceptual-designmaineyankee.pdf
[6] Rancho Seco Post Shutdown Decommissioning Activities Report, Amendment 4, 7/31/2003, Page 3
http://pbadupws.nrc.gov/docs/ML0322/ML032260147.pdf
[7] Rancho Seco Facility and Independent Spent Fuel Storage Installation (ISFSI) NRC Inspection Report 05000312/2013007 and 07200011/2013001, August 22, 2013, Attachment 2 Loaded Canisters at Rancho Seco ISFSI *http://pbadupws.nrc.gov/docs/ML1323/ML13235A252.pdf*
[8] CC Staff Report Page 6: *SCE states that it selected the chiller-based design instead of a system depending on evaporative cooling in order to avoid the high water usage and highly-visible vapor plumes associated with evaporative cooling units. http://documents.coastal.ca.gov/reports/2015/8/th15a-8-2015.pdf*

"underground" system sitting only half underground has not been evaluated by the NRC, so may require an additional NRC license amendment.

c. The dry storage system has not been permitted by the Coastal Commission nor have funds been approved by the California Public Utilities Commission (CPUC) for the chiller and dry storage systems. I am an intervener in the current CPUC San Onofre decommissioning proceeding and have submitted testimony challenging SCE's chiller and dry storage system assumptions and related spent fuel management concerns.

d. If SCE destroys the pools there will be no method to unload fuel from a failed canister.

e. SCE's DOE standard contract requires SCE load fuel assemblies into a DOE approved cask.[9] If the pools are destroyed, they will not be able to comply with the DOE contract. This is one of many factors that may require the fuel to stay at the coastline for an indefinite period of time.

f. The NRC acknowledged in their August 26, 2014 Continued Storage decision, fuel may need to stay at each nuclear plant for over 100 years and require canister replacement.[10] Without a pool, this is not possible.

g. The NRC states the thin steel dry storage canisters are subject to stress corrosion cracking, particularly from coastal environments.

h. The Koeberg Plant in South Africa had a similar component leak from cracks in 17 years. It is in a similar coastal environment to San Onofre and the through-wall crack was 0.61" deep. San Onofre canisters are 0.625" deep. Diablo Canyon, Humboldt and Rancho Seco thin canisters are 0.5" deep.

i. If we have the same timeline as Koeberg for cracking, we will need to unload canisters in 5 years, since the first canisters at San Onofre were loaded in 2003.[11]

j. SCE has no inspection or repair tools that can be used to find or fix cracks. Holtec CEO, Dr. Kris Singh, states the cracks cannot be repaired, in the face of millions of curies of radiation released from even a microscopic crack.[12] SCE, as stated by Tom Palmisano the July 23, 2015 Community Engagement Panel meeting, is aware of these issues, but claimed the stainless steel they are using (316L) is better than the Koeberg component 304L steel.[13] However, the NRC states both of these steels are subject to stress corrosion cracking from corrosive marine environments and once a crack initiates, it can go through the wall of the canister in 16 years.[14] [15]

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[9] Research and Development Activities Related to the Direct Disposal of Dual Purpose Canisters, William Boyle, Director, Office of Used Nuclear Fuel Disposition R&D (NE-53), DOE, U.S. Nuclear Waste Technical Review Board Spring Board Meeting, April 16, 2013, slide 2 *http://www.nwtrb.gov/meetings/2013/april/boyle.pdf*

[10] Continued Storage of Spent Nuclear Fuel, August 26, 2014 *http://www.nrc.gov/waste/spent-fuel-storage/wcd.html*

[11] San Onofre Nuclear Generating Station, Units 1, 2, 3, and Independent Spent Fuel Storage Installation (ISFSI) Inspection Report 05000206/2014007, 05000361/2014007, 05000362/2014007, AND 07200041/2014001, NRC, February 13, 2014, Attachment 2 *http://pbadupws.nrc.gov/docs/ML1404/ML14045A317.pdf*

[12] Dr. Kris Singh, October 14, 2014 SCE Community Engagement Panel https*://www.youtube.com/watch?v=euaFZt0YPi4&feature=youtu.be*

