



REPORT OF THE
SAN ONOFRE NUCLEAR
GENERATING STATION
TASK FORCE

2019 - 2020

SAN ONOFRE NUCLEAR GENERATING STATION TASK FORCE

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LETTER FROM REPRESENTATIVE MIKE LEVIN

MARCH 2020

INTRODUCTION

I am fortunate to represent one of the most beautiful Congressional districts in the United States. While we have many incredible resources, none is more important than our more than 50 miles of coastline. Directly threatening this resource is over 1,600 tons of spent nuclear fuel stored just 100 feet from the Pacific Ocean. This is the legacy of the San Onofre Nuclear Generating Station (SONGS), which stopped producing electricity in 2012. It is also the legacy of failed federal policies to address the storage and disposal of our nation's spent nuclear fuel.

Soon after being sworn into office in January 2019, I convened the SONGS Task Force, which has analyzed the technical and regulatory issues at SONGS and developed a set of policy recommendations. The Task Force has been co-chaired by Greg Jaczko, former Chair of the Nuclear Regulatory Commission (NRC) from 2009 to 2012, and retired Rear Admiral Len Hering. I am extremely grateful to Greg and Len for their leadership and guidance.

We have a growing spent nuclear fuel crisis in the United States. For decades, the U.S. Department of Energy (DOE) has been developing the Yucca Mountain Nuclear Waste Repository in Nevada. The biggest challenge with Yucca Mountain has been obtaining local consent. Recently, President Trump weighed in on Yucca Mountain, tweeting his opposition to the site and his desire to instead find “innovative approaches” to solve the nation's spent nuclear fuel problem. My hope is that the SONGS Task Force has provided many such ideas that can be a starting point for action.

As stated in the Surfrider Foundation's analysis prepared for this report, “Currently, there is no location for the interim storage or permanent disposal of any of the nation's commercially-generated [spent nuclear fuel].” Regardless of one's opinion on the past, present, and future of nuclear power, the lack of storage and disposal facilities for spent nuclear fuel is a massive problem that must be expeditiously addressed by the federal government, and I will continue to lead the charge to do so.

As our nation continues to grapple with long-term spent nuclear fuel issues, I introduced the Spent Fuel Prioritization Act (H.R. 2995), which would direct DOE to prioritize accepting high-level radioactive waste or spent nuclear fuel from decommissioned civilian nuclear power reactors that are located in high population density and earthquake hazard areas, such as SONGS.

I also advocated for \$25 million in the 2019 House Appropriations package to fund transportation planning and consent-based site selection for Consolidated Interim Storage (CIS). Despite some concerns around CIS, which are discussed in the Task Force report, I believe this funding is appropriate, and I am encouraged that similar funding has been included in President Trump's FY2021 budget request. With Yucca Mountain's future in doubt, developing a new geologic spent nuclear fuel repository could take several decades. I believe we cannot wait to move spent nuclear fuel from SONGS and other high-risk sites until a new geologic repository is operational, and that we must strive towards siting one or more CIS sites in the meantime.

The SONGS site offers specific challenges due to its proximity to seismic activity, rising sea levels, and large population density. Furthermore, recent concerns have arisen surrounding the choice of Holtec International to store onsite spent nuclear fuel, as well as training and monitoring being conducted by Southern California Edison (SCE). This report will explore each of these areas in depth.

The Task Force's report outlines just some of the major issues we face to securely store, remove, and eventually dispose of the spent nuclear fuel at SONGS, as well as some overarching national policy challenges that must be addressed.

In the near term, we must ensure the safety of the SONGS site, minimize the chance for accidents, improve emergency planning, and strengthen public trust. We must also begin planning in earnest to transport the waste away from SONGS — a highly challenging but not insurmountable task.

STAKEHOLDER ENGAGEMENT

During my first term in office, I have gathered a large quantity of relevant information from relevant stakeholders. The following is a partial list of meetings and discussions held on the subject of spent nuclear fuel:

- The full SONGS Task Force met on April 25, 2019; June 8, 2019; July 20, 2019; October 5, 2019; December 7, 2019; and January 23, 2020. The Task Force Technical Committee met on May 10, 2019; May 31, 2019; and August 5, 2019. The Task Force Policy Committee met on June 6, 2019; and September 5, 2019.
- I have had multiple meetings with representatives of the NRC and DOE, including the following: Chairman Kristine Svinicki (June 25, 2019), NRC Commissioner Jeff Baran (January 15, 2019), NRC Region IV Administrator Scott Morris (March 14, 2019; May 16, 2019), the NRC Office of Nuclear Material Safety and Safeguards (June 12, 2019), and the DOE Office of Spent Fuel and Waste Disposition (September 10, 2019).
- I have also written multiple letters to the NRC regarding SONGS and related matters, including on the following dates: January 18, 2019; April 15, 2019; April 17, 2019; June 11, 2019; June 21, 2019; October 17, 2019; and January 9, 2020. A copy of these letters, as well as responses from the NRC, are included in Appendix B of this report.
- On February 1, 2019, I met with SCE Community Engagement Panel leaders Dr. David Victor and Jerry Kern.
- On March 6, 2019 and October 24, 2019, I met with Counsel for the Commandant of the United States Marine Corps regarding the Department of the Navy's lease to SCE for SONGS.
- On April 9, 2019, I met with Dr. Alison MacFarlane, who chaired the NRC from 2012-2014, and Dr. Daniel Metlay, who served on the senior professional staff of the Nuclear Waste Technical Review Board.
- On April 16, 2019 and May 29, 2019, I was provided tours of SONGS by SCE staff. The April tour and meeting focused on long-term planning for the site, and the May tour and meeting focused on canister safety.
- On May 16, 2019, I met with Secretary of the Navy Richard Spencer regarding the Department of the Navy's lease to SCE for SONGS.
- On May 16, 2019, I wrote to SCE regarding its efforts to limit participation in our meeting on spent fuel canisters. A copy of this letter is included in Appendix B of this report.

- On June 7, 2019, I participated in a Congressional hearing of the House Oversight and Investigations Committee, Subcommittee on the Environment in Laguna Niguel, CA, which was attended by NRC representatives and led by Subcommittee Chair Harley Rouda (D-CA).
- On August 2, 2019, I visited the Yucca Mountain Nuclear Waste Repository in Nevada, along with Rep. Steven Horsford (D-NV), Rep. Bill Flores (R-TX), and Rep. Scott Peters (D-CA).
- On August 20, 2019, I attended and spoke at an NRC public meeting in San Juan Capistrano, CA.
- On October 7, 2019, I met with representatives from North Wind, Inc., regarding their strategic planning efforts on behalf of SCE.
- On October 9, 2019, I met with California State Senate President Pro Tempore Toni Atkins regarding oversight of spent nuclear fuel.
- On December 17, 2019, I met with representatives from Interim Storage Partners, who are in the process of securing a license for a Consolidated Interim Storage (“CIS”) facility in Texas.

TASK FORCE AREAS OF FOCUS

As the SONGS Task Force chairs describe in the report, the Task Force has been divided into a Policy Committee and Technical Committee, which together have provided substantive analysis and recommendations. The Policy Committee identified five categories for the Policy Recommendations section of this report:

- Federal Legislation and Regulatory Oversight
- State Legislation and Regulatory Oversight
- Best Practices
- Storage and Aging Management
- Safety and Handling

These categories have been completed by teams who have worked collaboratively on the end product. The report has been structured with both findings and associated recommendations, which refer to the Technical Committee’s section of the report and support the associated recommendations.

ACTIONS BASED ON KEY POLICY RECOMMENDATIONS

The SONGS Task Force made 30 policy recommendations, many of which have a federal nexus. I would like to highlight several important areas of my continued action at the federal level that are informed by these recommendations:

1. Our office will continue to aggressively pursue federal legislation that directs DOE to prioritize accepting high-level radioactive waste or spent nuclear fuel from decommissioned civilian nuclear power reactors that are located in high population areas and high earthquake hazard, as envisioned under the Spent Fuel Prioritization Act (H.R. 2995).
2. Our office will consider federal legislation amending the Atomic Energy Act to empower states to perform environmental review of the transport, siting, and storage of spent nuclear fuel. The first step will be to establish a group of federal, state, local, and tribal officials to study and report on the implications of providing states with these authorities
3. Our office will consider federal legislation to create a new Nuclear Waste Administration, as recommended by President Obama’s Blue Ribbon Commission on America’s Nuclear Future. The

Nuclear Waste Administration would establish a new facility siting process and a new framework to achieve consent for future storage and disposal sites, including mandates for accountability and enforcement.

4. Our office will consider federal legislation that requires spent nuclear fuel canisters to have a design life of at least 100 years. Failure risks of canisters due to stress corrosion cracking must not be overlooked. This includes requesting that the National Academy of Sciences conduct a thorough report assessing the following: the long-term risks of dry canister storage in below grade facilities; hydride reorientation of cladding in spent nuclear fuel storage; verification of damage detection, inspection, and repair methods; feasibility of repackaging/replacement procedure; and risk assessment of on-site storage of spent nuclear fuel.
5. Our office will continue to demand that the NRC use its existing regulatory authority to require resident inspectors at nuclear power plants while the plant is in the fuel handling and transfer phases of decommissioning. We will also advocate for independent monitoring and public reporting of relevant technical and safety information at SONGS and elsewhere.
6. Our office will work with appropriate federal agencies and the nuclear industry to authorize and develop a program that incentivizes spent nuclear fuel storage innovation through research and development to discover alternate ways to isolate nuclear material from humans and the environment.
7. Our office will work to encourage collaboration on best practices between military and civilian spent nuclear fuel handling authorities, and recommend NRC conduct a review of international practices related to storage of spent nuclear fuel inside hardened, enclosed buildings. We also will consider federal legislation to require the NRC to establish a new detailed quality and training program for all personnel at spent nuclear fuel sites as an element of licensing.
8. Our office will work to create a Congressional Spent Nuclear Fuel Caucus to discuss spent nuclear fuel storage, disposal, and transportation issues.

CONCLUSION

I would like to again extend my thanks to our SONGS Task Force co-chairs for their continued leadership, and to each member of the Task Force who volunteered their time and expertise in the production of this report. I am deeply encouraged by the outpouring of support for this endeavor in the months since the Task Force was formed.

Safety and transparency at SONGS, as well as the removal of spent nuclear fuel off the California coast and away from other high-risk areas as quickly and safely as possible, will continue to be among my top priorities for as long as I am honored to serve in Congress.

Yours Sincerely,

A handwritten signature in blue ink that reads "Mike Levin". The signature is fluid and cursive, with a prominent flourish at the end.

Mike Levin

United States Representative, 49th District of California

TRANSMITTAL LETTER

Dear Congressman Levin

On behalf of the members of the San Onofre Nuclear Generating Station Task Force, we transmit the final report of the Task Force. The report represents the views of all the Task Force members unless specifically noted in the report. We developed 30 recommendations based on 29 findings related to the challenge of dealing with spent nuclear fuel from the San Onofre Nuclear Generating Station outside San Diego, California.

You created the Task Force in January 2019 with the goal to address the safety challenges at the San Onofre Nuclear Generating Station (SONGS) and to drive solutions to deal with sensitive waste located at SONGS. To accomplish this directive, the Task Force established two committees: a technical committee and a policy committee. The technical committee reviewed the technical, legal and regulatory status of spent fuel storage issues at SONGS. The policy committee addressed the analysis of the technical committee and developed the findings and recommendations in the final report. Both committees created individual working groups to provide proposed findings and recommendations for the consideration of the full committee. The working groups reviewed reports from government, industry and public interest sources. Combined with the knowledge and expertise of the Task Force members, we developed the conclusions in this report.

The Policy Committee consisted of the following five working groups:

- Federal Legislation and Regulatory Oversight
- State Legislation and Regulatory Oversight
- Best Practices
- Storage and Aging Management
- Safety and Handling

The Task Force identified a number of challenges in the current approach to ensuring the safety of spent nuclear fuel at SONGS. These findings address failures or legal limitations in the organizations responsible for safety from the federal to the state government. In addition, the Task Force recognized that the lack of a long term disposal option creates specific challenges for the reactor storage of spent fuel. Included are a number of findings related to the specific problems that have occurred with spent fuel at SONGS. The Task Force also worked to identify best practices that could improve the short and long term safety of the SONG spent fuel. The full list of findings can be found in the report.

From the findings, the Task Force developed a comprehensive set of recommendations for government policy makers, government regulators, and industry participants. These recommendations provide specific guidance for Congress, state and federal authorities to improve the specific safety of fuel at SONGS and the overall national program for ensuring the long-term safety of spent nuclear fuel. The Task Force also identifies areas the current safety approach could benefit from the input of other organizations with relevant expertise. The full list of recommendations is provided in the report.

Many of these findings and recommendations provide a starting point for the effort to address the safety of spent nuclear fuel at SONGS. We expect that many of these points will evolve as the knowledge of long term spent fuel storage grows and the solutions emerge. We are prepared to update and revise these items as circumstances change.

Of particular note and importance, the two areas where there was the most significant concern and disagreement surrounds the storage cask currently being utilized for the storage of materials within the facility and the complete relaxation of the onsite radiologic monitoring requirement. Despite the lack of consensus on these issues within the Task Force, we believe they deserve continued attention.

Finally, we want to thank the tremendous effort of all the members of the Task Force. Dealing with spent nuclear fuel is a difficult technical, environmental, policy and communications challenge. The thoughtful, deliberative and extensive evidence and conclusions in this report represent the dedication and effort of the Task Force members. We think their work provides a comprehensive set of meaningful and reasonable solutions to improve the safety of spent nuclear fuel generated by SONGS. Moreover, we think their work provides key lessons for other sites dealing with similar spent fuel storage challenges. We appreciate the opportunity to work with such a committed and thoughtful group.

Finally, we commend you for your energy and commitment to resolving the spent fuel issues at SONGS and for leadership on the national challenge of dealing with spent nuclear fuel safely. We hope this report will provide useful information. We thank you for the opportunity to lead this Task Force and look forward to discussing the report with you as you continue your efforts to address this crucial issue for the people living and working near the San Onofre Nuclear Generating Station.

Sincerely,

Rear Admiral Leendert R. “Len” Hering, Sr., USN, Retired

Dr. Gregory B. Jaczko, former Chairman of the U.S. Nuclear Regulatory Commission

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KEY TERMS AND ABBREVIATIONS

CEC	Cavity Enclosure Container	NWPA	Nuclear Waste Policy Act
CCC	California Coastal Commission	OSHA	Occupational Safety and Health Administration
Disposal	The term “disposal” means the emplacement in a repository of high-level radioactive waste, spent nuclear fuel, or other highly radioactive material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste.		
DOE	U.S. Department of Energy	SCE	Southern California Edison
DON	Department of the Navy	SLC	California State Lands Commission
DOT	U.S. Department of Transportation	SNF	Spent nuclear fuel. The term “spent nuclear fuel” means fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.
EPA	U.S. Environmental Protection Agency	SONGS	San Onofre Nuclear Generating Station
FEMA	Federal Emergency Management Agency	Storage	The term “storage” means retention of high-level radioactive waste, spent nuclear fuel, or transuranic waste with the intent to recover such waste or fuel for subsequent use, processing, or disposal.
FSAR	Final Safety Analysis Report	UMAX	Holtec International Storage Module Underground MAXimum Capacity
ISFSI	Independent Spent Fuel Storage Installation	VVM	Vertical Ventilated Module
IPC	Interjurisdictional Planning Committee		
MLLW	Mean lower low water level		
MPC	Multi-purpose canister		
NRC	Nuclear Regulatory Commission		

EXECUTIVE SUMMARY

FINDINGS

- A. There are multiple agencies at the local, state, and federal levels that have jurisdiction over the storage, transportation, and safety of SNF, with the lead agency being the federal NRC.
- B. The Independent Spent Fuel Storage Installation (ISFSI) at SONGS could experience structural degradation from direct groundwater or seawater exposure over time, due to the close proximity to a rising coastal waterline and groundwater table.
- C. The current lack of a permanent repository for SNF is unacceptable and could put our communities, coastlines and other natural resources at risk.
- D. Consent-based siting, with meaningful partnerships and open communication among federal, state, local, and tribal leaders, is a critical step toward establishing a permanent SNF repository.
- E. Lack of an effective timeline and metrics for SNF has led to stranded SNF throughout the United States.
- F. Environmental review and safeguards for permanent disposal are needed for effective federal regulation of SNF.
- G. The management of SNF sites by non-utility private entities may endanger safety.
- H. Current storage canisters at SONGS lack retrievability of SNF.
- I. State agencies have not sufficiently coordinated efforts on SNF storage permitting.
- J. State agencies have not defined their authority over SNF oversight.
- K. Lack of nuclear industry transparency with stakeholders has led to renewed social and political pressure opposing the storage and disposal of SNF in the U.S.
- L. SNF dry storage canisters serve as radiation containment.
- M. The NRC regularly grants licensees significant exemptions from its rules.
- N. Non-utility entities are buying nuclear plants in the decommissioning phase.
- O. Lack of training by SNF storage contractors has led to negative consequences.
- P. Nuclear fuel handling procedures that ensure safety in military operations have not been applied to civilian nuclear power plants.
- Q. Other countries place SNF systems inside enclosed buildings.
- R. Pursuant to current law, DOE is required to take ownership of SNF canisters for permanent disposal.

- S. Most on-site SNF storage systems are above ground, on parking lot-type pads, where the storage canisters are each covered in a concrete overpack.
- T. There are instances of metal-to-metal contact between steel storage canisters and the storage vault liner when employees download canisters into the partially below grade storage system.
- U. The 2018 FSAR did not address ISFSI air vent blockage and cessation of canister passive cooling via flash flood, tsunami inundation, or landslide.
- V. The repackaging/replacement procedure for damaged canisters or damaged fuel is underdeveloped.
- W. SCE does not have an optimal and qualified long-term plan for inspection, maintenance, monitoring, or repair procedures.
- X. The current method the NRC uses to calculate risk – risk triplet method and risk-tree analysis – does not sufficiently quantify risk.
- Y. There is no ability to detect chemical damage to SNF in current dry storage configuration.
- Z. The high accessibility and visibility of the site leaves it extremely vulnerable to an act of malfeasance.
- AA. The decision of the NRC to allow SONGS to disable the alert and notification system has created significant public concern.
- BB. Lack of sufficient training and qualification requirements for canister handling were major factors in the August 2018 download incident.
- CC. Improper and inadequate equipment and technology were other major factors in the August 2018 download incident.