[13] Dry Fuel Storage Defense in Depth, SCE, Tom Palmisano, July 23, 2015, slide 10 *http://www.songscommunity.com/docs/04_SCECEPISFSI-DID_072315.pdf*

[14] Chloride-Induced Stress Corrosion Cracking Tests and Example Aging Management Program, Darrell S. Dunn NRC/NMSS/SFST, Public Meeting with Nuclear Energy Institute on Chloride Induced Stress Corrosion Cracking Regulatory Issue Resolution Protocol, August 5, 2014, slide 9 & 10 *https://sanonofresafety.files.wordpress.com/2013/06/8-5-14-scc-rirp-nrc-presentation.pdf*

k. The existing steel canisters may already be cracking, but no one knows because they cannot be inspected.

l. There is no seismic rating for a cracked canister.

m. The dry casks need to cool for decades before they can be shipped to a permanent site. SCE plans to load 37 fuel assemblies in each Holtec canister and the majority of the fuel at San Onofre is high burnup fuel. The combination of a high number of fuel assemblies and hotter fuel will require decades of storage before fuel can be transported.[16] Therefore, it's critical we have a retrieval system and that requires a functional spent fuel pool.

4. **The SCE Inspection and Maintenance Plan should be part of the documentation that the public can review and comment on prior to any Coastal permit**. There is no urgency that requires the permit be approved prior to this. [17]

5. **The Commission needs to consider the lifespan of the system in a corrosive marine environment and based on the potential for a much longer lifespan than estimated by SCE**. What is the actual warranty of the chillers for our corrosive marine environment?

6. **Chillers are known to be extremely loud and there will be three to four of them in use**. What is the decibel level of these and is it acceptable?

7. **Additional substantiation and independent verification is needed for the adequacy of the proposed air chiller system.**

   a. The staff report (page 6) states "*In the present "defueled" state of Units 2 and 3, the heat load in the spent fuel pools is **significantly** lower than if freshly offloaded fuel was still being added to the pools. The SFPI system would have a **cooling capacity roughly twice that needed to dissipate the current heat load**, and thus can provide an interim system for spent fuel cooling until the fuel can be transferred to dry cask storage*."

   b. The word "significantly" is subjective and not quantified. Significantly lower does not mean low enough.

   c. How was the cooling capacity determined? Rancho Seco ran a test to see how long the fuel would take to almost reach the boiling point, due to the margin of error in attempting to calculate this. This is not something to rely on with an estimate. As we know from the steam generator project, SCE has relied on incorrect calculations in the past.

   d. If fuel assemblies must be returned to the pool from the dry casks, they may be much hotter. This variable need to be analyzed. Since this is an experimental system and unloading fuel

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[15] NRC Summary of August 5, 2014 Public Meeting with the Nuclear Energy Institute on Chloride Induced Stress Corrosion Cracking Regulatory Issue Resolution Protocol
https://sanonofresafety.files.wordpress.com/2013/06/ml14258a081-8-5-14meetingsummary.pdf

[16] Ibid, Slide 10

[17] *However, because no specific plan is currently available, Commission staff recommends Special Condition 1, which would require SCE to submit, for the Executive Director's review and approval, an Inspection and Maintenance Plan detailing the type and frequency of system inspections and the procedures that would be followed to assure that SFPI system remains in good working condition and will continue to meet its initial seismic safety design throughout the project life*., Spent Fuel Pool Island Cooling System– CC Staff Report 7/24/2015
http://documents.coastal.ca.gov/reports/2015/8/th15a-8-2015.pdf

back into the pools has never been done, it's a significant unknown. Returning hotter fuel to a cooler pool might cause a problem.[18]

e. Given this system has never been used as primary cooling of high burnup fuel and there is a large amount that is still extremely hot, there is not a large margin for error.

f. SCE has yet to provide substantiation for the adequacy and reliability of this system over the lifespan needed.

g. Independent verification is needed of SCE's statements.

h. Who is the technical source of the above claims? What are their qualifications? Is SCE relying on the vendor for these claims?

8. **There appear to be inadequate redundancies and backup plans in this system.**

   a. Regarding the four chillers (two for each spent fuel pool) as referenced on Page 7, doesn't the use of only one spare chiller and use of crossties reduce the needed redundancies?

   b. There appear to be many single points of failure and reliance on workers to be able to access the facility in a severe earthquake and make the needed repairs.

   c. SCE admitted not all portions of the cooling system are earthquake safe.

9. **What is the expected lifespan of the various parts of the system?**

10. What pollutants will still continue to be dumped into the ocean, even if this system is installed, since only part of the once-through system will be discontinued?

11. **The earthquake evaluations appear to be pre-Fukushima and have not taken into consideration the new USGS data**, including the information about faults able to jump 9 feet to another fault. And the new information about strike-slip faults and other information about the lessons learned from Fukushima for earthquakes and tsunamis.[19] San Onofre "design basis" predates Fukushima.

12. **The Tsunami analysis is pre-Fukushima and is also based on the short project life span**, which is not a conservative assumption. Also, what if the Tsunami wall failed? What is the lifespan of the Tsunami wall and has it be inspected and evaluated?

13. **What is the daily intake of ocean water reduction due to this chiller system? Please revise Executive Summary.**

    a. The staff Executive Summary (Page 2) states this alternative spent fuel cooling system will eliminate the plant's use of ocean cooling water. However, Page 11 states daily intake of ocean water will only be reduced **from approximately 98 MGD to 48 MGD** and a **portion of this reduction is due to changes other than the air chiller cooling system**. This should be clarified and also indicate the actual reduction due to the air chillers and included in the Executive Summary. [20]

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[18] Viability of Existing INL Facilities for Dry Storage Cask Handling, Randy Bohachek et. al., Rev. 1, April 30, 2013, Idaho National Laboratory, FCRD-UFD-2013-000027. INL/EXT-13-29035, Page 2 *http://energy.gov/sites/prod/files/2013/12/f5/INLFacilitiesDry%20StorHBUFViabilRptR1b.pdf*

[19] Earthquake Risks *http://sanonofresafety.org/earthquake-and-tsunami-risks/*

[20] CC Staff Report, Page 11: *At present, the daily intake of ocean water at SONGS is approximately 98 MGD, or about 4% of the full operational flow when the plant was operational. Even at this reduced level of intake, the plant remains a major user of once-through cooling water, and results in the mortality of large numbers of marine organisms, both through entrainment in the intake stream and through impingement against the intake screens.*

b. Can these other systems still be installed without the chiller system?

14. What is the coastal impact if this system fails?

a. The staff report needs to address the discharge of fluids or contaminants to coastal waters and affect on marine organisms if the system fails. It only addresses this for "under normal operating conditions" (page 2).

15. **SCE reimbursements and mitigation are only partially addressed.**

a. CC staff states SCE shall reimburse the Coastal Commission for all Coastal Commission costs and attorney fees. Other areas that may need reimbursement are not addressed.

b. Reimbursements for any impacts to the coastal environment caused by malfunction of this system, including loss of access to I-5 are not addressed.

c. What is impact if the system fails?

d. What if the mitigation of the system fails?

e. SCE said replacement reactor steam generators would last 40 to 60 years, yet failed after 1 year of operation of Reactor Unit 3 and with decades of premature wear in both Reactors. The NRC determined Southern California Edison was at fault. "…a significant design deficiency in replacement steam generators, resulting in rapid tube wear of a type never before seen in recirculating steam generators." In the NRC's 12/23/2013 the NRC cited SCE with a Notice of Violation. They stated: "…design control measures were not established to provide for verifying or checking the adequacy of certain designs."[21]

Installation of the SFPI system, along with a previously-approved retrofit of the plant HVAC system and installation of smaller intake pumps (CDP waiver 9-15-0417-W), would eliminate the need for once-through cooling water and halve the plant's rate of ocean water intake, to approximately 48 MGD.

[21] San Onofre Nuclear Generating Station – Final Significance Determination of White Finding and Notice of Violation, NRC Inspection Report 05000361/2012009 AND 05000362/2012009, NRC, December 23, 2013 *http://pbadupws.nrc.gov/docs/ML1335/ML13357A058.pdf*