Image: Southern California Edison

RECOMMENDATIONS

1. Congress should consider federal legislation requiring a plan for removal of SNF from the SONGS site on San Onofre State Beach.
2. Congress should consider federal legislation that creates a framework to achieve consent for future storage and disposal sites.
3. Congress should consider federal legislation regarding SNF to include mandates for accountability and enforcement. Specifically, the legislation should include nationally agreed upon legislative definitions, timeline requirements, incentives for sites to accept SNF, and viable enforcement mechanisms.
4. Congress should consider federal legislation to allow for state authority to perform environmental review of the transport, siting, and storage of SNF.
5. The California Attorney General should intervene in any potential sale of utility-owned nuclear assets to non-utility private entities.
6. The California State Legislature should require those managing nuclear power plants to use easily retrievable and monitorable storage systems.
7. The California Public Utilities Commission, California Energy Commission, California Coastal Commission, and California State Lands Commission, among others, must share information with one another and require only best practices be implemented at storage sites.
8. States must be given authority to conduct oversight of SNF storage.
9. The California Public Utilities Commission should prevent utilities that own nuclear assets from increasing rates for decommissioning.
10. The California Public Utilities Commission should require power plant owners to establish funding reserves from nuclear power plant owner resources to cover emergency response to high levels of radiation releases, as long as radioactive material is on-site.
11. Congress should support the creation of a separate, federal Nuclear Waste Administration to mandate best practices.
12. Congress should consider legislation to adopt the Blue Ribbon Commission on America's Nuclear Future's recommendation to establish a new facility siting process, establish a new SNF management organization, and broaden support to municipalities affected by transportation routes.
13. Congress should consider legislation that restricts NRC from approving canisters with a design life of less than 100 years.
14. Congress should consider legislation requiring the NRC to create capitalization minimums for businesses applying to purchase nuclear power plants in decommissioning.
15. The NRC should use its existing regulatory authority to require permanent on-site inspector roles at nuclear power plants while the plant is in the fuel handling and movement phases of decommissioning.
16. Congress should encourage collaboration on best practices between military and civilian SNF handling authorities.
17. The NRC should conduct a review of international practices related to storage of SNF inside hardened, enclosed buildings.

18. Congress should work with DOE and industry to authorize and develop a program that incentivizes SNF storage innovation through research and development to discover alternate ways to isolate nuclear material from humans and the environment.
19. Members of Congress should create a Spent Nuclear Fuel Caucus to discuss SNF storage, disposal, and transportation issues.
20. The DOE and nuclear power plant owners should reach a consensus on which canister and storage system to use for storage of SNF and apply jointly to the NRC for the license.
21. Congress should request that the National Academy of Sciences conduct a thorough report assessing the following: the long-term risks of dry canister storage in below grade facilities; hydride reorientation of cladding in SNF storage; verification of damage detection, inspection, and repair methods; feasibility of repackaging/replacement procedure; and risk assessment of on-site storage of SNF.
22. The nuclear power plant owner and the NRC should conduct an FSAR study to mitigate loss of passive cooling in ISFSI via air vent blockage and inundation with water from rain or coastal flooding, or sand and silt from a landslide.
23. Congress should require the DOE and nuclear power plant owners to develop a technical procedure for canister repackaging/replacement prior to further NRC canister license approval, SNF pool decommissioning and removal, and loading of canisters in an on-site ISFSI.
24. Congress should require the NRC to implement a new method of conducting a failure mode and risk analysis to determine the risk probability number, a more accurate measure for each risk factor. DOE and NRC should cooperate in this risk assessment process.
25. The SNF at SONGS requires a storage configuration with more levels of redundancy and must be moved to a technically defensible storage facility to reduce threats. From a security standpoint, the SNF should be moved further away from the coastline.
26. Congress should budget adequate funding annually to ensure *proper and comprehensive* emergency planning measures are in place for all surrounding municipalities to implement for the safety of their residents.
27. Congress should work towards a consent-based final disposal site including prioritization for sites with higher risk of sea level rise, high population density and high potential for seismic events, including as envisioned under the Spent Fuel Prioritization Act (H.R. 2995).
28. The NRC should consider requiring SONGS to reenact the alert and notification system because the costs or downsides are far outweighed by its benefits.
29. Congress should consider legislation to require the NRC to establish a new detailed quality and training program for all ISFSI personnel as an element of ISFSI licensing.
30. Congress should consider legislation requiring ISFSI licensees to utilize additional equipment and technology for canister loading.

FEDERAL LEGISLATION AND REGULATORY OVERSIGHT

FINDINGS AND RECOMMENDATIONS

INTRODUCTION

Due to the hazards that spent nuclear fuel (SNF) storage poses to our community and coastal environment, the SONGS Task Force has established a method for local stakeholders to address safety challenges at SONGS through regular meetings, research, reports and analysis. This Task Force formed a committee to analyze the current federal legislative and regulatory oversight framework to address these threats and recommends that new federal legislation be introduced.

The United States has a SNF problem and has yet to find an answer. There are over 90,000 metric tons of nuclear waste in the United States;¹ however, there are no immediately viable long-term repositories for this SNF. Currently, most SNF is stranded, stored at or near the facility where it is generated.² SONGS is currently holding 3.6 million pounds of SNF, approximately two percent of the national total, nestled between an active and valuable beach recreation location and an active federal highway thoroughfare servicing hundreds of thousands of people per day.

SONGS is situated 100 feet away from the shoreline and is adjacent to world renowned surf breaks, such as Trestles and San Onofre Old Man's, that bring hundreds of thousands of visitors each year. It is also directly adjacent to Interstate 5, one of the U.S.'s busiest highways, and within the vicinity of eight million people.³ Of particular concern, this location is also within close proximity to the Newport-Inglewood-Rose

Canyon fault zone and therefore is susceptible to earthquake activity.⁴ If an accident were to occur, the effects of radioactive SNF would have the potential to adversely affect the ocean, marine life, beach goers, a major highway, and densely populated neighboring communities.

All these factors make SONGS an inadequate location for the storage of SNF (not to mention community opposition). The U.S. Department of Energy (DOE) and Nuclear Regulatory Commission (NRC) have yet to designate and license a repository location for the safe long-term disposal of SNF. The Yucca Mountain project in Nevada was the primary effort to establish a permanent disposal facility. However, former President Barack Obama abandoned the Yucca Mountain project in 2008 due to Nevadans' heavy opposition to the project. Since then, several Congresses have proposed to amend the Nuclear Waste Policy Act (NWPA) of 1982 in an effort to find appropriate disposal locations for the U.S.'s SNF, but no recent progress has been made in the legislature.

Through research and analysis of SNF statutes, regulations and proposed amendments, as well as the shortcomings and pitfalls of the current regulatory regime, the Task Force has concluded that new effective federal legislation is needed to address the important issue areas articulated herein.

FINDINGS

A. There are multiple agencies at the local, state, and federal levels that have jurisdiction over the storage, transportation, and safety of SNF, with the lead agency being the federal NRC.⁵

The NRC is the agency that licenses, regulates, and oversees all aspects of nuclear power generation—including the storage, transportation, and safety of SNF. However, the NRC works with other federal agencies such as the Federal Emergency Management Agency (FEMA), U.S. Environmental Protection Agency (EPA), and Department of Transportation (DOT) to oversee emergency response, environmental safety, and transportation of SNF, respectively. Under the NWPA, the NRC is also authorized to work with the U.S. DOE to develop a permanent repository for the nation's SNF. The actual disposal of the SNF in a repository is the DOE's responsibility, while NRC is responsible for licensing and overseeing the disposal.

On the state level, various state land use agencies, such as the California Coastal Commission (CCC) and California State Lands Commission (SLC) have jurisdiction over applicable land use permits and leases for construction, operation, and maintenance of nuclear power plants on state land.

On the local level, local governments are largely responsible for emergency response in the event of an accident at a nuclear power plant that causes the release of radioactive material into the surrounding environment. Local governments also play a large role in keeping their constituents informed about events at nearby nuclear power plant facilities. The primary mechanism for local government involvement at SONGS is through the Interjurisdictional Planning Committee (IPC), which oversees emergency planning at SONGS within the Emergency Planning Zone (area within a 10-mile radius from SONGS). The

IPC's mission is to integrate emergency plans, coordinate decision-making for SONGS-related activities, and educate the public. The IPC is a partnership that is recognized at the local, state, and federal levels. The IPC is meeting monthly throughout the SONGS decommissioning process. Furthermore, each IPC jurisdiction maintains their own emergency response plan that is specific to an emergency at SONGS. However, the IPC entities worked together to develop joint standard operating procedures and policies that all entities will follow during a response to an emergency event at SONGS.

The nature of each entity's jurisdiction will vary depending on the location and status of the nuclear power plant. For example, because SONGS is located at Marine Corps Base Camp Pendleton on Department of Navy (DON) land, DON has played a large role as the reactor's landlord throughout its lifecycle. However, other power plants could be located on state- or federally-owned land, which would invoke different jurisdictional roles.

B. The Independent Spent Fuel Storage Installation (ISFSI) at SONGS could experience structural degradation from direct groundwater or seawater exposure over time, due to the close proximity to a rising coastal waterline and groundwater table.⁶

Due to the immediate coastal location and subterranean design of the Holtec ISFSI at SONGS, the proximity of this structure to both seawater and groundwater is concerning. The exact subterranean location of the base of the ISFSI is reported at different elevations, with the NRC reporting the location at 8.5 feet Mean lower low water level (MLLW)⁷ and CCC reporting the ISFSI base at 7.5 feet MLLW.⁸ Regardless, the groundwater table at the site of the ISFSI sits in

close proximity at 5.4 feet MLLW and fluctuates as high as 6.1 feet MLLW,⁹ meaning the ISFSI base can already be as close as 1.4 feet (or 2.4 feet, according to the NRC) above the water table. Over the next 50 years, coastal hazards, including exacerbated storms, coastal erosion, sea level rise, groundwater level rise and seawater intrusion into groundwater aquifers could cause the ISFSI to be directly exposed to seawater and/or freshwater.¹⁰

The main threat to the structural integrity of the ISFSI concrete and Vertical Ventilated Module (VVM) structures is contingent upon the porosity of the concrete, as water permeability through the structure and exposure to reinforcing steel or the Cavity Enclosure Container (CEC) could cause corrosion and subsequent loss of structural integrity of the rebar, CEC, and concrete structure as a whole. This could have impacts on the eventual retrievability of downloaded canisters due to reduced ability for the VVM and/or ISFSI pad to withhold necessary weight loads. It could also reduce earthquake resilience and missile resilience. As mentioned in the Holtec UMAX Final Safety Analysis Report (FSAR), “[t]he materials that comprise the dry SNF storage should maintain their physical and mechanical properties during all conditions of operations. The SNF should be readily retrievable without posing operational safety problems”.

Notable potential impacts to the ISFSI and canisters from direct groundwater or seawater exposure include: (1) reduced structural integrity of the concrete “monolith” due to corrosion induced spalling from uncoated rebar in reinforced concrete, (2) corrosion of exposed carbon steel of the CEC divider shell if coating is scratched during canister downloading, (3) lack of an enclosure wall to further avoid groundwater intrusion, (4) chloride induced stress corrosion cracking on the Multi-purpose canister (MPC) and (5) general corrosion of the MPC due to scratching of the chrome-oxide layer during downloading. Additional information on the ISFSI components and issues listed above would

help determine the risk to the ISFSI from water exposure, including clarification on any coatings or sealants used at SONGS, and the level of corrosivity of sediment adjacent to the SONGS ISFSI.

While the FSARs determine that a 60-year design life and 100-year service life are expected for the ISFSI, including the VVM and reinforced concrete, the atmospheric and environmental conditions at the plant may warrant a request for more robust inspections of the ISFSI. As stated in the UMAX FSAR “ISFSIs located in areas subject to atmospheric conditions that may degrade the storage cask or canister should be evaluated by the licensee on a site-specific basis to determine the frequency for such inspections to assure long-term performance.”

C. The current lack of a permanent repository for SNF is unacceptable and could put our communities, coastlines and other natural resources at risk.¹¹

SONGS was never intended to be a long-term storage location for SNF. The proximity to the coastline, susceptibility to geologic instability, and location within a densely populated area make it a very poor location to store SNF. Over eight million people reside in the vicinity and the SNF is located directly adjacent to Interstate 5 Freeway, one of the nation’s busiest highways, servicing hundreds of thousands of freeway passengers per day. With increasing rates of coastal erosion, sea level rise, and likelihood of more frequent and severe storms due to climate change, the long-term storage of SNF on the coastline amounts to an unacceptable risk to the communities and resources at stake.

Other sections of this report speak to the potential hazards and the specific risks associated with this SNF storage location. At a minimum, concerning events that could lead to reduced integrity of the current storage system include: extreme sea level rise scenario (including inundation/submersion

of the ISFSI), terrorist attack, groundwater intrusion, degraded or compromised canisters, landslide event, and internal accident and errors in management of the SNF (such as the August 2018 near-drop incident).

D. Consent-based siting, with meaningful partnerships and open communication among federal, state, local, and tribal leaders, is a critical step toward establishing a permanent SNF repository.¹²

The NWPA failed to give affected states and Native American tribes meaningful regulatory authority in the maintenance, transportation, and disposal of SNF within their boundaries. This led to political stalling and undermined the intent of the NWPA’s SNF disposal regime. In the meantime, decommissioned plants are indefinitely serving as SNF storage sites. However, these plants are inadequate storage sites for SNF because they are not built for long-term or permanent disposal. Further, affected states and Indian tribes are not consenting to the disposal of the SNF in such close proximity to their communities.

According to the Blue Ribbon Commission on America’s Nuclear Future (BRC), rather than attempting to site SNF facilities over the objections of host jurisdictions, success is more likely to result from a consent-based process that gives all levels of government a “meaningful consultative role in important decisions.”¹³ A “meaningful role” is not fully defined here, but it could also include “direct authority over aspects of regulation, permitting, and operations where oversight below the federal level can be exercised effectively and in a way that is helpful in protecting the interests and gaining the confidence of affected communities and citizens.”¹⁴

E. Lack of an effective timeline and metrics for SNF has led to stranded SNF throughout the United States.¹⁵

There is a lack of meaningful or effective penalties for non-compliance within the NWPA or metrics to force action.

F. Environmental review and safeguards for permanent disposal are needed for effective federal regulation of SNF.

The NWPA provides general guidelines the Energy Secretary must adhere to when evaluating potential SNF repository sites.¹⁶ Among these guidelines are general factors that disqualify a site from serving as an SNF repository such as proximity to natural resources, seismic activity, and atomic energy defense activity, and water resources. Additional disqualifying criteria include proximity to the National Park System, the National Wildlife Refuge System, the National Wild and Scenic Rivers System, the National Wilderness Preservation System, or National Forest Lands. These specific land-based ecosystems of national significance are protected from SNF.

RECOMMENDATIONS

1. Congress should consider federal legislation requiring a plan for removal of SNF from the SONGS site on San Onofre State Beach. (Finding A, B, C)

It is incumbent upon the federal government to ensure that there is meaningful action to locate and implement appropriate long-term siting and a final resting place(s) for SNF. There must be meaningful collaboration between states and the federal government in order to achieve this goal. The current federal framework for regulating SNF siting and disposal is insufficient and has led to stranded SNF throughout the country, jeopardizing our communities and some of the nation's most sensitive natural resources, such as the beloved coastline at San Onofre State Beach.

2. Congress should consider federal legislation that creates a framework to achieve consent for future storage and disposal sites. (Finding A, E)

In order to address the current failure to give affected communities, states, and native nations meaningful involvement in the maintenance and transportation of SNF within their boundaries, new legislation should grant affected communities consultation and authority relating to the terms on which they would host a SNF facility. Affected states and native nations should be able to adopt additional safety requirements as they see fit.

3. Congress should consider federal legislation regarding SNF to include mandates for accountability and enforcement. Specifically, the legislation should include nationally agreed upon legislative definitions, timeline requirements, incentives for sites to accept SNF, and viable enforcement mechanisms. (Findings A, C, E)

In order to address the lack of accountability for movement of SNF, legislation should require

a strict timeline for permanent disposal and mitigation requirements if there is deviation from the timeline. There must also be enforcement mechanisms to demand this change and not simply accept failure, as with past legislation. The enforcement requires “teeth” in the legislation that will exact penalties and/or require mitigation for failures to achieve certain milestones with enumerated deadlines.

In order to ensure accountability, the stakeholders and the public should have the ability to obtain information, to require oversight by independent outside experts/inspectors, and to require that these experts issue public findings and recommendations by a certain time. The legislation should require and establish responsibility for public reporting of on-site accidents, near accidents, and remedies. There should be penalties for failure to adhere to the requirements and responsibilities under this legislation.

Federal legislators should consider forming a new agency with one purpose: to locate and implement permanent disposal of SNF through a consent-based process and within a certain time. Federal officials should explore other ways to force action, such as penalties, especially on regulated industry participants in this process.

4. Congress should consider federal legislation to allow for state authority to perform environmental review of the transport, siting, and storage of SNF. (Finding F)

In order to address critical safety and environmental review concerns, states should have regulatory authority for SNF storage and removal. Additionally, EPA should have environmental review authority for the siting process, and NRC regulations should be amended to allow for environmental review under current laws and standards (rather than allow for preemption).

Relevant environmental review and protection law should include protection for both land and marine resources. In order to address resource protection, proximity to a marine protected area should be included as a general factor that could disqualify a site from serving as an SNF repository.

Environmental law cannot be curtailed or sacrificed for the sake of expediency. The siting and transportation of SNF must proceed with full review and safeguards for our citizenry and natural resources. Both federal and state environmental laws should be adhered to in the process of siting future storage locations and developing the transportation plan for SNF. In addition to specific land-based ecosystems of national significance that are protected from SNF,

the same protection should be afforded to marine-based ecosystems of national significance.

State laws should not be preempted or subordinated due to federal law on SNF storage and disposal. In order to progress and identify acceptable areas for SNF repository siting, there must be meaningful collaboration between state governments and the federal government. In achieving this objective, Congress could amend the NWPA to reflect standards that are similar to other environmental statutes that allow for stricter state environmental safeguards, such as the Coastal Zone Management Act. Local environmental protections, land use plans and other relevant municipal ordinances should be taken into account for the appropriate siting and transportation of SNF.

CONCLUSION

The time to move SNF off the coast at San Onofre State Beach is long overdue and federal action is needed for a solution. It currently sits in a location that threatens the approximately eight million people who reside in the vicinity, one of the nation's busiest highways in the I-5 corridor, the country's second busiest intercity passenger rail corridor in the Los Angeles – San Diego – San Luis Obispo Corridor, a military base, the fifth most popular state park in California, and a beloved coastline. Before threats become realities,

the federal government must safely move SNF from SONGS to an appropriate final repository. In order to do so, changes must be made to the federal laws and regulations for SNF management. The federal government must ensure that it allows states to meaningfully participate in regulating the SNF that will affect their cities and towns, while continuing to pay close attention to environmental issues. Although there is no perfect solution, keeping SNF at SONGS is unacceptable.

STATE LEGISLATION AND REGULATORY OVERSIGHT

FINDINGS AND RECOMMENDATIONS

INTRODUCTION

The State Policy Committee analyzed policy gaps at the state oversight level as it relates to corporate takeovers of SNF storage sites, lack of retrievability of SNF from canisters in use, state agency coordination, state authority on SNF, and collaboration on federal solutions. The focus of the work is to advance the conversation beyond the current stalemate and improve outcomes for health and safety in ways that addresses unique site-specific and state-specific challenges.

Historically, states have hesitated to lead on SNF policy because of threats of federal preemption on human health and safety by the NRC. However, states have several opportunities for action at their disposal when leaders choose to approach the issue. As the nation enters indefinite on-site storage of SNF, the involvement and oversight of state leaders becomes more critical.

A state's economy, resources, and way of life depend entirely on communities remaining free of hazardous materials in land, water, and air. We learned from Chernobyl and Fukushima that disasters at operating reactors pose serious consequences and force the creation of exclusion zones where people cannot live. After careful study, we have found several global knowledge gaps in long-term dry storage of SNF. The consequences of these knowledge gaps are amplified because many storage decisions were made on the assumption that off-site permanent disposal would be available in the near term.

Policy recommendations were developed after careful review and analysis of Task Force Technical Committee reports, latest scientific articles, and history of state engagement in nuclear energy policy.



Image: Southern California Edison

FINDINGS

G. The management of SNF sites by non-utility private entities may endanger safety.

Economists have weighed in on the liability and economic risks posed by recent Holtec International and NorthStar Group Services acquisition applications and purchases of nuclear power plant sites as they enter decommissioning.¹⁷ As of the publishing of this report, at least six nuclear power plant sites across Massachusetts, New York, New Jersey, Vermont, Florida, and Michigan have been purchased or have pending purchase agreements between a third-party and the NRC.^{18,19} These companies lack the experience and financial reserves to complete these projects safely using best practices.²⁰ Maura Healey, Attorney General of Massachusetts, sued the NRC over a license transfer of Pilgrim Nuclear Power Station to Holtec International, another private business.²¹ If entities fail to have necessary training, safety protocols, financial capital, and sound financial management, such transfer of corporate ownership could endanger the health, safety, and economic stability of the 30 states which store SNF²²

H. Current storage canisters at SONGS lack retrievability of SNF.

This image demonstrates the difference between the above ground storage system at Diablo Canyon in San Luis Obispo and the partially below grade system at SONGS in San Diego County.²³

Image: Samuel Lawrence Foundation

The storage canister model in use at SONGS is welded shut. According to a March 2019 NRC report, these canisters lack the ability to meet the certificate of compliance requirements for inspection, monitoring, maintenance, and repair via ASME-qualified methods.²⁴ Canisters in use at SONGS are stored in a secondary concrete structure called an ISFSI. There are two of these structures on-site, an Areva NUHOMS and a Holtec UMAX. The Holtec UMAX ISFSI is partially below grade and subject to concrete deterioration, atmospheric corrosion, heat damage, and environmental damage.²⁵ The design of the concrete ISFSI prevents the visualization and damage detection of the ISFSI, canisters, and SNF stored within.²⁶ Damage to the ISFSI structure and storage canisters may prevent the retrieval of the storage canisters and therefore the SNF assemblies inside the canisters.²⁷ Only two reactor sites in the nation use the Holtec UMAX Storage system: SONGS (CA) and Callaway (MO).²⁸

The lack of retrievability is further complicated by the fact that SCE has not developed and verified a canister repackaging/replacement procedure in the event that a damaged storage canister must be emptied into a new and more robust canister system.^{29,30}



I. State agencies have not sufficiently coordinated efforts on SNF storage permitting.

Most of the time, state agencies work independently and do not share information among other agencies at the state and federal levels. The agencies make SNF permit decisions almost entirely based on utility documents and testimonies.³¹ The fact that state agencies are not sufficiently vetting information from the utility is concerning.

J. State agencies have not defined their authority over SNF oversight.

States are reluctant to exercise their authority over SNF storage because of threats of NRC federal preemption on health and safety matters relating to radioactive material.^{32,33,34} In 2002 the State of California took bold action to regulate low-level radioactive waste with the passage of AB 2214, thereby amending the California Health and Safety Code.³⁵ This law set minimum objectives for the design of low-level radioactive waste isolation facilities. Low-level radioactive waste is often material used in medical procedures.³⁶

RECOMMENDATIONS

5. The California Attorney General should intervene in any potential sale of utility-owned nuclear assets to non-utility private entities. (Finding G)

The Task Force is concerned whether any company can safely manage a site with SNF when a decommissioning fund is exhausted. This recommendation seeks to avoid a situation where a non-utility buyer exhausts a nuclear decommissioning fund and cannot charge ratepayers to cover decommissioning costs.

If nuclear power plant owners attempt to sell nuclear plants in decommissioning, then the California Attorney General should take action to ensure non-utility buyers have the ability to fund decommissioning even if the decommissioning fund is exhausted.

6. The California State Legislature should require those managing nuclear power plants to use easily retrievable and monitorable storage systems. (Finding H)

SNF storage canisters are the only containment mechanism preventing radiation exposure to

our environment and people. The state must compel nuclear power plant owners and DOE to develop, validate through the National Academy of Sciences, and seek NRC approval for a canister repackaging/replacement procedure. This process should also include study of advanced canister models with the ability to be inspected, monitored, maintained, and repaired.

SNF must be accessible for inspection, damage detection, repair, and eventual transport. Canisters must be required to meet the storage license criteria for retrieval. Retrieval is defined here as removal from the ISFSI storage facility and opened for fuel assemblies to be removed from the canisters. If SNF inside a storage canister cannot be retrieved, then new risks and downstream storage issues may become a hindrance to the transportation to an off-site storage facility.

A number of initiating factors could create a scenario where a canister and its SNF are rendered irretrievable and lead to radiation leaks, including natural disasters; acts of malfeasance; or aging-related degradation of fuel cladding, SNF, storage canister, or ISFSI.³⁷

In addition, there is no transfer station on-site to repackage/replace a damaged canister.^{38,39}

7. The California Public Utilities Commission, California Energy Commission, California Coastal Commission, and California State Lands Commission, among others, must share information with one another and require only best practices be implemented at storage sites. (Finding I)

It is critical that state agencies remain engaged on SNF storage to protect the interests of Californians. The sharing of information among state agencies should improve the decommissioning decisions made over time.

Permits and licenses are approved by the NRC and various California agencies without the utility meeting the permit conditions on the day of approval. The decommissioning permit approvals by the California Coastal Commission in 2015 and 2019 are key examples of a practice where conditions of the permit were impossible to meet upon permit approval, namely special condition 2(d), “Evidence that the fuel storage casks will remain in a physical condition sufficient to allow off-site transport, and a description of a maintenance and inspection program designed to ensure that the casks remain transportable for the full life of the amended project,” in California Coastal Commission application number 9-15-0228 in 2015.^{40,41} This is a serious oversight on the part of the leaders charged with protecting the interests of the state, its residents, and the environment.

8. States must be given authority to conduct oversight of SNF storage. (Finding J)

States have been recipients of nuclear energy power generation and therefore must be responsible for joining the search for storage solutions. Often state leaders attribute inaction to the federal government, instead of seeing an opportunity for collaboration to expedite solutions. There is a clear opportunity for the

State of California to lead the charge for effective engagement between federal and state agencies through economic enforcement, legal challenges to third-party license transfers, increasing state authority, rate regulation, and SNF storage accountability. California can serve as a model for the other 29 states with SNF.

There are several regulatory oversight actions on SNF storage available to states that have yet to be authorized. Significantly more state oversight is necessary to ensure safety in operations. California should lead the development of a “state’s oversight structure on nuclear waste storage,” and the model can be replicated in other states.

9. The California Public Utilities Commission should prevent utilities that own nuclear assets from increasing rates for decommissioning. (Finding J)

The California Public Utilities Commission has an approval role in utility rate setting hearings and manages oversight of disbursements to the nuclear decommissioning funds. To ensure effective protection of California resources, it is important that the California Public Utilities Commission does not provide any opportunity for utilities or third-parties to repeatedly increase rates during the decommissioning phase.

10. The California Public Utilities Commission should require power plant owners to establish funding reserves from nuclear power plant owner resources to cover emergency response to high levels of radiation releases, as long as radioactive material is on-site. (Finding J)

The potential for SNF contamination threatens California’s natural resources, economy, food, water, health, safety, and transportation. If our communities are exposed to high levels of radioactive contamination, the effects would be catastrophic. For these reasons, it is imperative that California takes an active role to ensure there is an incentive for safety on the part of the

nuclear power plant owner. Establishing funding reserves from the nuclear power plant owner would provide the resources necessary to take immediate action were there to be contamination

from natural disasters or acts of malfeasance. No decommissioning reserves should be requested from ratepayers.

CONCLUSION

State agencies and leaders have not yet exercised their influence and power to regulate the storage of SNF. We have found that there are several points at which the state can intervene and incentivize safety. The California Public Utilities Commission holds the signing authority to the decommissioning trust fund and must exercise stronger oversight by not allowing rate increases in the decommissioning phase and requiring funding reserves from nuclear power plant owner resources to cover emergency responses while radioactive material is on-site.

California must require retrievable and monitorable storage canisters and storage systems, increase state oversight authority on SNF, and codify legislation on SNF storage in the state. States must remain more vigilant to the risks of

SNF storage at reactor sites over decades. State agencies must share information with one another prior to approving SNF storage permits.

Two risks loom large over the next several decades. The corporate purchases by Holtec, NorthStar and other non-utility businesses are a danger to the economy, resources, health, and safety of California and other states. The state must vehemently oppose any efforts for corporate purchases of nuclear power plants in decommissioning. The concerns about SNF retrievability from canisters in the partially below grade storage system also pose serious danger, given the close proximity to the ocean and unstable coastal bluffs. These are actions the state can immediately implement to bolster SNF oversight measures.

BEST PRACTICES

FINDINGS AND RECOMMENDATIONS

INTRODUCTION

The Best Practices Policy Committee focused on defining improvements which would immediately provide more structure and safety backstops to the U.S. SNF management program. These findings list some of the critical best practices, which are currently absent from the system. Future study on how to apply international best practices in the U.S. would be a great value to legislators, nuclear power plant owners, and other decision makers.⁴²

There is a lack of technical data on best practices across the world because improvements are slow, still in development, and not widely publicized. Nuclear energy is a relatively new technology with work beginning in the 1950s. SNF storage technologies have not existed long enough to test durability in real radiation conditions over time.

Year after year, Congress budgets little to no money toward SNF storage, transportation, and

disposal.⁴³ The lack of Congressional funding has stunted any progress in the siting, construction, and approval of SNF disposal sites. Communities are growing distrustful of utilities and the nuclear industry in general because of their lack of transparency, focus on profit, and frequent errors. In the early 2000s, waiting on a national permanent repository was a smart move. Today, we must strongly consider all other options for off-site storage, because the current situation of SNF stranded on-site near reactors at 65 different cities presents a clear and present danger.

Policy recommendations were crafted after careful review and analysis of Task Force Technical Committee reports, interviews with nuclear experts, international regulator websites and documents, news reports, and written responses from NRC staff and commissioners.



FINDINGS

K. Lack of nuclear industry transparency with stakeholders has led to renewed social and political pressure opposing the storage and disposal of SNF in the U.S.

A serious communication breakdown is evident among stakeholders affected by the nuclear industry. Nevada and New Mexico rejected SNF storage or disposal in their state outright.^{44,45} Members of the public have lost trust in utilities, regulators have dropped the ball on safety, Members of Congress stunt any progress by leaving SNF storage and disposal direction and dollars out of annual budgets, state and local elected officials mostly bypass the issue, and educational institutions rarely raise SNF problems in their curricula.⁴⁶ This absence of responsibility for SNF leaves many people confused, blaming other agencies for their inadequacies, and does not advance progress on disposal solutions for the SNF issue.⁴⁷

Some northern European countries have made substantially more progress than the U.S. when it comes to constructing permanent repositories and transporting SNF across communities.⁴⁸ Those countries benefit from having fairly small populations with shared values. The U.S. must recognize SNF disposal as a shared national problem and stop passing the buck. The competing interests of nuclear power plant owners and surrounding residents is becoming an obstacle, as is not recognizing SNF disposal as a common problem affecting all people.

L. SNF dry storage canisters serve as radiation containment.

The components that make up SNF, radionuclides, decay at various rates, remain dangerously radioactive for 200,000 years, and must be isolated from humans and the environment, forever.⁴⁹ Storage canisters and the ISFSI they are stored in are the only protection

between SNF, people, and the environment.

The general factors when considering what containment canister to purchase include size, cost, heat transfer, storage space on-site, and density of fuel assemblies packed inside.⁵⁰ The utility selection criteria often overlook redundancies, or several layers of protection which prevent radiation exposure, and the ability to sufficiently inspect, monitor, maintain, and repair canisters.⁵¹ SCE and other nuclear power plant owners have chosen canisters with 5/8-inch walls in a concrete overpack that lack redundancies and are often stored outdoors and exposed to hazards.⁵²

M. The NRC regularly grants licensees significant exemptions from its rules.

NRC licensing and permitting for storage lacks transparent review processes and critical analysis of applications that one expects of a regulator.⁵³ Many NRC licenses are approved with a long list of exemptions to rules, giving significant flexibility to utilities.⁵⁴ Current NRC inspection criteria for SNF storage are often simply a reduction of the list of inspection criteria that is typical for an operating reactor. This lack of standards in storage and inspection criteria removes key safety incentives in the SNF storage phase.

N. Non-utility entities are buying nuclear plants in the decommissioning phase.

One concerning development involves non-utility businesses applying to the NRC to buy up nuclear plants in the decommissioning phase.⁵⁵ In the past, utility companies were profitable when they ensured safety in their nuclear power plant operations.⁵⁶ Non-utility companies who purchase nuclear power plants in decommissioning often lack the technical expertise and financial resources needed to guarantee successful decommissioning and to safely steward the tons of SNF left on-site.⁵⁷

When non-utility actors purchase nuclear power plants, costs are deeply cut and timelines are often decreased by decades.⁵⁸ Safety goes down in worker safety, environmental exposure, and increases risk of financial exposure for states and citizens who own assets in the surrounding areas.^{59,60}

Companies are attracted to the opportunity to profit, from each nuclear power plant's multi-billion-dollar ratepayer-funded decommissioning money, by taking a minimalist approach to SNF storage.⁶¹ Currently there are no NRC regulations regarding the purchasing of nuclear power plants in decommissioning, with long-term SNF storage on-site.

O. Lack of training by SNF storage contractors has led to negative consequences.

Human error is of grave concern when it comes to SNF. The August 2018 near miss event at SONGS was in part attributed to undertrained workers, as reported by an on-site Occupational Safety and Health Administration (OSHA) contractor.^{62,63} This incident occurred when a 54-ton, fully-loaded canister was misaligned, and nearly fell 18 feet into a storage vault. SCE did not promptly report the event to regulators.⁶⁴ The contractors who made this serious canister misalignment error were employed by SCE's contractor, Holtec.⁶⁵

P. Nuclear fuel handling procedures that ensure safety in military operations have not been applied to civilian nuclear power plants.

The high standards for nuclear handling safety created by the military do not apply to civilian nuclear handling. The cause of this discrepancy is a failure of administration and regulatory management of SNF.⁶⁶ These different standards led to a separation between military and civilian nuclear handling procedures, which resulted in significantly more safety incidents in civilian

nuclear handling than in military.⁶⁷ The creation of formal collaboration and cross-training opportunities between military and civilian nuclear handling programs would incentivize safety and spur research and development for SNF storage.⁶⁸

Our SONGS Task Force Co-Chair, Admiral Len Hering, has extensive experience serving as a Nuclear Weapons Safety Officer, Handling Officer, and Surety Officer. He voiced concerns over SNF handling procedures in a January 2019 report where he stated that, "At SONGS I find that virtually none of the protocols that should be expected for the safe handling of this dangerous material are present."⁶⁹

Q. Other countries place SNF systems inside enclosed buildings.

Storing canisters inside a closed building would have to be technically evaluated to determine what impacts the building would have on loading operations and canister performance.⁷⁰

Buildings enclosing SNF storage would reduce radiation levels at the site boundary to some extent.⁷¹

It is unclear if San Onofre is a good site for a retrofit of a building enclosure.

RECOMMENDATIONS

11. Congress should support the creation of a separate, federal Nuclear Waste Administration to mandate best practices. (Finding K)

Currently, NRC operations are skewed towards operating reactors. The original plans for the long-term, off-site storage and disposal of SNF have not materialized^{72,73} A Nuclear Waste Administration, with a singular focus on the radioactive waste stream, is necessary to manage oversight in the absence of NRC regulatory accountability and substantial SNF storage oversight.

The U.S. needs a federal agency whose scope is focused on SNF storage and eventual disposal.

12. Congress should consider legislation to adopt the Blue Ribbon Commission on America's Nuclear Future's recommendation to establish a new facility siting process, establish a new SNF management organization, and broaden support to municipalities affected by transportation routes. (Finding K)

The Blue Ribbon Commission provided several relevant recommendations for SNF storage and disposal, and siting of permanent repositories.⁷⁴ As a country we must find solutions to handling SNF with the utmost safety, and we can only achieve that together with understanding, science, and transparent regulatory judgment. Local, state, federal, industry, and advocacy entities must foster effective dialogue among stakeholders surrounding all U.S. reactor sites, at proposed disposal repository locations, and along transportation pathways to ensure transparent conversations that lead to solutions.

Abandoning SNF at over 65 sites in 30 states puts the health and safety of people and the environment at risk for generations. Engaging in

trusting, transparent, and data-driven dialogue will advance solutions across regions through an independent and civil process. This national conversation will help to ensure all concerns are heard and through the exchange of ideas will lead to significant improvements in containment, storage, and disposal of SNF.

13. Congress should consider legislation that restricts NRC from approving canisters with a design life of less than 100 years. (Finding L, M)

The current state of U.S. SNF storage at reactor sites requires a long-term vision for more than 100 years. Congress must work with the NRC to ensure that thousands of canisters are not approved and then stranded on-site beyond their design lifespan.

The selection of a canister storage system with 5/8-inch walls may have seemed theoretically reasonable for a temporary storage period, but they are completely inadequate for the anticipated on-site storage of over 100 years and subsequent transportation off-site.⁷⁵ Our leaders must ensure that on-site containment is robust and long lasting, as little progress has been made on any interim storage or permanent disposal facility.

NRC is charged with regulating the safe operation of nuclear power plants and protecting the health and safety of people and land surrounding nuclear power plants, but their licensing approvals do not reflect the discrepancy between the interests of DOE and nuclear power plant owners. DOE requires that canisters are undamaged before transport to an off-site facility.⁷⁶ Nuclear power plant owners look out for their profit, risk, and stability as a company. A utility company's concern about profit and shareholder interests influence their decision making and has led to errors in judgment.

Congress must be held accountable for budgeting adequate funding for SNF storage, disposal, transport, and research and development. It is imperative that radiation containment canisters with a lifespan of less than 100 years are not approved by the NRC. This selection criteria ensures that the best and most long-term storage canister selection is made with consideration paid to indefinite on-site storage and transportation.

14. Congress should consider legislation requiring the NRC to create capitalization minimums for businesses applying to purchase nuclear power plants in decommissioning. (Finding N)

While nuclear power plant owners have committed errors of judgment and action, we see even more risk potential from companies which lack the experience and financial reserves to manage a nuclear plant in decommissioning. This process of transferring responsibility to private companies requires thorough evaluation of necessary technical, financial, and regulatory expertise. The NRC transferring ownership of nuclear power plants to companies lacking verified qualifications and capitalization minimums has the potential to put people and the environment at risk.

If left unchecked, these inexperienced companies may pose a larger risk to long-term SNF storage than the current status quo because of their speed, undertrained workers, gaps in knowledge, and inability to financially support operations or project delays.^{77,78} In a commitment to best practices, Congress and the NRC should continually ask the question of, “who is best prepared to handle and steward SNF for generations?”

15. The NRC should use its existing regulatory authority to require permanent on-site inspector roles at nuclear power plants while the plant is in the fuel handling and movement phases of decommissioning. (Finding O)

Independent and objective regulatory oversight is critical for safety during handling and transfers of SNF. Additional independent investigators are necessary to monitor the procedures on-site and to detect issues in handling and radiation exposure. The NRC’s pattern of accepting utility reports and allowing the utility to “self-regulate” do not meet the stringent health and safety mission they are charged with in their mission.

16. Congress should encourage collaboration on best practices between military and civilian SNF handling authorities. (Finding P)

The civilian nuclear handling procedures are significantly weaker than the military handling procedures. Members of Congress can develop relationships with top military leadership and connect them with nuclear power plant leaders in their districts to create a framework to share military best practices in handling nuclear material in order to protect U.S. national security and resources. Many nuclear plants are within close proximity to military bases and national treasures, and for this reason, the military has a large stake in preventing a civilian nuclear failure. The strong safety history of military handling of nuclear material should lend several transferable applications to the deficient civilian nuclear power industry.

17. The NRC should conduct a review of international practices related to storage of SNF inside hardened, enclosed buildings. (Finding Q)

Other countries, like Switzerland, construct hardened facilities where they handle SNF, and also where they may repackage SNF if there is damage or concern.⁷⁹ In addition, these countries also use canisters which can be inspected, monitored, maintained, and repaired.⁸⁰ These basic criteria are not in place at most U.S. nuclear power plants. Having a hardened building where SNF is handled provides another layer of protection against radiation exposure to the environment.

CONCLUSION

The U.S. NRC has not lived up to its original mandate to protect public health and safety. This report has defined many pitfalls in NRC's management of SNF. There are several initiatives which can improve the current state of on-site SNF storage in the near term if public agencies and leaders better coordinate efforts. A renewed commitment to the SNF storage scope and role of regulators, agencies, utilities, and Congress would improve outcomes immediately, especially when paired with specific safety criteria for SNF storage and full-time, on-site inspectors.

The creation of a Nuclear Waste Administration would provide a much needed focus on the long-term radioactive waste storage problem across the nation. Solutions have potential for more success when science is combined with the lived experience of people surrounding nuclear power plants. These robust national conversations would increase public trust when tied with specific outcomes and structured in the consent-based framework of the Blue Ribbon Commission.

Currently, utilities exercise too much influence over state and federal regulators. Congress needs to exert their leadership on the SNF issue by strengthening legislation; commissioning a Nuclear Waste Administration; preventing unqualified companies from buying plants in decommissioning; and defining collaboration between military and civilian nuclear handling operations. Most importantly, Congress must

consistently budget adequate funding for the storage, disposal, study, transportation, and construction of a permanent repository. It is time for the U.S. to live up to our reputation as a leader in SNF management. Our lack of progress on SNF storage and disposal is a weakness and poses great risk to our economy and national systems of food, water, transportation, and security. The SNF storage and disposal crisis needs to be addressed immediately. Otherwise, the associated costs and consequences could come to dominate the U.S. economy through contamination of land, water, air, and genes of future generations.⁸¹

Enough time has passed with the use of nuclear power to illuminate the blind spots of the regulators, utilities, nuclear industry, elected officials, and residents. Now the challenge is for leaders to address and plan for the safest storage and disposal available today, with continual improvements applied as technology advances – that means thicker-walled casks. Nuclear energy is a technology that brought much hope and promise to diversify our energy grid, and we have seen great disappointment with the absence of balanced leadership for safety, common sense, and transparency in dealing with the SNF and nuclear power plants in decommissioning. The U.S. must take this opportunity to pause, reflect, and use all knowledge available to affect a new SNF policy before a catastrophe.

STORAGE AND AGING MANAGEMENT

FINDINGS AND RECOMMENDATIONS

INTRODUCTION

The Storage and Aging Management Policy Committee analyzed the technical evidence for the storage, monitoring, inspection, reporting, repair, handling, and aging management of SNF at SONGS. Our members focused recommendations on the transition from wet storage in SNF pools to dry storage in steel canisters with 5/8-inch walls, and the necessary preparation required for failures and deficiencies in storage sites. After the SNF cools for a number of years in SNF pools at reactor sites, the fuel assemblies can be placed into a variety of dry storage canisters that the nuclear power plant owner chooses. Those canisters are then placed on-site for storage, typically on either a parking lot-like platform or within a storage vault that is partially below grade.

The U.S. was unprepared for SNF storage when it began experimenting with nuclear power in the 1950s. Today there is still no interim or permanent SNF facility built and approved. Therefore, U.S. nuclear power plant operators are forced to store and manage SNF on the site of reactor facilities at over 65 power plant sites in 30 states. This on-site storage situation is how SNF is to be stored in the U.S. indefinitely. Those same nuclear power plant owners are unprepared for long-term storage, and their staff are undertrained in safety and handling procedures.⁸²

Storage concerns are mounting, and many are questioning utility choices in storage materials, siting of SNF at reactors, and the fate of our SNF in this century and beyond. Most utilities made their storage site and canister selections based on federal agency timelines for a permanent

disposal facility, and those deadlines have passed by decades.⁸³ The risks are increasing as sea levels rise, fires and floods intensify, and storm ranges expand. The storage decisions were made based on outdated data, and the U.S. is not prepared to address deficiencies and damage at storage sites because no transfer stations and no repackaging/replacement procedures are approved nor tested on fully-loaded storage canisters.⁸⁴

The NRC enacted regulations which require “an aging management review of containment structures to ensure the effects of aging will be managed so their intended functions will be maintained for the period of extended operation.”⁸⁵ These vulnerable on-site storage configurations are intended to be stewarded through individual aging management plans proposed by utility owners, which consider storage timeline, cost, and uncertainties. As of yet, these storage plans and subsequent aging management plans are only now being released and have not stood widespread, independent scrutiny or the test of time.⁸⁶ More research is needed to understand how SNF storage sites can be engineered to be climate resilient and climate ready, and also to define the true risk of radiation exposure from dry cask storage, over decades.

These policy recommendations were developed after careful review and analysis of Task Force Technical Committee reports, NRC documents, international nuclear agencies, and the latest scientific articles and books on SNF storage.

FINDINGS

R. Pursuant to current law, DOE is required to take ownership of SNF canisters for permanent disposal.

The NWPA requires the DOE to take ownership of SNF for off-site transfer to a permanent disposal facility.⁸⁷ The U.S. has no successes in the siting, approval, construction, and operation of a permanent disposal facility for SNF. The deadline to construct a repository jumped from 1980 to 1998 to 2009 to 2048.⁸⁸ In 2014, the NRC even acknowledged the reality that SNF will be stored at reactors indefinitely, if a geologic repository does not become available.^{89,90}

This lack of urgency, adequate funding, and tangible progress demonstrates an inability to meet deadlines on the parts of government agencies, nuclear power plant owners, and Congress. In fiscal year 2020, Congress allocated \$25 million to DOE programs related to integrated SNF management systems, but the money does not come with specific Congressional direction on spending and it is insufficient to make substantial progress on SNF storage, disposal, and transport.⁹¹

S. Most on-site SNF storage systems are above ground, on parking lot-type pads, where the storage canisters are each covered in a concrete overpack.

When all SNF at SONGS is moved to dry storage, there will be 123 canisters of SNF stored on-site, including 73 canisters in the newer Holtec facility and 50 canisters in the Orano-TN NUHOMS system (Orano was previously known as AREVA). The Holtec UMAX system is a newer design of storage system which is partially below grade, with the canister vents at the surface of the land. Concrete is poured around steel silos that the storage canisters are then lowered into. This style of concrete storage system is only used at two sites in the nation: SONGS (CA) and Callaway (MO).⁹² This style of partially below grade on-site storage system is a new storage configuration design. Experts have identified serious flaws in recent years: gouging and scratching upon downloading, potential for clogging of vents, and misalignment risks upon downloading.^{93,94}

At SONGS, the storage system is buried partially below grade in unstable sandstone bluffs that are susceptible to some of the highest rates of erosion



This image demonstrates the difference between the above ground storage system and the partially below grade system.

Image: Samuel Lawrence Foundation

on the California coast.⁹⁵ There is a documented history of natural and man-induced erosion and landslides along the coastal cliffs surrounding SONGS.^{96,97,98} The sea wall, which provides a buffer between the ISFSI and wave action, has its foundation in the fragile bluff and is also vulnerable during high-erosion events.⁹⁹

These partially below grade storage systems add risk factors of scratching and gouging upon downloading of canisters, questionable canister and SNF retrievability, and prevent ASME-qualified inspection, monitoring, and repair.¹⁰⁰ The inability to detect radiation releases, damage to canisters, or damage to SNF geometry in below grade dry canister storage systems cause serious concerns.

T. There are instances of metal-to-metal contact between steel storage canisters and the storage vault liner when employees download canisters into the partially below grade storage system.

This contact between storage canisters and other materials inside the storage vault have caused scratching and gouging, and present potential sites for chemical corrosion.¹⁰¹ The only visual assessment of storage canisters method performed by SCE included a camera and a borescope, technology which takes no direct measurement but captures photos and makes a computer model of photos.¹⁰² This is an inadequate method of identifying canister damage and it does not qualify as an inspection.¹⁰³ It also lacks adaptive management for the root cause of scratching and gouging of canisters.¹⁰⁴

U. The 2018 FSAR did not address ISFSI air vent blockage and cessation of canister passive cooling via flash flood, tsunami inundation, or landslide.

The FSAR for SONGS did not address several risk scenarios.¹⁰⁵ The land surrounding SONGS has a demonstrated history of landslides and tsunami.¹⁰⁶ A recent economic report poses

substantial losses if radiation contaminated air, land, and water in Southern California.¹⁰⁷ This lack of depth on the FSAR is a serious fault and an oversight that needs to be mitigated immediately.

V. The repackaging/replacement procedure for damaged canisters or damaged fuel is underdeveloped.

The discussions which pushed for removal of fuel assemblies from the SNF pools did not sufficiently consider the damage over time to dry storage canisters and SNF during on-site storage.¹⁰⁸ This lack of forethought stranded thousands of storage canisters at reactor sites around the nation without a plan for dealing with a canister breach. Most canister models used in the U.S. are thinner-walled and have only one layer of defense between radioactive material and the environment.

The lack of a viable repackaging/replacement procedure leaves no ability to handle or contain radiation if an act of malfeasance or material failure lead to canister or fuel damage. Nuclear power plant owners spoke on record that they do not have a repackaging/replacement procedure and nationally the procedure is underdeveloped, untested on canisters fully-loaded with radioactive material, and has not been implemented at nuclear power plants.¹⁰⁹

W. SCE does not have an optimal and qualified long-term plan for inspection, maintenance, monitoring, or repair procedures.

Currently, SCE has not implemented an adequate damage detection and inspection protocol nor have they tested their protocols on loaded canisters.¹¹⁰ The precise detection and mitigation of damage to canisters and SNF is necessary to prevent radiation exposure to the environment.¹¹¹ The March 2019 visual assessment conducted by the NRC was not an ASME-qualified inspection method.¹¹² The utility's choice of storage canisters and storage facility prevents the inspection, maintenance, monitoring, or repair of the only

defense of containment between the environment and high-level radioactive waste.¹¹³ This is of serious concern because on-site storage of SONGS's SNF is expected for an indefinite period of time.

Currently, industry and the NRC are performing research and development programs on repair processes for dry cask storage systems of all kinds. At the CCC hearing on October 17, 2019, SCE presented a proposed process for in-situ repair of stainless steel canisters. Follow-up validation including vendor certification, ASME approvals, and NRC approvals are required before these procedures are considered verified.

X. The current method the NRC uses to calculate risk – risk triplet method and risk-tree analysis – does not sufficiently quantify risk.

The risk triplet method and risk-tree analysis used by the NRC to quantify scenario consequences is a flawed approach because it is missing risk

scenarios and does not give a full scope of the risk due to the multiplicative properties of the equation.¹¹⁴ This method of risk analysis does not demonstrate true risk. For example, one low outlier probability multiplied by another, higher risk probability can make the risk seem neutral.

In the absence of an accurate risk calculation, SCE often misrepresents comments made in previous NRC investigations. SCE staff often make claims of, “zero risk,” when the true answer is that SCE does not know the true, precise risk of radiation exposure from dry cask storage, over decades.¹¹⁵ When SCE uses evidence out of context, they both misconstrue and extrapolate to situations beyond the scope of the original regulator's comment.^{116,117,118} There is risk in dry cask storage, and much of the risk and impact of material degradation and loss of cooling due to natural disasters is unknown and currently undetectable while SNF is stored in the current canisters and storage system, partially below grade.¹¹⁹



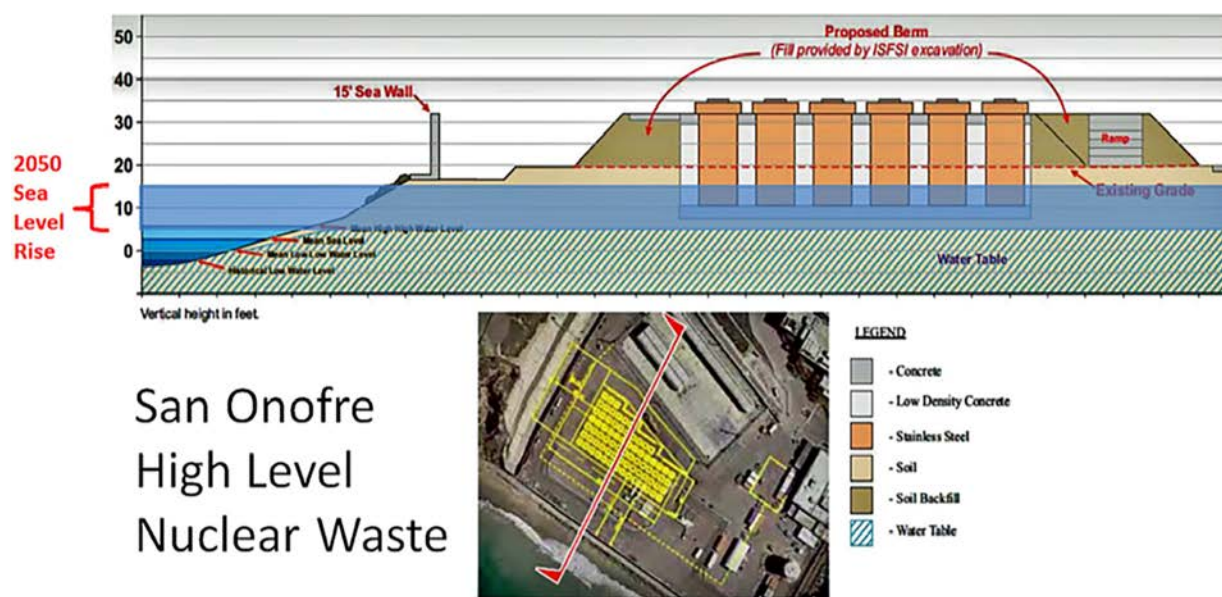
Image: Southern California Edison

Y. There is no ability to detect chemical damage to SNF in current dry storage configuration.

Hydrides formed on the zirconium alloy cladding of fuel pellets reorient themselves as the material cools in canisters, causing degradation of cladding.¹²⁰ When hydrides reorient radially the material becomes brittle and ductility decreases causing damage to the fuel and radiation leaks inside the canister.¹²¹ Different factors affect the reorientation of hydrides in each canister.¹²² Cladding failure is a major issue changing the composition of SNF inside a canister, likely complicating transport off-site.¹²³

Z. The high accessibility and visibility of the site leaves it extremely vulnerable to an act of malfeasance.

Today, two separate ISFSIs exist at SONGS. The newest, built by Holtec, is located about 100 feet from the Pacific Ocean on the 85-acre grounds of SONGS. The property is part of Marine Corps Base Camp Pendleton and is owned by DON. Two of the nation’s busiest transportation corridors – Interstate 5 and the Los Angeles-San Diego-San Luis Obispo Rail Line – flank the site. The ISFSIs are clearly visible in Google Earth images and in numerous published photographs.¹²⁴



San Onofre
High Level
Nuclear Waste

Image: Samuel Lawrence Foundation

RECOMMENDATIONS

18. Congress should work with DOE and industry to authorize and develop a program that incentivizes SNF storage innovation through research and development to discover alternate ways to isolate nuclear material from humans and the environment. (Finding R)

Dry cask storage technology is not improving at the same pace as the growing volume of SNF. To meet the technical challenges of SNF storage into the future, we need a large and urgent research and development campaign which focuses on the study of storage materials, transportation logistics, and siting of repositories. These DOE research efforts need to receive full funding from Congress year-after-year to ensure their success in the national issue of SNF storage.

SNF storage has seen slow innovation since the use of civilian nuclear power began in the 1960s. The NRC decision for on-site SNF storage in dry casks was made in the early 2000s on the premise that a permanent repository would be open, and SNF would not remain at reactor sites for long. The consequences and costs of operating a nuclear plant and managing the storage of SNF compound as time goes on.¹²⁵

19. Members of Congress should create a Spent Nuclear Fuel Caucus to discuss SNF storage, disposal, and transportation issues. (Finding R, W)

SNF is a common problem affecting the nation, and currently there is no congressional coalition which collectively makes decisions to advance the safest storage and disposal of SNF in the U.S. It is essential that Congressional members engage in regular dialogue and decision making to improve the storage, transport, and disposal methodologies to ensure best practices.

20. The DOE and nuclear power plant owners should reach a consensus on which canister and storage system to use for storage of SNF and apply jointly to the NRC for the license. (Finding R, S)

Nuclear power plant owners have different interests than the DOE. Investor-owned utilities, like SCE, must manage their shareholder interests. SCE chose a dry cask and storage system which may not maintain the integrity of canisters in the decades it will take to construct an interim storage or permanent disposal facility. The DOE's interests focus on receiving undamaged canisters, prepared for transportation to an off-site repository. If the DOE is not involved in the canister and on-site storage facility selection, then the nuclear power plant owner may choose a storage configuration which only suits their bottom line and strategy to reduce cost of containment, staff, and maintenance.

The nuclear power plant owner at SONGS selected canisters with a design life of sixty years. This means our storage situation at the reactor may last sixty years, but early reports of scratching and corrosion have raised doubts.¹²⁶ There is significant uncertainty about whether the canisters in use can even be transported given the physical damage already evidenced. Poor choices in canisters and storage facilities were made by utilities based on broken promises of permanent disposal made by the federal government.¹²⁷ Today, utilities place blame on anyone but themselves, even though utility owners could have chosen stronger storage canisters and better storage locations.

DOE's efforts to design a universal MPC system failed in the late 1990s due to a lack of repository designs and was re-engaged in the early 2000s under the Transportation, Aging, and Disposal (TAD) initiative.¹²⁸ The DOE needs to be an

active participant in canister selection if there is to be successful containment of SNF radiation from people and the environment.

The roadblock of utility players not wanting to spend money on buying quality casks needs to be mitigated through state and federal regulation. This requirement should apply to new canister applications and the canisters used to repackage/replace existing SNF in dry storage.

21. Congress should request that the National Academy of Sciences conduct a thorough report assessing the following: the long-term risks of dry canister storage in below grade facilities; hydride reorientation of cladding in SNF storage; verification of damage detection, inspection, and repair methods; feasibility of repackaging/replacement procedure; and risk assessment of on-site storage of SNF. (Finding S, T, U, V, W, X, Y)

The consequences of storing SNF on-site at reactors is understudied. This storage arrangement produces substantial risk to SNF and storage materials. It is imperative that science advances regularly to keep pace with best practices in containment.

The current research, licenses, and generous NRC license exemptions do not accurately address the increasing risks of sea level rise and climate change. The NAS study should examine the emerging risk factors for below grade storage arrangements, hydride reorientation of SNF cladding, verify proposed canister damage detection, inspection and repair methods, feasibility of repackaging/replacement procedure, and produce a thorough risk assessment of indefinite on-site storage of SNF. This report would provide stakeholders with an independent and scientific assessment of current risk and define detailed mitigation actions for storage technology.

Inspection protocols are critical for continued on-site storage. Special attention should be paid to

inspect the bottom of canisters, monitor radiation signatures, and detect fuel geometry changes and hydride reorientation inside the canisters (i.e. x-ray detection). If a technical committee finds that canisters in-use cannot be inspected or repaired according to qualified standards and ASME codes, then Congress must require those canisters be replaced with storage casks which meet these fundamental safety standards to protect health and safety.

22. The nuclear power plant owner and the NRC should conduct an FSAR study to mitigate loss of passive cooling in ISFSI via air vent blockage and inundation with water from rain or coastal flooding, or sand and silt from a landslide. (Finding U)

This follow up report is well within the scope of continued storage on-site and is necessary to validate the current storage license.

23. Congress should require the DOE and nuclear power plant owners to develop a technical procedure for canister repackaging/replacement prior to further NRC canister license approval, SNF pool decommissioning and removal, and loading of canisters in an on-site ISFSI. (Finding V)

There is no permanent repository approved. The nation must prepare for damaged SNF canisters which require mitigation. This repackaging/replacement procedure would ensure that all DOE criteria are met for eventual transportation of canisters off-site when a repository is available to accept SNF.¹²⁹

24. Congress should require the NRC to implement a new method of conducting a failure mode and risk analysis to determine the risk probability number, a more accurate measure for each risk factor. DOE and NRC should cooperate in this risk assessment process. (Finding X)

This change in models would capture the true risk

and inform how to manage the aging of SNF by identifying the highest risk event.

25. The SNF at SONGS requires a storage configuration with more levels of redundancy and must be moved to a technically defensible storage facility to reduce threats. From a security standpoint, the SNF should be moved further away from the coastline. (Findings T, W, P)

Given the uncertainty that San Onofre's spent fuel will be able to be moved to a national facility prior to 2035 (the date at which the coastal development permit will require Edison to apply for an amendment to retain, remove, or relocate the ISFSI) and even 2051 (the date at which the coastal development permit will expire), consideration should be given to the prospect of local relocation of the SONGS ISFSI to a higher elevation nearby, further from the ocean, where it could be better protected.

SNF should be placed into canisters with several layers of redundancy that can be monitored, inspected and repaired, and they should be moved to an acceptable storage facility at a significantly higher elevation.

If the SNF at the two ISFSIs at SONGS is repackaged/replaced then moved to a technically defensible storage facility on higher ground, the problems of ocean water and ground water

intrusion can be avoided. The SNF would also be better secured from an act of malfeasance.

26. Congress should budget adequate funding annually to ensure proper and comprehensive emergency planning measures are in place for all surrounding municipalities to implement for the safety of their residents. (Finding Z)

Currently, as referenced earlier in Finding #A, there is a local network of municipalities within a 10-mile radius of SONGS called the IPC which meets monthly to review emergency planning procedures. There is a concern, however, that these plans may not be adequate for any type of full-scale radiation disaster in the area, and the eight million people in the 50-mile radius may not be adequately protected against harmful exposure to radiation in such an event. This is a critical factor in the overall protection of the community and its members and needs to be significantly enhanced.

27. Congress should work towards a consent-based final disposal site including prioritization for sites with higher risk of sea level rise, high population density and high potential for seismic events, including as envisioned under the Spent Fuel Prioritization Act (H.R. 2995). (Findings U, X, Z)

CONCLUSION

Government agencies, utilities, and legislators across the U.S. are woefully unprepared for the aging management of SNF, especially during the time SNF is stored on-site at reactors. The preoccupation with risks of operating reactors has led to policy gaps in the global knowledge base about dry storage over decades. Those policy gaps result in a nuclear industry and nuclear regulator

that depend on risk analysis methods which lack depth and assume the best-case scenario because SNF is not in an active reactor.

These poorly founded assumptions are further complicated by the absence of several best practices in risk assessment. The NRC's decisions lose value when they do not accurately

represent risk. Currently the NRC lacks the following critical risk assessment technologies and methodologies: independent risk analysis of dry cask storage in partially below grade storage, mitigation strategies for ISFSI air vent blockage and inundation with water or sand/silt from a landslide, technical canister repackaging/replacement procedure, qualified procedures for inspection, maintenance, monitoring, and repair, failure mode and risk analysis methodology, visual detection of fuel geometry inside canisters, among other serious concerns. All of the aforementioned recommendations must be implemented at the NRC to improve the risk assessment of SNF in dry storage.

Serious concerns raised as findings in this committee are followed by recommendations which can be enacted immediately. At SONGS, we expect the SNF to remain on-site indefinitely, and it is imperative that the storage configuration is resilient to natural conditions and human error. The lack of qualified inspection standards, and a verified repackaging/replacement procedure for canisters is an incredible oversight on the part of Congress and NRC. Each of these risks will only intensify as storage time increases.



Image: Southern California Edison

SAFETY AND HANDLING

FINDINGS AND RECOMMENDATIONS

INTRODUCTION

The SONGS Task Force technical analysis team considered nine separate questions regarding Safety and Handling at SONGS.

The recommendations made here are based upon the team's findings.

FINDINGS

AA. The decision of the NRC to allow SONGS to disable the alert and notification system has created significant public concern.

NRC analysis determined there is no credible scenario that would result in the release of radiation at SONGS beyond the area boundary. Therefore, there was no need to maintain the public warning system. An operating reactor emits a tremendous amount of heat when first shut down, sufficient to volatilize isotopes such as Cesium-137. Furthermore, water is used to cool the SNF. If the water is not cooled sufficiently, the water (and cesium) can turn into a vapor, and be transferred off-site, if not otherwise contained. SONGS SNF lacks the heat to volatilize (e.g.) Cs-137, and there is no water in a dry storage canister to create a plume.¹³⁰

Public confidence is a critical aspect of consent, whether interim or long term. Public concern about the lack of a warning system has been expressed repeatedly at SONGS Community Engagement Panel meetings and at large.

BB. Lack of sufficient training and qualification requirements for canister handling were major factors in the August 2018 download incident.

Human performance appears to be the major contributing factor in the canister download incident of August 2018. Prior to the August 2018 incident, the training did not use a systematic approach. Since the August 2018 incident, both Holtec and SCE have revamped their training and qualification requirements to address the gaps in their program.¹³¹ However, an overarching factor still seems to be the lack of detailed regulatory guidance in the Code of Federal Regulation, 10 CFR 72, regarding the training and qualifications of personnel at an ISFSI.¹³² On Subpart I [Training and Certification of Personnel, 10 CFR 72.190, 192 and 194] of PART 72—LICENSING REQUIREMENTS FOR THE INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL, HIGH-LEVEL RADIOACTIVE WASTE, AND REACTOR-RELATED GREATER THAN CLASS C WASTE only touches on the topic. The above three sections of Subpart I merely state goals, i.e. “must be limited to trained and certified personnel”, “shall establish a program for training, proficiency testing, and certification of ISFSI or MRS personnel” and “physical condition and the general health of personnel...must not be such as might cause operational errors...”

CC. Improper and inadequate equipment and technology were other major factors in the August 2018 download incident.

Root causes of this mishap were inadequate training of the crew and the improper and inadequate equipment and technology available to the crew to perform its task. A drop-restraining system was not in place when the canister was

about to fall. During the downloading operation, the canister system was not visible to the crane operator. There was no guide system for downloading and the crane operator was verbally instructed by the downloading crew. Holtec was not prepared for this kind of accident and thus a mitigation policy was not in place.¹³³



Image: Southern California Edison

RECOMMENDATIONS

28. The NRC should consider requiring SONGS to reenable the alert and notification system because the costs or downsides are far outweighed by its benefits. (Finding AA)

Around eight million people live within fifty miles of SONGS. With fifty sirens strategically placed within ten miles of SONGS, the system provided reliable, prompt notification to the public in the event of an emergency. Although the reactors are now quiet, there is public fear that the 3.6 million pounds of SNF stored at SONGS, in an area bounded by two earthquake faults and one hundred feet from the ocean, still threatens population and peace of mind.¹³⁴ SONGS was never intended for long-term SNF storage, but given that no viable long term storage site currently exists, it is apparent that the cities surrounding SONGS need a way to assure their citizens that they are safe and protected in the event of a catastrophe. The costs of bringing the system back online can be paid for. Public confidence is priceless.

29. Congress should consider legislation to require the NRC to establish a new detailed quality and training program for all ISFSI personnel as an element of ISFSI licensing. (Finding BB)

The new standards should establish an independent training organization to implement the program with elements to include:

- a. Testing administered to determine passage or failure of training.
- b. Retraining requirements and timelines.
- c. Conduct unannounced inspections and/or testing of personnel.
- d. Record keeping requirements to document personnel issues, i.e. complaints, disciplinary procedures, disciplinary proceedings against specific personnel, specific personnel's involvement in incidents concerning safety, etc.

and make those records open to the public at any time for inspection and copying.

- e. Specific roles, requirements, qualifications and training for a loading "team".

30. Congress should consider legislation requiring ISFSI licensees to utilize additional equipment and technology for canister loading. (Finding CC)

Such items must include:

- a. Sufficient numbers of appropriately designed cameras positioned appropriately to enable downloading operator to view entire operation in real time so operation can be adjusted or halted as necessary for safety.
- b. Installation of a contact sensor to avoid any metal to metal grinding.
- c. In the event of any detected metal to metal grinding, direct measurement of any surface irregularities resulting from download grinding.
- d. Establish maximum acceptable depths of metal to metal grinding during download operation.
- e. NRC official present at all times during all loading operations.

ALTERNATIVE VIEWS

COMMENTARY AND DISSENTING STATEMENTS

Nina Babiarz:

1. **Federal Legislation and Regulatory Oversight Introduction should precede with a statement buried in Pg. 17 of State Policy section;** *“Because of the threats of NRC federal preemption on health and safety matters relating to radioactive material and due to the threats that spent nuclear fuel storage poses to our community and coastal environment, the San Onofre...”* (after all isn't that the ultimate and overarching crux issue between Federal and State authority @ SONGS?)
2. **Page 21, Conclusion of State Policy Section, paragraph that begins with:** *“Two risks loom large...”* **should be preceded by:** *‘Due to the absence of an independent professional risk assessment and analysis, two risks, among many others, loom large...’*
3. Best Practices:
 - a. Pg. 34 relevant to **‘The 2018 Final Safety Analysis Report (FSAR) did not address the ISFSI air vent blockage and cessation of canister passive cooling via flash flood, tsunami inundation or landslide.** A sentence that should follow the last in this finding that currently reads: ‘This lack of depth on the FSAR is a serious fault and an oversight that needs to be mitigated immediately.’ Is: The NRC’s irresponsible suppression for ‘proprietary’ purposes of the FSAR detailing a SONGS flood analysis previously conducted that now supersedes the safety of millions, should also be included in that mitigation.
4. Storage and Aging Management; ‘Special Conditions’ as amended to the CA Coastal Commission (CCC) permit issued SCE on October 6, 2015; A request for a current status as to whether SCE is actually in compliance with the permit should have been secured from the CCC since the evidence shows, by Edison’s own written admission right in their CA Coastal Commission permit application, that the ‘examination techniques and remote surface inspection tools are still *“under development”* and that *‘their utility for the maintenance and monitoring of the spent fuel casks has not yet been demonstrated...NOR is it clear when these techniques, tools and standards would become available for use at SONGS.’* If SCE is not in compliance with the CCC permit issued, a ‘Recommendation’ in this Section would be to call for revoking SCE CCC permit to bury the waste until a system to validate the structural integrity of the cans can be achieved.
5. Safety and Handling; I am one of many who shared Admiral Hering’s concerns expressed on our last teleconference regarding 2-1/2 pages (Pg. 46-48) of recommendations with no funding source; empty vessels with no direction. A few that stand out that could and should be paid for by SCE’s current DTF with the exception of #37 (warning systems); SCE should bear that financial burden alone:
 - a. Priority issue of ‘criticality’: Combine and Move #44 and #45 to the very front of the line. SCE should be accountable for opening the demo cask for a determination of the current status of the cladding performance

- b. #33 – “Hot Cell’ should be procured and in place prior to the demolition/removal of the Spent Fuel Pools (SFP)
- c. #37 – ‘Any potential costs of bringing warning system back online: Southern California Edison should burden that cost since they made the premature decision to remove and repurpose prior to the need for them expiring.
- d. #47 before calling for national standards, require NRC (Greg Warnick’s) accountability of the ‘issues’ addressed in the NRC’s August 20th SONGS update to the public since the resumption of the burial in July 2019; SCE/Holtec’s **inability to effectively develop and implement the NRC corrective actions required**. NRC should have required SCE/Holtec to report these incidents as an NRC demonstration of **enforcement**. Instead NRC retroactively altered the procedures to accommodate SCE **inadequate adherence to NRC corrective action procedures**. Those ‘issues’ were an obvious violation of SCE’s NRC’s ‘corrective action’ and a clear demonstration of the NRC’s inability and/or unwillingness to regulate the utility industry; See attached.

Malcolm Bund:

Page 9 SONGS is located on Camp Pendleton, not next to it.

Finding B – the use of the could in reference to the ISFSI makes the point that it is a weak finding.

Either the ISFSI is a known issue or will it survive until 2050? SONGS, from SCE/Holtec perspective, was never meant to be a permanent home for the SNF.

Page 12 Rec 4. Are we sure that Finding F covers this state rec????

By the time we arrive at Page 10 we have had 5 references to the SONGS location. Is that what we want? Suggest review and revise.

Page 13 last para in Finding H: this para assumes that SCE sees the need to repackage which they don’t. But as there is a requirement under the NWPA law for canister inspection and maintenance both SCE and NRC have mistakenly proceeded and the whistle needs to be blown.

The point we should be making is NRC has repeatedly neglected their responsibility to follow the NWPA and has sided with management in violation of laws. Why isn’t the Task Force holding the NRC responsible as regulators and upholding their responsibility?

N page 23

We keep arguing that undercapitalized companies are buying decommissioned plants without ever being able to prove that the companies are undercapitalized. The selling utilities are stepping away from the challenge of disassembling Nuclear plants but we don’t know if they are side stepping the liability issues. THE ARTICLES QUOTED SAY NOTHING ABOUT THE CAPITAL STRUCTURE OF HOLTEC OR OTHER CLEAN UP COMPANIES. WE ARE SPECULATING HERE ABOUT CAPITALIZATION. I THINK THE QUESTIONS are: WHY ARE THE UTILITIES NOT OUT SOURCING THEIR RESPONSIBILITY RATHER THAN SELLING THEIR OBLIGATION? What obligations are the Utilities walking away from and what are they keeping? If the clean up fails then who is responsible to complete the work? What is Holtec paying for the pleasure of the clean up challenge?

S on Page 303 and T on page 32 and W on Page 35 Again, how do we know the canisters are scratched especially if we keep saying the canisters can’t be inspected!!!!

U on page 34 when was the last reported tsunami in the SO area??? Most everything in the last section beginning page 42 is redundant.

Katie Day and Angela Howe, for The Surfrider Foundation:

The Surfrider Foundation does not sign on to the entirety of Section 2 State Legislation; Recommendations 14, 20, and 25; and the Introduction and Findings U, X and Y of Section 4 Storage and Aging Management

Dan Dominguez:

The Honorable Gregory Jaczko, former NRC Chairman
The Honorable Rear Admiral Leendert Hering ret.

Dear Co-Chairs, Messrs. Jaczko and Hering

Thank you for the opportunity to serve on the technical committee for the San Onofre Nuclear Generating Station Task Force. I appreciate Congressman Levin's efforts to initiate discussions at the state and federal level to jump start the process of siting and building a permanent high-level waste repository, or the siting and building of a CIS facility until such permanent repository is built.

However, I have concerns over some of the recommendations of the Task Force Report. I oppose recommendations that could delay or prevent the transfer of SNF to a permanent repository or to a CIS facility or prevent the transfer of SNF from wet storage to dry cask storage, which is inherently safer than wet storage.

I fully support the task force's goal of moving the San Onofre spent nuclear fuel (SNF) to a permanent fuel storage location or to a Consolidated Interim Storage (CIS) location as quickly and as safely as possible. It is for this reason that I will include my name on the report if it is annotated that I have submitted an alternative view and only if this cover letter, along with my alternative view, are included in the report.

Sincerely,

Daniel Dominguez

Federal Legislation and Regulatory Oversight

Letter/Number	Comment
Introduction Section D, delete annotated wording	This led to political stalling and undermined the intent of the NWPA’s SNF disposal regime. In the meantime, decommissioned plants are indefinitely serving as SNF storage sites. However, these plants are inadequate storage sites for SNF because they are not built for long-term or permanent disposal.
Recommendations # 2 (pg 11)	In order to address the current failure to give affected communities, states, and native nations meaningful involvement in the maintenance and transportation of SNF within their boundaries, new legislation should grant affected communities consultation and authority relating to the terms on which they would host a SNF facility. Affected states and native nations should be able to adopt additional safety requirements as they see fit.
Recommendations #3 (pg 12)	In order to ensure accountability, the stakeholders and the public should have the ability to obtain information, to require oversight by independent outside experts/inspectors, and to require that these experts issue public findings and recommendations by a time certain. The legislation should require and establish responsibility for public reporting of onsite accidents, near accidents, and remedies. There should be penalties for failure to adhere to the requirements and responsibilities under this legislation.
Recommendations #4 (pg 12)	In order to address critical safety and environmental review concerns, states should have regulatory authority for SNF storage <i>at a</i>

Commented [DD1]: Delete, the site is adequate for storage, it just wasn’t built for long term storage.

Commented [DD2]: Vague and not specific enough. Potential to create so many different requirements would delay fuel transfer to a long term storage facility, or consolidated interim storage.

Commented [DD3]: At what severity of the accident or near accidents is the report required. Does it include only fuel related accidents or does it also include industrial accidents? Not specific enough would create confusion on what is reportable and what is not.

owned utilities, like SCE, must manage their shareholder interests. SCE therefore chose a dry cask and storage system which may not maintain the integrity of canisters in the decades it will take to construct an interim storage or permanent disposal facility. The DOE's interests focus on receiving undamaged canisters, prepared for transportation to an off-site repository. If the DOE is not involved in the canister and on-site storage facility selection, then the nuclear power plant owner may choose a storage configuration which only suits their bottom line and strategy to reduce cost of containment, staff, and maintenance.

The nuclear power plant owner at SONGS selected canisters with a design life of sixty years. This means our storage situation at the reactor may last sixty years, but early reports of scratching and corrosion raised doubts.¹²⁷ There is an incredible uncertainty about whether the canisters in use can even be transported with the physical damage already evidenced. Poor choices in canisters and storage facilities were made by utilities based on broken promises of permanent disposal made by the federal government.¹²⁸ Today the utilities place blame on anyone but themselves, even though utility owners are the entity who could have chosen stronger storage canisters and locations. DOE's efforts to design a universal MPC system failed in the late 1990's due to a lack of repository designs and was re-engaged in the early 2000's under the Transportation, Aging, and Disposal (TAD) initiative.¹²⁹ The DOE needs to be an active participant in canister selection if there is to be

Commented [DD27]: Delete. Fallacious argument. All the canisters and associated systems must be approved by the NRC. The utilities can only use NRC approved canisters.

Commented [DD28]: Delete, no basis in fact

	<p>defense between radioactive material and the environment. The lack of a viable repackaging/replacement procedure leaves no ability to handle or contain radiation if an act of malfeasance or material failure lead to canister or fuel damage. Nuclear power plant owners spoke on record that they do not have a repackaging/replacement procedure and nationally the procedure is underdeveloped, untested on canisters fully loaded with radioactive material, and has not been implemented at nuclear power plants.¹¹⁰</p>
Findings # Y	<p>Y. There is no ability to detect chemical damage to SNF in current dry storage configuration. Hydrides formed on the zirconium alloy cladding of fuel pellets reorient themselves as the material cools in canisters, causing degradation of cladding.¹²¹ When hydrides reorient radially the material becomes brittle and ductility decreases causing damage to the fuel and radiation leaks inside canister.¹²² Different factors affect the reorientation of hydrides in each canister.¹²³ Cladding failure is a major issue changing the composition of SNF inside a canister, likely complicating transport off site.¹²⁴</p>
Recommendations #21 (pg 38)	<p>21. The DOE and nuclear power plant owners should reach a consensus on which canister and storage system to use for storage of SNF and apply jointly to the NRC for the license. (Finding R, S) The nuclear power plant owners have different interests than the DOE. Investor-</p>

Commented [DD25]: Delete. Seems to confuse solid nuclear fuel with liquid nuclear waste. Additionally, the report cited examples of operating nuclear plants, plants outside of the jurisdiction and control of the United States, and drew correlations to a spent fuel storage facility. Their assessment is faulty. The laws of physics do not support the amount of radiation release they proclaim would occur.

Commented [DD26]: Delete. The canisters are filled with an inert gas (helium). My understanding of chemistry is you need a hydrogen atom to form a hydride. There is no hydrogen in the canister.

	<p>canister vents at the surface of the land. Concrete is poured around steel silos that the storage canisters are then lowered into. This style of concrete storage system is only used at two sites in the nation: SONGS (CA) and Callaway (MO).⁹² This style of partially below grade on-site storage system is a new storage configuration design and experts have discovered serious flaws were discovered in recent years: gouging and scratching upon downloading, potential for clogging of vents, and misalignment risks upon downloading.^{93,94}</p>
Findings #S last paragraph (pg 33)	<p>These partially below grade storage systems add risk factors of scratching and gouging upon downloading of canisters, questionable canister and SNF retrievability, and prevent ASME-qualified inspection, monitoring, and repair.¹⁰¹ The inability to detect radiation releases, damage to canisters, or damage to SNF geometry in below grade dry canister storage systems cause serious concerns.</p>
Findings #V (page	<p>V. The repackaging/replacement procedure for damaged canisters or damaged fuel is underdeveloped. The discussions which pushed for removal of fuel assemblies from the SNF pools did not sufficiently consider the damage over time to dry storage canisters and SNF during on-site storage.¹⁰⁹ This lack of forethought stranded thousands of storage canisters at reactor sites around the nation without a plan for dealing with a canister breach. Most canister models used in the U.S. are thinner-walled and have only one layer of</p>

Commented [DD23]: Reword to include that while these were problems they have since been resolved.

Commented [DD24]: Delete. Not true

Storage and Aging Management

Letter/Number	Comment
Introduction paragraph 4 (pg 31)	<p>The NRC enacted regulations which, “requires an aging management review of containment structures to ensure the effects of aging will be managed so their intended functions will be maintained for the period of extended operation.”⁸⁵ These vulnerable on-site storage configurations are intended to be stewarded through individual aging management plans proposed by utility-owners, which consider storage timeline, cost, and uncertainties. As of yet, these storage plans and subsequent aging management plans are only now being released and have not stood widespread, independent scrutiny or the test of time, over decades.⁸⁶ More research is needed to understand how SNF storage sites can be engineered to be climate resilient and climate ready, and also to define the true risk of radiation exposure from dry cask storage, over decades.</p>
Findings # S (pg 32)	<p>S. Most on-site SNF storage systems are above ground, on parking lot-type pads, where the storage canisters are each covered in a concrete overpack.</p> <p>When all SNF is moved to dry storage, there will be 123 canisters of SNF stored on site. Seventy-three canisters in the newer Holtec facility and fifty canisters in the Orano-TN NUHOMS system (Orano was previously known as AREVA). The Holtec UMAX system is a newer design of storage system which is partially below grade, with the</p>

Commented [DD22]: Dry cask storage is inherently safer than wet storage. An example of "...Perfect being the enemy of the good..."

	<p>plant owners look out for their profit, risk, and stability as a company. A utility company's concern about profit and shareholder interests influence their decision-making and has led to errors in judgement.</p> <p>Congress must be held accountable for budgeting adequate funding for storage, disposal, transport, and research and development. It is imperative that radiation containment canisters with a lifespan of less than 100 years are not approved by the NRC. This selection criteria ensures that the best and most long-term storage canister selection is made with consideration paid to indefinite on-site storage and transportation.</p>
<p>Best Practices and Recommendations Conclusions (pg 29)</p>	<p>Enough time has passed with the use of nuclear power to illuminate the blind spots of the regulators, utilities, nuclear industry, elected officials, and residents. Now the challenge is for leaders to address and proactively plan for the safest storage and disposal available today, with continual improvements applied as technology advances – that means thicker-walled casks.</p> <p>Nuclear energy is a technology that brought much hope and promise to diversify our energy grid, and we have seen great disappointment with the absence of balanced leadership for safety, common sense, and transparency in dealing with the SNF and nuclear power plants in decommissioning. The discovery of nuclear radiation caused Marie Curie's untimely death, let it not lead to the demise of humanity. The U.S. must take this opportunity to pause, reflect, and use all knowledge available to affect a new SNF policy before a catastrophe.</p>

Commented [DD19]: Would subject communities to increased risk by keeping SNF in wet storage. Dry cask storage is inherently safer than wet storage.

Commented [DD20]: Delete, no proof that thicker-walled canisters are safer.

Commented [DD21]: Delete. Proselytizing, not germane to the charter of the committee to find ways to move the fuel to long-term storage or CIS.

Abandoning SNF at over 65 sites in 30 states puts the health and safety of people and the environment at risk, for generations. Engaging in trusting, transparent, and data-driven dialogue will advance solutions across regions through an independent and civil process. This national conversation will help to ensure all concerns are heard and through the exchange of ideas will lead to significant improvements in containment, storage, and disposal of SNF.

14. Congress should consider legislation that restricts NRC from approving canisters with a design life of less than 100 years. (Finding L, M) The current state of U.S. SNF storage at reactor sites requires a long-term vision for more than 100 years. Congress must work with the NRC to ensure that thousands of canisters are not approved and then stranded on-site beyond their design lifespan. The selection of a canister storage system with 5/8-inch walls may have seemed theoretically reasonable for a temporary storage period, but they are completely inadequate for the anticipated on-site storage of over 100 years and subsequent transportation off-site.⁷⁴ Our leaders must ensure that on-site containment is robust and long-lasting, as little progress has been made on any interim storage or permanent disposal facility. NRC is charged with regulating the safe operation of nuclear power plants and protecting the health and safety of people and land surrounding nuclear power plants, but their licensing approvals do not reflect the discrepancy between the interests of DOE and nuclear power plant owners. DOE requires that canisters are undamaged before transport to an off-site facility.⁷⁵ Nuclear power

Commented [DD18]: Misre presents facts. No one has abandoned SNF.

	<p>Storing canisters inside a closed building would have to be technically evaluated to determine what impacts the building would have on loading operations and canister performance.⁶⁸</p> <p>Buildings enclosing SNF storage would reduce radiation levels at the site boundary to some extent.⁶⁹</p> <p>It is unclear if San Onofre is a good site for a retrofit of a building enclosure.</p>
<p>Best practices Recommendations #13 (pg 25)</p>	<p>13. Decisionmakers should adopt the Blue Ribbon Commission on America's Nuclear Future's recommendation to establish a new facility siting process, establish a new SNF management organization, and broaden support to municipalities affected by transportation routes. (Finding K)</p> <p>The Blue Ribbon Commission provided several relevant recommendations for SNF storage and disposal, and siting of permanent repositories.⁷³ As a country we must find solutions to handling SNF with the utmost safety, and we can only achieve that together with understanding, science, and transparent regulatory judgement. Local, state, federal, industry, and advocacy entities must foster effective dialogue among stakeholders surrounding all U.S. reactors sites, at proposed disposal repository locations, and along transportation pathways to ensure transparent conversations that lead to solutions.</p>

Commented [DD17]: Delete. Radiation levels at the site boundary are at background, you can't reduce levels below background. A building would not reduce radiation levels at the site boundary.

<p>Best practices. Findings #N</p>	<p>N. Undercapitalized non-utility entities are buying nuclear plants in the decommissioning phase. One concerning development involves undercapitalized non-utility businesses applying to the NRC to buy up nuclear plants in the decommissioning phase.⁵³ In the past utility companies were profitable when they ensured safety in their nuclear power plant operations.⁵⁴ Non-utility companies who purchase nuclear power plants in decommissioning often lack the technical expertise and financial resources needed to guarantee successful decommissioning and to safely steward the tons of SNF left on-site.⁵⁵ When non-utility actors purchase nuclear power plants, costs are deeply cut and timelines are often decreased by decades.⁵⁶ Safety goes down in worker safety, environmental exposure, and increases risk of financial exposure for states and average citizens who own assets in the surrounding areas.^{57,58} Companies are attracted to the opportunity to profit, from each nuclear power plant's multi-billion-dollar ratepayer-funded decommissioning money, by taking a minimalist approach to SNF storage.⁵⁹ Currently there are no NRC regulations regarding the purchasing of nuclear power plants in decommissioning, with long-term SNF storage on-site.</p>
<p>Best practices. Findings #Q (pg 25)</p>	<p>Q. Other countries place SNF systems inside enclosed buildings.</p>

Commented [DD16]: Delete, misrepresents what the referenced article stated.

	decommissioning reserves should be requested from ratepayers.
Conclusions (pg 20)	California must require retrievable and monitorable storage canisters and storage systems, begin a transparent process to identify an interim storage facility within the state, enact a significant state oversight authority on SNF, and codify legislation on SNF storage in the state. States must remain more vigilant to the risks of SNF storage at reactor sites over decades. State agencies must share information among one another prior to approving SNF storage permits.
Conclusions (pg 20)	Two risks loom large over the next several decades. The corporate purchases by Holtec, NorthStar and other non-utility, undercapitalized businesses are a danger to the economy, resources, health, and safety of California and other states. The state must vehemently oppose any efforts for corporate purchases of nuclear power plants in decommissioning. The concerns about SNF retrievability from canisters in the partially below grade storage system also pose serious danger, given the close proximity to the ocean and unstable coastal bluffs. These are actions the state can immediately implement to bolster SNF oversight measures.

Commented [DD13]: Delete, more than likely illegal. Regardless would incentivize utilities to cut costs; which is probably not what we want.

Commented [DD14]: Delete this paragraph. Dry cask storage is inherently much safer than wet storage. This section could delay the movement of fuel into dry cask storage creating increased risk and is counter to the charter of the committee

Commented [DD15]: Delete, assumes facts not supported by any evidence.

Best Practices

Letter/Number	Comment
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	<p>California can serve as a model for the other 29 states with SNF. There are several regulatory oversight actions on SNF storage available to states that have yet to be authorized. Significantly more state oversight is necessary to ensure safety in operations. California should lead the development of a “state’s oversight structure on</p>
<p>Recommendations # 11 (pg 19)</p>	<p>11. The California Public Utilities Commission should require power plant owners to establish funding reserves from nuclear power plant owner resources to cover emergency response to high levels of radiation releases, as long as radioactive material is on site. (Finding J)</p> <p>The potential for high level radioactive waste contamination threatens California’s natural resources, economy, food, water, health, safety, and transportation. If our communities are exposed to high levels of radioactive contamination the effects would be catastrophic. For these reasons it is imperative that California takes an active role to ensure there is an incentive for safety on the part of the nuclear power plant owner. Establishing funding reserves from the nuclear power plant owner would provide the resources necessary to take immediate action were there to be contamination from natural disasters or acts of malfeasance. No</p>

Commented [DD12]: Delete 6, 7 and 8, dry cask storage is inherently much safer than wet storage. This section could delay the movement of fuel into dry cask storage creating increased risk and is counter to the charter of the committee

information among state agencies should improve the decommissioning decisions made over time. Permits and licenses are approved by the NRC and various California agencies without the utility meeting the permit conditions on the day of approval. The decommissioning permit approvals by the California Coastal Commission in 2015 and 2019 are key examples of a practice where conditions of the permit were impossible to meet upon permit approval, namely special condition 2 (d), “Evidence that the fuel storage casks will remain in a physical condition sufficient to allow off-site transport, and a description of a maintenance and inspection program designed to ensure that the casks remain transportable for the full life of the amended project,” in California Coastal Commission application number 9-15-0228 in 2015.^{37,38} This is a serious oversight on the part of the leaders charged with protecting the interests of the state, its residents and the environment.

8. States must be given authority to conduct oversight of SNF storage. (Finding J) The state has been a recipient of nuclear energy power generation and therefore is responsible for joining in the search for storage solutions. Often state leaders attribute inaction to the federal government, instead of seeing an opportunity for collaboration to expedite solutions. There is a clear opportunity for the State of California to lead the charge for effective engagement between federal and state agencies through economic enforcement, legal challenges to third-party license transfers, increasing state authority, rate regulation, and SNF storage accountability.

nuclear power plant owners and DOE to develop, validate through the National Academy of Sciences, and seek NRC approval for a canister repackaging/replacement procedure. This process should also include study of advanced canister models with the ability to be inspected, monitored, maintained, and repaired. SNF must be accessible for inspection, damage detection, repair, and eventual transport. Canisters must be required to meet the storage license criteria for retrieval. Retrieval is defined here as removal from the ISFSI storage facility and opened for fuel assemblies to be removed from the canisters. If SNF inside a storage canister cannot be retrieved, then new risks and downstream storage issues may become a hindrance to the transportation to an off-site storage facility. A number of initiating factors could create a scenario where a canister and its SNF are rendered irretrievable and lead to radiation leaks, including: natural disasters, acts of malfeasance, or aging-related degradation of fuel cladding, SNF, storage canister, or concrete. SFSI.34 There is no transfer station on site to repackaging/replace a damaged canister.35,36

7. The California Public Utilities Commission, California Energy Commission, California Coastal Commission, and California State Lands Commission, among others, must share information with one another and require only best practices be implemented at storage sites. (Finding I) It is critical that state agencies remain engaged on SNF storage to protect the interests of Californians. The sharing of

	canister repackaging/replacement procedure in the event that a damaged storage canister must be emptied into new and more robust canister system.26,27
Findings and Recommendations #J (pg 16)	States are reluctant to exercise their authority over SNF storage because of threats of NRC federal preemption on health and safety matters relating to radioactive material.29,30,31 In 2002 the state of California took bold action to regulate low-level radioactive waste with the passage of AB 2214 <i>Low-level radioactive waste disposal facility</i> on September 12, 2002 In 2002 the state of California took bold action to regulate low-level radioactive waste with the passage of AB 2214 <i>Low-level radioactive waste disposal facility</i> on September 12, 2002 thereby amending the California Health and Safety Code.32 This law set minimum objectives for the design of low-level radioactive waste isolation facilities. Low-level radioactive waste is often material used in medical procedures.33
Recommendations #6 (pg 17)	6. The Legislature of California should require those managing nuclear power plants to use easily retrievable and monitorable storage systems. (Finding H) SNF storage canisters are the only containment mechanism preventing radiation exposure to our environment and people. The state must compel

Commented [DD10]: Delete, Speculative, assumes facts that are not supported by any evidence.

Commented [DD11]: Delete, not sure what the point of this statement other that it bolsters my concern about creating a myriad of conflicting regulations. Yes, California passed AB2214 but they never built Ward Valley waste disposal facility due to politics.

	<p>license transfer of Pilgrim Nuclear Power Station to Holtec International, another private business.¹⁸ If entities fail to have the necessary training, safety protocols, financial capital, and sound financial management, this transfer of corporate ownership could endanger the health, safety, and economic stability of the 30 states which store SNF.¹⁹</p>
<p>Findings and Recommendations #H (pg 15)</p>	<p>The storage canister model in use at SONGS is welded shut. According to a March 2019 NRC report, these canisters lack the ability to meet the certificate of compliance requirements for inspection, monitoring, maintenance, and repair via ASME-qualified methods.²¹ Canisters in use at SONGS are stored in a secondary concrete structure called an ISFSI. There are two of these structures on site, an Areva NUHOMS and a Holtec UMAX. The Holtec UMAX storage system ISFSI is partially below grade and subject to concrete deterioration, atmospheric corrosion, heat damage, and environmental damage.²² The design of the concrete ISFSI prevents the visualization and damage detection of the ISFSI, canisters, and SNF stored within.²³ Damage to the ISFSI structure and storage canisters may prevent the retrieval of the storage canisters and therefore the SNF assemblies inside the canisters²⁴. Only two reactor sites in the nation use the Holtec UMAX Storage system: SONGS (CA) and Callaway (MO).²⁵ The lack of retrievability is further complicated by the fact that SCE has not developed and verified a</p>

Commented [DD9]: Delete misrepresents the NRC report. Specious argument.

	<p>other relevant municipal ordinances should be taken into account for the appropriate siting and transportation of SNF.</p>
<p>Recommendations Conclusion (pg 13)</p>	<p>The time to move SNF off the coast at San Onofre State Beach is long overdue and federal action is needed for a solution. It currently sits in a location that threatens the approximately 8 million people who reside in the vicinity, one of the nation's busiest highways in the I-5 corridor, the country's second busiest intercity passenger rail corridor in the Los Angeles – San Diego – San Luis Obispo Corridor, a military base, the fifth most popular state park in California, and a beloved coastline. Before threats become realities, the federal government must safely move SNF from SONGS to an appropriate final repository. In order to do so, changes must be made to the federal laws and regulations for SNF management. The federal government must ensure that it allows states to meaningfully participate in regulating the SNF that will affect their cities and towns, while continuing to pay close attention to environmental issues. Although there is no perfect solution, keeping SNF at SONGS is unacceptable.</p>

Commented [DD5]: Delete, having every state create their own set of requirements/laws for SNF storage would create a hodge-podge of requirements that would prevent fuel movement. The deleted text would work for any state that created a CIS facility on state land, but this seems to apply to all SNF storage facilities, therefore should be deleted.

Commented [DD6]: Add... or consolidated interim storage facility.

Commented [DD7]: See my previous comment on a hodge-podge of regulations.

State Policy Recommendations

Letter/Number	Comment
<p>Findings and Recommendations #G (page 15)</p>	<p>... third-party and the NRC. 15,16 These companies lack the experience and financial reserves to complete these projects safely using best practices.17 Maura Healey, Attorney General of Massachusetts, sued the NRC over a</p>

Commented [DD8]: Delete ; misrepresents what the reference article stated.

	<p><i>consolidated interim storage sites that are on state lands.</i></p>
<p>Recommendations #4 (pg 12)</p>	<p>Relevant environmental review and protection law should include protection for both land and marine resources. In order to address resource protection, include proximity to a marine protected area as a general factor that could disqualify a site from serving as an SNF repository.</p> <p>Environmental law cannot be curtailed or sacrificed for the sake of expediency. The siting and transportation of SNF must proceed with full review and safeguards for our citizenry and natural resources. Both federal and state environmental laws should be adhered to in the process of siting future storage locations and developing the transportation plan for SNF. In addition to specific land-based ecosystems of national significance that are protected from 13</p> <p>SNF, the same protection should be afforded to marine-based ecosystems of national significance as well.</p> <p>State laws should not be preempted or subordinated due to federal law on SNF storage and disposal. In order to progress and identify acceptable areas for SNF repository siting, there must be meaningful collaboration between state governments and the federal government. In achieving this objective, Congress could amend the NWPA to reflect standards that are similar to other environmental statutes that allow for stricter state environmental safeguards, such as the Coastal Zone Management Act. Local environmental protections, land use plans and</p>

Commented [DD4]: Should only apply to consent based consolidated interim storage construction in an affected state that is not on federal land. Would not apply on federal land, since established law grants the federal government exclusive rights to federal land use and I doubt they would cede that right to states.

	<p>successful containment of SNF radiation from people and the environment.</p> <p>The roadblock of utility players not wanting to spend money on buying quality casks needs to be mitigated through state and federal regulation. This requirement should apply to new canister applications and the canisters used to repackaging/replace existing SNF in dry storage</p>
<p>Recommendations #24 (pg 39)</p>	<p>24. Congress should require the DOE and nuclear power plant owners to develop a technical procedure for canister repackaging/replacement prior to further NRC canister license approval, SNF pool decommissioning and removal, and loading of canisters in an on-site ISFSI. (Finding V)</p> <p>There is no permanent repository approved. The nation must prepare for damaged SNF canisters which require mitigation. This repackaging/replacement procedure would ensure that all DOE criteria are met for eventual transportation of canisters off-site when a repository is available to accept SNF. 130</p>

Commented [DD29]: Delete, no basis in fact.

Commented [DD30]: Delete. This would delay the transfer of SNF to dry cask storage from wet storage. Dry cask storage is inherently safer than wet storage.

Rob Howard:

The Honorable Gregory Jaczko, former NRC Chairman
The Honorable Rear Admiral Leendert Hering ret.

Dear Co-Chairs, Messrs. Jaczko and Hering

First let me thank you and Congressman Levin for the opportunity to participate on the San Onofre Nuclear Generating Station Task Force. My time spent on the technical committee was enlightening.

As I have stated in the past, I believe our primary task is to come together with recommendations around how to move the spent nuclear fuel to a long term storage facility. That facility could be a permanent solution or a consolidated interim storage facility.

This memo is to share my concerns with the report and my support for including alternate views of the draft report. Generally, I oppose any actions or recommendations that do not support moving spent nuclear fuel to a passive, dry cast storage unit. Dry cast storage is clearly safer than wet storage pools.

I also oppose recommendations that allow each state entity to have a say in the movement and storage of fuel unless that entity is consenting to receive and store the spent nuclear fuel. Allowing states to weigh in on the transportation could present unnecessary delays in moving the fuel to a storage facility.

I support your efforts to come up with a solution to safely store the spent nuclear fuel in a permanent storage facility or a consolidated interim storage facility and I look forward to your efforts following this report. It is for this reason that I will sign on to the report if this memo is included and you specify that I support the annotations provided by committee member Dan Dominguez.

Sincerely,
Rob Howard

Jerry Kern:

I have strong reservations regarding recommendation number 4. There should be an overarching NEPA document for transportation. If Recommendation 4 is adopted as submitted the fuel will never be moved because each jurisdiction will have the EIR challenged and be tied up in litigation for the foreseeable future.

Larry Kramer:

Recommendation 8: “States must be given authority to conduct oversight of SNF storage.”

This action would result in states identifying differing acceptance criteria. This would just add to the cost borne by taxpayers and cause further confusion.

The following is just a comment.

Finding Q and Recommendation 18. This seems like it might apply somewhere else but has no place in a report on San Onofre. As indicated building a structure over the canisters would be counterproductive;

the construction possibly damaging the canisters and the finished building likely negatively affecting the cooling air flow required. Is there some measurable radiation level at the site boundary? The statement in Finding Q implies there is, which if not true, is misleading at best.

Ted Quinn:

Please see attached my comments to the draft report. The comments to the First Section, Federal Legislation and Regulatory Oversight,” have been incorporated and I want to sign to endorse this Section. However, as per the attached comments which were not incorporated, I cannot include my name in endorsing or agreeing with those sections.

I am requesting that you revise the Members listing on Page 1 to list me as follows:

Ted Quinn, community member-at-large, Federal Legislation and Regulatory Oversight Only
--- see attached comments dated February 23, 2020

I support the Congressman and the First Section of this Report and hope that it can help support resolution of the disposition of Spent Nuclear Fuel (SNF) for SONGS and the U.S.

State Policy Recommendations Section

Letter/Number	Comment
Finding H	<p>Finding H. “According to a March 2019 NRC report, these canisters lack the ability to meet the certificate of compliance requirements for inspection, monitoring, maintenance, and repair via ASME-qualified methods²⁰.”</p> <p><i>COMMENT:</i></p> <p><i>Why wouldn't the actual NRC report from NRC's website be footnoted? Furthermore, the report referenced, Footnote 21, does not support the above statement.</i></p> <p><i>Reference 22, lacks legitimate peer-review.</i></p> <p><i>Reference 23, lacks legitimate peer-review or acceptance by staff outside of SLF.</i></p> <p><i>Reference 24—has it been accepted by peers outside of Surfrider?</i></p>
Finding H	<p>“The lack of retrievability is further complicated by the fact that SCE has not developed and verified a canister repackaging/replacement procedure in the event that a damaged storage canister must be emptied into new and more robust canister models”</p> <p><i>COMMENT: SCE has demonstrated retrievability repeatedly using the canister simulator. There is no legitimate technical reason to believe MPCs cannot be retrieved from the storage module.</i></p>

Finding I	<p>“The agencies make nuclear waste permit decisions almost entirely based on utility documents and testimonies, with weak or no scientific support.” COMMENT: <i>I don't see Ref. 28 as weak or lacking scientific support.</i></p>
Recommendation 6	<p>“Retrieval is defined here as removal from the ISFSI storage facility and opened for fuel assemblies to be removed from the canisters.” COMMENT: <i>What does it mean? What system is envisioned? SCE has demonstrated capability to inspect and repair canisters stored in UMAX modules.</i></p> <p><i>This paper just re-defined irretrievability? Retrieval does not include removal of fuel from the canister at the site; no one advocates opening storage casks (canisters) simply to see what the condition is inside the container. The DOE/industry is already investigating non-invasive means to confirm the integrity the canister contents. Regardless, there is no credible degradation mechanism for container contents, provided integrity is maintained, due to the drying process and inert gas backfill.</i></p>
Recommendation 6	<p>“There is no transfer station on-site to repackage/replace a damaged canister^{34,35}. This inability to repackage/replace nuclear waste may create a host of risks to people and the environment over time.” COMMENT: <i>No shutdown site in the U.S. that is proceeding into full decommissioning, has maintained or been required to maintain a spent fuel pool by the NRC. This was reviewed and accepted by the CCC at the 2019 hearing as well.</i></p>
Recommendation 7	<p>“Permits and licenses are approved by the NRC and various California agencies without the utility meeting the permit conditions on the day of approval” COMMENT: <i>What conditions of the permit were impossible to meet? The CCC findings and unanimous approval was based on the application of scientific requirements now and a set of controls on SCE actions as the permit holder to meet in the future.</i></p>
Recommendation 8	<p>“States much be given authority to conduct oversight of spent nuclear fuel storage.” COMMENT: <i>This is counterproductive, in both that a Congressional Task Force is recommending state law changes for one state, and the fact that oversight of the safety and licensing of nuclear facilities resides with the NRC by the Federal Code of Regulations (CFR). An action like this would result in multiple states identifying differing acceptance criteria at added cost and also requiring states to retain similar experts to the capabilities of NRC employees, which again, would be double coverable and the cost born by taxpayers and ratepayers.</i></p>

Recommendation 9	<p>“The State of California should task their regulatory authority on nuclear waste oversight with identifying an consent-based interim or permanent nuclear waste storage site in California.”</p> <p><i>COMMENT: Not legal in accordance with the NWPA --- it is federal responsibility for all facilities including power plant and medical and other radioactive wastes from industrial use.</i></p>
Recommendation 10	<p>“The CPUC should prevent the utility from going back to ratepayers and increasing rates.”</p> <p><i>COMMENT: The CPUC has oversight over the decommissioning trust funds and must ensure sufficiency of these funds during the Nuclear Decommissioning Cost Triennial Proceedings (NDCTP). The funds, which were collected during the operational time of the plant already allow for the decommissioning to proceed without additional funds from the ratepayer. This has been verified by independent analysis presented to the NRC in the decommissioning planning phase.</i></p>
Recommendation 11	<p>“The CPUC should require power plant owners to establish funding reserves from nuclear power plant owner resources to cover emergency response to radiation releases, as long as radioactive material is on-site.”</p> <p><i>COMMENT: The CPUC already does this. Emergency Planning response funds are part of the Decommissioning Cost Estimate, that is revised every 3 years.</i></p>
Conclusion	<i>Comment corrected.</i>

Best Practices Section

Letter/Number	Comment
Introduction – third paragraph	Comment corrected.
Finding K	<i>COMMENT: Not true – actual consent based siting is occurring. There is also support for the repositories and CISOs. New Mexico’s CIS may still be licensed and constructed as well as Texas.</i>
Finding M	<i>COMMENT: What are some specific exemptions applicable to dry storage of fuel at SONGS? The canisters used at SONGS meet all applicable NRC regulations. FYI: SCE has not applied for any exemptions to Part 72 licensing requirements, and neither has Holtec.</i>
Finding N	<i>COMMENT: NRC performs a prudence review of all ownership changes on operating units as well as shutdown units – and has successfully completed these with strong controls applied over many years.</i>
Finding O	<i>COMMENT: Does not recognize the 18 month shutdown and subsequent programmatic changes and NRC elevated enforcement and inspections conducted to approve the new fuel transfer process.</i>

Finding P	<i>COMMENT: Are there examples of fuel handling procedures and protocols outside the nuclear industry that the NRC should be made aware of to ensure best practices are applied? The finding is not clear on this or whether the NRC has previously considered these.</i>
Recommendation 14	<p><i>COMMENT: I do not know of any that have an advertised design life greater than 100 years. NRC Generic Environmental Impact Statement for spent fuel (NUREG -2157) addresses fuel storage beyond the 60 years allowed for decommissioned plants in safe store.</i></p> <p><i>“Because the timing of repository availability is uncertain, the GEIS analyzes potential environmental impacts over three possible timeframes: a short-term timeframe, which includes 60 years of continued storage after the end of a reactor’s licensed life for operation; an additional 100-year timeframe (60 years plus 100 years) to address the potential for delay in repository availability; and a third, indefinite timeframe to address the possibility that a repository never becomes available. All potential impacts in each resource area are analyzed for each continued storage timeframe.”</i></p>
Recommendation 15	<i>COMMENT: The NRC reviews the entity to determine whether they have the financial capability to finish the decommissioning.</i>

Storage and Aging Management Section

Letter/Number	Comment
Finding S	<p><i>COMMENT: Sea wall is not needed to protect the dry storage systems, as the systems are rated to withstand submergence well above the height of the seawall.</i></p> <p>“These partially below grade storage systems add risk factors of scratching and gouging upon downloading of canisters, questionable canister and spent fuel retrievability, and prevent American Society of Mechanical Engineers (ASME)-qualified inspection, monitoring, and repair⁹⁸”.</p> <p><i>COMMENT: The report referenced, Footnote 101, does not support the above statements, other than documenting scratches found on the canister surfaces.</i></p>

Finding T	<p>COMMENT: Finding T: “The only visual assessment of storage canisters method performed by Southern California Edison included a camera and a borescope, technology which takes no direct measurement, but captures photos and makes a computer model of photos (Footnote 103). This is an inadequate method of identifying canister damage and it does not qualify as an inspection (Footnote 104)”</p> <p><i>COMMENT: Determining depth through 3D analysis is exactly what the system is designed and certified to do. NIST-traceable standards confirm proper system operation. Simply stating the system is inadequate lacks technical rigor. The direct response of SCE to the CCC includes requirements for an AMP ahead of the NRC requirements, including an independent review.</i></p>
Finding U	<p><i>COMMENT: This is false. Bluff failure was evaluated as part of the ISFSI safety analysis. Tsunami impact is evaluated in the UMAX FSAR, I previously referenced in this section.</i></p>
Finding V	<p><i>COMMENT: Footnote 108. There is no peer-reviewed report that suggests a breach of a dry storage canister can result in the wide-spread contamination contemplated in the economic consequence report. Comparisons are made to Fukushima and Chernobyl, operating reactors that are not comparable to SONGS spent fuel that has been cooling for over 8 years. Representing fearmongering claims by a Congressman, with no technical basis, reduces the legitimacy of this report.</i></p>
Finding X	<p>“In the absence of accurate risk calculation SCE often misinterprets comments made in previous NRC investigations. SCE staff often make claims of “zero risk,” when the true answer is that SCE does not know the true precise risk of radiation exposure from dry cask storage, over decades^{113.}”</p> <p>COMMENT: <i>This statement does not reflect the NRC review of the dry cask storage FSAR or specific installations at SONGS. The NRC stated numerous times in 2018 and 2019 that there is no credible threat to the public from the SONGS dry cask storage installation due to the length of time since shut-down and the qualification and certification of the dry cask storage system for both AREVA and HOLTEC.</i></p>
Finding Y	<p><i>COMMENT: This is correct and demonstrates a lack of understanding of the applicable research. Hydrides are formed when zirc corrodes. Since the spent fuel is stored in an inert gas (helium) it doesn't corrode in dry storage so no new hydrides are formed in dry storage. The concern for hydrides in spent fuel is that while the fuel is in dry storage the fuel may get hot enough to allow the existing hydrides to redistribute within the clad. The hydrides are brittle and if they redistribute in an unfavorable way the clad can become weaker. Based on EPRI research and looking at an actual fuel assembly (North Anna) and also a separate paper from the NRC, data shows the mechanical properties of the cladding is not compromised during long term storage of SNF. EPRI Reports attached.</i></p>

Recommendation 21	<i>COMMENT: The regulator has stated publicly the scratches do not affect transportability of the canister, and there are no provisions in the transportation license that would prohibit shipping the canisters due to the observed wear. Note that SCE specified an additional 1/8" thickness for the canister shell beyond the nominal design, which more than compensates for the measured scratch depth.</i>
Recommendation 22	<i>COMMENT: The bottom of the canister? It is a 3 inch thick plate with no credible degradation mechanisms leading to a breach. Additionally, this is the purpose of the High Burnup Fuel demonstration cask, which will examine HBF fuel rods after typical storage conditions are durations.</i>
Recommendation 23	<i>COMMENT: Already in the existing FSAR.</i>
Recommendation 30	<i>COMMENT: SCE already committed to such a program.</i>

Dave Rice:

Regarding the issue of ‘consent’: I know this is a big deal, it came out of the Blue Ribbon Commission, and it sounds ‘politically correct’ to say it. But as I see it, as it’s currently viewed (which is ‘mandatory’), this is potentially a major roadblock to success in getting the SNF off the beach here. The only mitigating factors stated in the report for implementing ‘consent-based siting’ are words like ‘timeline requirements, incentives for sites to accept, and enforcement mechanisms’ in Recommendation #3. These aren’t adequate.

I think the language should say that, while consent is the goal, and we would look for that wherever possible, we still have to look out for the greater good, and if that runs into conflict with consent, then a state like ours needs to have an ability to enlist ‘eminent domain’ and move forward with a site even if ‘consent’ in the area cannot be completely established. End of the day, if no one consents, 8 million people are screwed, and that makes no sense (if we’re talking about compared to a site in the desert let’s say with 1000 people or less who aren’t all on board).

Dan Stetson:

Only Federal section, see disclaimer:

Daniel Stetson, community member-at-large, Federal Legislation and Regulatory Oversight Only --- see attached comments from Ted Quinn dated February 23, 2020

David Zito:

I still have a significant concern that there are no stipulations on timelines for any of the recommendations which creates challenges on determining urgency or prioritization and would feel more comfortable if this had been added.

APPENDICES

Both appendices are available at: <https://mikelevin.house.gov/san-onofre-task-force-report>

Appendix A – Technical Analysis

Appendix B – Documents and Errata

ENDNOTES

- 1 https://www.gao.gov/key_issues/disposal_of_highlevel_nuclear_waste/issue_summary
- 2 <https://www.scientificamerican.com/article/what-does-the-us-do-with-nuclear-waste/>
- 3 “Backgrounder on Emergency Preparedness at Nuclear Power Plants,” NRC (noting ingestion pathway zone is within a circumference of 50 miles), available at <https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/emerg-plan-prep-nuc-power.html>
- 4 See e.g. Grant Ludwig, Lisa & Shearer, Peter. (2004). [Activity of the Offshore Newport-Inglewood Rose Canyon Fault Zone, Coastal Southern California, from Relocated Microseismicity. Bulletin of the Seismological Society of America. 94. 747-752. 10.1785/0120030149](#)
- 5 Compiled by Katie Day, “Task Force Technical Analysis” Day Report 1.
- 6 Compiled by Katie Day, “Task Force Technical Analysis” Day Report 2
- 7 See US NRC email to Tom Palmisano, dated May 22, 2017. Subject: SAN ONOFRE NUCLEAR GENERATING STATION – NRC INSPECTION REPORT 05000206/2016004, 05000361/2016004, 05000362/2016004, AND 07200041/2016002
- 8 See CCC. 2015. Tu14a. Application Number 9-15-0228. Adopted Findings: Regular Permit. pg. 47
- 9 See CCC. 2015. Tu14a. Application Number 9-15-0228. Adopted Findings: Regular Permit. pg. 47
- 10 See CCC. 2015. Tu14a. Application Number 9-15-0228. Adopted Findings: Regular Permit. pg. 32
- 11 Compiled by Katie Day, “Task Force Technical Analysis” Day Reports One and Four
- 12 Blue Ribbon Commission on America’s Nuclear Future, “Report to the Secretary of Energy” (January 2012), available at https://www.energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf
- 13 Id.
- 14 Id.
- 15 NWSA 42 USC 10101
- 16 42 U.S.C. § 10132
- 17 Ringleb, Al H., and Steven N. Wiggins. “Liability and Large-Scale, Long-Term Hazards.” *Journal of Political Economy*, vol. 98, no. 3, 1990, pp. 574–595
- 18 See <https://gothamist.com/news/company-poised-dis-mantle-indian-point-radioactive>
- 19 See <https://www.lohud.com/story/news/investigations/2019/06/19/nuclear-plant-decommissioning-is-a-gold-mine-for-some-but-at-what-risk/1269407001/>
- 20 Davis, L and C. Hausman, 2019, “Nuclear Moral Hazard,” UC Berkeley Energy Institute at Haas Blog. <https://energyathaas.wordpress.com/2019/06/24/nuclear-moral-hazard/>
- 21 <https://www.mass.gov/lists/pilgrim-nuclear-power-station-license-transfer-application-proceeding>
- 22 Davis, L and C. Hausman, 2019, “Nuclear Moral Hazard,” UC Berkeley Energy Institute at Haas Blog. <https://energyathaas.wordpress.com/2019/06/24/nuclear-moral-hazard/>
- 23 Image credit Samuel Lawrence Foundation
- 24 NRC Visual Assessment March 21-23, 2019. <http://www.samuellawrencefoundation.org/wp-content/uploads/2019/10/NRC-Visual-Assessment-Report.pdf>
- 25 Chakraborty, S, 2020, “Task Force Technical Analysis,” Chakraborty report, pages 14-15
- 26 Chakraborty, S, 2020, “Task Force Technical Analysis,” Chakraborty report, pages 14-15, 19-20
- 27 Day, K, 2020, “Task Force Technical Analysis,” Day report 2, page 14
- 28 StoreFuel. October 2019 Issue
- 29 See SCE presentation, CEP March 2018, hour 1:34 – 1:37 <https://www.youtube.com/watch?v=mjgna2atn7Y&feature=youtu.be>
- 30 See California Coastal Commission October 2019, Hour 3:52 – 3:58 <https://cal-span.org/unipage/?site=-cal-span&owner=CCC&date=2019-10-17&mode=large>
- 31 California Coastal Commission, October 2019, Hour 3:55 – 3:58 <https://cal-span.org/unipage/?site=-cal-span&owner=CCC&date=2019-10-17&mode=large>
- 32 Day, K, 2020, “Task Force Technical Analysis,” Day report 1
- 33 NRC 10 CFR 8.4, see <https://www.nrc.gov/reading-rm/doc-collections/cfr/part008/part008-0004.html>
- 34 U.S. NRC, NRC: NMSS - State Regulations and Legislation, <https://scp.nrc.gov/rulemaking.html#CA>.
- 35 See http://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=200120020AB2214
- 36 See <https://www.nrc.gov/reading-rm/basic-ref/glossary/low-level-radioactive-waste-llw.html>
- 37 Chakraborty, S, 2020, “Task Force Technical Analysis,” Chakraborty report
- 38 See SCE CEP March 2018, hour 1:34 – 1:37 <https://www.youtube.com/watch?v=mjgna2atn7Y&feature=youtu.be>
- 39 SCE CEP August 2019, Defense In Depth Presentation www.songscommunity.com/internal_redirect/cms.ipres-room.com.s3.amazonaws.com/339/files/2019/082219-DryCaskStorageDefenseInDepth.pdf

- 40 See Application No. 9-15-0228 <https://www.coastal.ca.gov/meetings/mtg-mm15-10.html>
- 41 See Application No. 9-19-0194 <https://www.coastal.ca.gov/meetings/agenda/#/2019/10>
- 42 Technical considerations are covered in a later section of this report.
- 43 Energy and Water Appropriations Act of 2020, appropriation for "Integrated Waste Management System", PDF page 95 <https://docs.house.gov/bills/thisweek/20191216/BILLS-116HR1865SA-JES-DIVISION-C.pdf>
- 44 See <https://susielee.house.gov/media/in-the-news/nevada-lawmakers-introduce-bill-stop-attempts-revive-yucca-mountain>
- 45 See <https://www.sandiegouniontribune.com/business/energy-green/story/2019-06-10/new-mexicos-governor-comes-out-against-nuclear-waste-site>
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- 47 California Coastal Commission, October 2019, Hour 4:45 – 4:50 <https://cal-span.org/unipage/?site=-cal-span&owner=CCC&date=2019-10-17&mode=large>
- 48 Fountain, H., 2017, New York Times, "On Nuclear Waste, Finland Shows U.S. How It Can Be Done" <https://www.nytimes.com/2017/06/09/science/nuclear-reactor-waste-finland.html>
- 49 See <https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/radwaste.html>
- 50 See "Overview of Dry Spent Fuel Storage at San Onofre Nuclear Generating Station", 2019, SCE <https://www.songscommunity.com/need-to-know/overview/sce-releases-comprehensive-dry-storage-overview-paper>
- 51 Chakraborty, S, 2020, "Task Force Technical Analysis," Chakraborty report
- 52 Day, K, 2020, "Task Force Technical Analysis," Day report 2
- 53 See NRC 10 CFR 50.12 <https://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0012.html>
- 54 See NRC 10 CFR 50.12 <https://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0012.html>
- 55 In 2019 the Pilgrim Nuclear Power Plant in Massachusetts was purchased by Holtec International.
- 56 Hausman, C, 2014, "Corporate Incentives and Nuclear Safety," American Economic Journal: Economic Policy. Aug 2014, Vol. 6, No. 3: Pages 178-206
- 57 Davis, L and C. Hausman, 2019, "Nuclear Moral Hazard," UC Berkeley Energy Institute at Haas Blog. <https://energyathaas.wordpress.com/2019/06/24/nuclear-moral-hazard/>
- 58 See <https://www.vpr.org/post/vermont-yankee-transfer-approved-northstar-will-decommission-plant#stream/0>
- 59 Davis, L and C. Hausman, 2019, "Nuclear Moral Hazard," UC Berkeley Energy Institute at Haas Blog. <https://energyathaas.wordpress.com/2019/06/24/nuclear-moral-hazard/>
- 60 See <https://apnews.com/651923b9359b-4d64a807aa677999dc03>
- 61 See <https://apnews.com/651923b9359b-4d64a807aa677999dc03>
- 62 See <https://www.sandiegouniontribune.com/business/energy-green/sd-fi-nrc-songsinspection-20180824-story.html>
- 63 Chakraborty, S, 2020, "Task Force Technical Analysis," Chakraborty report, pages 32-36
- 64 See <https://www.nrc.gov/reactors/operating/ops-experience/songs-spec-insp-activities-cask-loading-misalignment.html>
- 65 See <https://www.sandiegouniontribune.com/business/energy-green/sd-fi-songs-lochbaum-20180820-story.html>
- 66 See Secretary Moniz's Speech, 2015, "A Look Back on the Blue Ribbon Commission on America's Nuclear Future" <https://www.energy.gov/articles/secretary-monizs-remarks-look-back-blue-ribbon-commission-america-s-nuclear-future>
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- 68 Ford, M. J. et al., 2018, Issues in Science and Technology, Vol XXXIV no. 4, "Nuclear Power Needs Leadership, but Not from the Military," section Ways for DOD to Help, <https://issues.org/nuclear-power-needs-leadership-but-not-from-the-military/>
- 69 English, T, S. Chakraborty, L. Hering, 2019, "San Onofre Nuclear Waste Problems" <http://www.samuellawrencefoundation.org/san-onofre-nuclear-waste-problems/?etfb=1&PageSpeed=off>
- 70 Technical Group Finding (SONGS Task Force, Technical Analysis), Dan Dominguez, pages 21-22
- 71 Technical Group Finding (SONGS Task Force, Technical Analysis), Rob Howard, pages 150 - 155
- 72 Alley, W.M. and R. Alley, 2013, "Too Hot to Touch: The Problem of High-Level Nuclear Waste," Cambridge University Press.
- 73 Information provided by Enresa rep Javier Fernandez Lopez during an in-person meeting in Madrid May 10, 2019
- 74 See Blue Ribbon Commission on America's Nuclear Future, 2012, "Report to the Secretary of Energy", <https://cybercemetery.unt.edu/archive/brc/20120620215729/http://brc.gov/index.php?q=library/documents/brc-generated-documents>
- 75 Task Force committee discussion and conclusion
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- 77 Davis, L and C. Hausman, 2019, "Nuclear Moral Hazard," UC Berkeley Energy Institute at Haas Blog. <https://energyathaas.wordpress.com/2019/06/24/nuclear-moral-hazard/>
- 78 See <https://apnews.com/651923b9359b-4d64a807aa677999dc03>

- 79 https://www.zwilag.ch/en/model-of-the-facility_-content--1-1030.html
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- 85 <https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1611/>
- 86 See "Long-term Maintenance of the AREVA TN NUHOMS and Holtec HI-STORM UMAX Dry Cask Storage Systems at San Onofre Nuclear Generating Station", November 2019 https://www.songscommunity.com/internal_redirect/cms.ipressroom.com.s3.amazonaws.com/339/files/201910/CEP%20White%20Paper%20Licensing%20Inspection%20and%20Mitigation%20for%20TN%20and%20Holtec%20Systems%2011%2012%2019.pdf
- 87 See Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.) <https://uscode.house.gov/view.xhtml?path=/prelim@title42/chapter108&edition=prelim>
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- 91 Energy and Water Appropriations Act of 2020, appropriation for "Integrated Waste Management System", PDF page 95 <https://docs.house.gov/billsthisweek/20191216/BILLS-116HR1865SA-JES-DIVISION-C.pdf>
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- 95 Young, A, 2017, "Decadal-scale coastal cliff retreat in southern and central California," Geomorphology 300, 164-175 <https://www.sciencedirect.com/science/article/abs/pii/S0169555X17304476?via%3Dihub>
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- 101 NRC Visual Assessment March 21-23, 2019. <http://www.samuellawrencefoundation.org/wp-content/uploads/2019/10/NRC-Visual-Assessment-Report.pdf>
- 102 Chakraborty, S, 2020, "Task Force Technical Analysis," Chakraborty report, pages 37-38
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